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MINERALS YEARBOOK

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Prepared under the direction of

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INTRODUCTION

Recording the activities of an industry from year to year is motivated by the need for a basis on which to plan the future. "What's past is prologue." Basic data on the performance of the mineral industry during its year of peak activity are presented in detail in the following pages of Minerals Yearbook, 1947. It is believed that this information will be of considerable assistance to businessmen and labor leaders, to legislators and Government officials charged with administering national security and other programs in the national and international interest, and to the general public.

The alphabetization of chapters and the utilization of more readable type in headings—initiated in Minerals Yearbook, 1946—are continued in this edition. Further progress was made in standardizing the order of presentation of material in each chapter. Publication was delayed by the inadequacy of printing funds and by diversion of the staff to special studies, particularly for the National Security Resources Board and the Munitions Board.

The manuscript of Minerals Yearbook, 1947, was meticulously checked for statistical correctness and comparability by John Hozik, statistical editor, who also compiled the national and State production tables comprising the cardinal chapter—Statistical Summary of Mineral Production. Clarity, grammar, and style of the manuscript were improved by the editing of Mabel E. Winslow, assisted by Anna B. Brown and Estelle R. Templeton, of the Office of Minerals Reports, who in addition applied type specifications. She also assembled the exceedingly useful index. Most of the more than 100 charts, clearly showing major trends at a glance, were drafted by Adelaide B. Palmer, of the Minerals Yearbook Section, and the remainder were prepared under the supervision of Louis F. Perry, Central Experiment Station, Pittsburgh, Pa. The statistical editor was assisted materially by K. Joyce D'Amico in verifying figures and preparing summary tables.

Planning and completion of the publishing program were under the able guidance of John H. Ady, Chief of Publications of the Department of the Interior and liaison officer between the Department and the Government Printing Office. Notable assistance in this phase was rendered by Helen Logan.

Presentation of most of the facts contained in this volume is made possible only by the time and energy devoted by the mineral industry to completion of questionnaires. Other information is supplied by business magazines, trade associations, scientific journals, and Government agencies. In particular, data on foreign trade and foreign production are received from the United States Department of Commerce and the United States Department of State, respectively. Special appreciation is acknowledged in behalf of the following State geologists and other officials who cooperated with the Bureau of Mines in compiling production data:

Alabama: Walter B. Jones, State geologist, University.
Alaska: B. D. Stewart, commissioner of mines, Department of Mines, Juneau.
California: Olaf P. Jenkins, chief, and Charles V. Averill, supervising mining engineer, California Division of Mines, San Francisco.
Florida: Herman Gunter, director, Florida Geological Survey, Tallahassee.
Georgia: Garland Peyton, director, Division of Mines, Mining and Geology, Atlanta.
Illinois: M. M. Leighton, chief, and Walter H. Voskuil, mineral economist, State Geological Survey Division, Urbana.
Iowa: H. Garland Hershey, State geologist, Iowa City.
Kansas: Raymond C. Moore, State geologist, and John C. Frye, executive director, State Geological Survey of Kansas, Lawrence.
Maryland: Joseph T. Singewald, Jr., director, Department of Geology, Mines, and Water Resources, Baltimore.
Michigan: Gerald Eddy, State geologist, Lansing.
Missouri: Edward L. Clark, State geologist, Rolla.
New Hampshire: T. R. Myers, geologist for State Planning and Development Commission, Durham.
New Jersey: Meredith E. Johnson, State geologist, Trenton.
New York: John G. Broughton, State geologist, Albany.
North Carolina: Jasper L. Stuckey, State geologist, Raleigh.
Oklahoma: Robert H. Dott, director, Oklahoma Geological Survey, Norman.
South Dakota: E. P. Rothrock, State geologist, Vermillion.
Texas: John T. Lonsdale, director, Bureau of Economic Geology of the University of Texas, Austin.
Utah: Arthur L. Crawford, director, Utah Geological and Mineralogical Survey, Salt Lake City.
Virginia: William M. McGill, State geologist, and Linwood H. Warwick, office administrator, Virginia Geological Survey, Charlottesville.
Washington: Sheldon L. Glover, supervisor, Division of Mines and Mining, Olympia.
West Virginia: Paul H. Price, State geologist, Morgantown.
Wisconsin: E. F. Bean, State geologist, Madison.

Bureau of Mines statisticians and researchers who rendered substantial assistance to the authors of this volume include the following: In Washington, D. C.—Hope Anderson, Ivan F. Avery, Charlotte R. Buck, Dorothy M. Burch, Edith E. den Hartog, Leon W. Geyer, Naomi W. Kearney, James G. Kirby, Lena M. Lunsford, Ann C. Mahoney, Annie L. Marks, Edith D. McKinney, Lena Mohme, Robert C. Morris, Virginia M. Oliver, Carribel Rockwell, Emma M. Seeley, Mary E. Trought, and Virginia E. Wrenn; in Los Angeles, Calif.—Edward T. Knudsen, Adele B. Esser, and Harry L. Scarborough; in San Francisco, Calif.—Opal Y. Sharman; in Denver, Colo.—Helen G. Post, Florence H. Scott, and Tressa B. Westall; in Salt Lake City, Utah—Alice K. Feltch, Virginia C. Halverson, and LaRu T. Shepherd.

ALLAN F. MATTHEWS

October 1949.

PART I. GENERAL REVIEWS

Review of the Mineral Industries In 1947

By ALLAN F. MATTHEWS

OPERATION of mines, mills, and smelters in the United States in 1947 yielded mineral products valued at an all-time high of $12,393,000,000. The peak aggregate value was due largely to high unit prices. However, about a third of the gain resulted directly from a simultaneous record in physical volume of output. Correspondingly, petroleum and many major chemical and constructional mineral raw materials were consumed at record rates in 1947. The quantities of bituminous coal, iron, and most nonferrous metals used represented increases over 1946 but failed to equal earlier highs. Prices of mineral commodities in 1947 were 21 percent above 1946 and 34 percent above 1945. Such inflation, though, was notably less than for agricultural commodities. The mineral industries employed more persons in 1947 and progressed in safety experience. Exports of minerals by the United States nearly doubled in dollar volume in 1947 compared with 1946, whereas imports increased only one fourth; as a result, mineral exports were a third larger than imports.

PRODUCTION

Value of Production.—The output of mineral products in the United States mounted in 1947 to a peak value of $12,393,000,000, a 39-percent rise above the previous record in 1946. More than half of the increase resulted from a 36-percent gain in the value of mineral fuels produced and most of the remainder from a 60-percent gain in the value of metals produced. Nonmetallic minerals (other than fuels) were 25 percent greater. Of the three major mineral groups in 1947, fuels were valued at $7,843,000,000 (63 percent of the total), other nonmetallics at $1,635,000,000 (13 percent), and metals at $2,915,000,000 (24 percent).

The 39-percent increase in value of mineral output in 1947 compares with a 21-percent increase in the value of agricultural products, an 11-percent gain in all products combined, and a 12-percent increase in national income. This comparison is based upon Bureau of Agricultural Economics reports on cash receipts from marketing farm products ($30,014 million in 1947 and $24,864 million in 1946) and upon Bureau of Foreign and Domestic Commerce reports on gross national product ($235.7 billion in 1947 and $212.6 billion in 1946) and national income ($201.7 billion in 1947 and $179.6 billion in 1946).

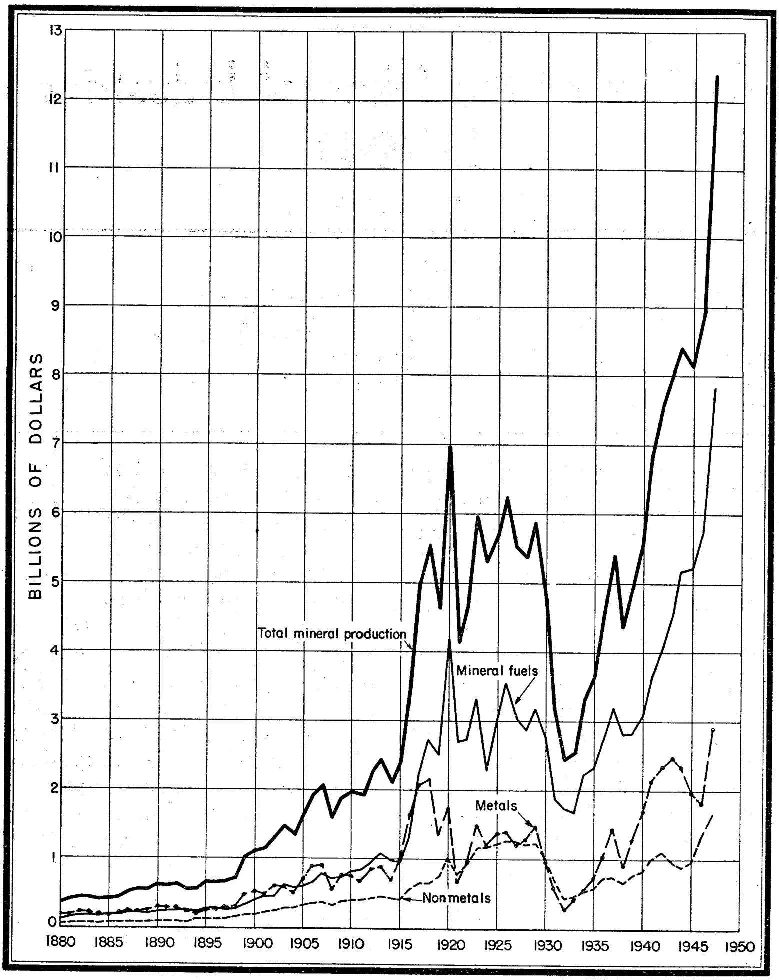

FIGURE 1.—Trends in value of mineral production in the United States, 1880–1947.

Volume of Production.—Increases in the physical volume of production in 1947 compared with 1946 were 11 percent for minerals, 2 percent for agricultural products, and 10 percent for manufactures, according to the Federal Reserve Board. The Board's index of mineral production (1935–39=100) reached a record annual high of 149 in 1947 and a record monthly high of 156 in December 1947. While mines were yielding their greatest outputs and farms were operated nearly at record levels, the physical volume of manufactures in 1947 was only three-fourths that of the 1943 peak.

The tonnages of mineral fuels produced in 1947 averaged 9 percent greater than 1946. Output of bituminous coal and lignite was up 16 percent, a result of strong demand and fairly tranquil labor-management relations. Anthracite production, on the other hand, declined 5 percent, apparently owing to inadequate stocking of coal for winter consumption by home owners. Nine percent more petroleum, 10 percent more natural gas, and 14 percent more natural gasoline, related products, and liquefied petroleum gases were pumped in 1947

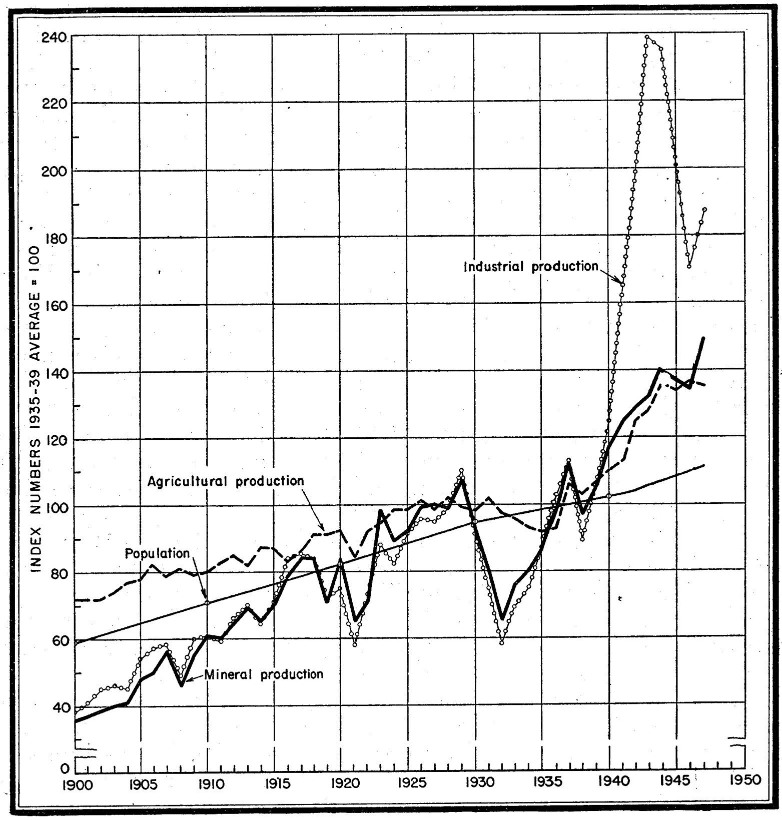

FIGURE 2.—Comparison of growth of physical volume of mineral production with that of agricultural and industrial production (manufactures and minerals) and population, 1900–47 [1]

than in 1946. All these major mineral fuels except anthracite established production records in 1947.

Metals, as a group, showed the largest quantitative gain—31 percent—in 1947 compared with 1946, but this represented not much more than recovery from the set-back of iron-mine and nonferrous-smelter strikes in the spring of 1946. The tonnage of metals produced in 1947 was only 13 percent greater than in 1940, whereas that of mineral fuels was 40 percent and of other nonmetallic minerals 61 percent. Iron-ore and pig-iron outputs were 33 and 29 percent, respectively, more in 1947 than in 1946. Ferro-alloys production was up 19 percent, stimulating increases of 66 percent in vanadium and 32 percent in molybdenum. However, domestic mining of manganese ore (8 percent less than in 1946), chromite (77 percent less), and tungsten ore (40 percent less) continued the declines evident in 1945 or earlier. Smelter production of copper, lead, and zinc from domestic ores increased 44, 30, and 11 percent, respectively, in 1947 compared with 1946. The precious metals gold and silver managed to show gains of 48 and 83 percent, respectively, despite the fixed

[1] The following indexes have been used: Volume of farm production, U. S. Department of Agriculture; mineral production, 1900–18, Warren Persons' Forecasting Business Cycles; mineral production of 1919–47 and industrial production, Federal Reserve Board; total population of the United States, Bureau of the Census.

price of gold in an economy of rising production costs. Bauxite mining was 9 percent greater in 1947 than in 1946, and aluminum refining was 40 percent greater—both being peacetime records. However, sales of primary magnesium ingot slumped 41 percent in 1947, the fourth consecutive annual decline. The tonnages of ilmenite, antimony, and beryl concentrated in 1947 were 19, 43, and 45 percent, respectively, greater than in 1946, and in the case of ilmenite was an all-time high. On the other hand, mercury and platinum outputs dropped 8 and 42 percent, respectively. After an interval of many years, the United States returned in 1947 to the ranks of significant radium producers; the refinery in New York State, built during World War II, changed its input to predominantly domestic ores.

Mining of nonmetallic minerals (other than fuels) was 13 percent more active in 1947 than in 1946, and compared with 1940 it was at a higher level of output than the mining of either fuels or metals. The postwar building boom pushed tonnages of cement, sand and gravel, stone, slate, and gypsum sold in 1947 10 to 16 percent above 1946; this was a peacetime high for sand and gravel and an all-time high for the others. Among the chemical and fertilizer minerals, phosphate rock made the most pronounced gain (32 percent), while sulfur, pyrites, potash, lime, fluorspar, and barite increased 13 to 19 percent. Salt sales increased 7 percent. These were record tonnages for all eight of these important nonmetallics, except that fluorspar output was greater during World War II. Strong demand by the ceramics industries—glass, porcelain enamel, pottery, refractories, and structural clay products—induced record quantitative highs by these 1947 gains over 1946: Clay 10 percent, ground feldspar 3 percent, boron minerals 17 percent, and zircon about 50 percent. Among other nonmetallic minerals, talc (with pyrophyllite) and asbestos increased 13 and 71 percent, respectively, for new highs, and appreciable gains were also made by bromine (83 percent) and magnesite (16 percent). Moderate advances were shown by abrasive garnet and graphite, while mica and peat declined.

Number of Firms.—There were about 34,000 mining firms in the United States September 30, 1947, more than in any year since 1942, according to the Department of Commerce. During 1944–47 about 18,000 new mining firms were formed and 15,000 discontinued, a net gain of 3,000.[2] Since 1939 the number of petroleum and gas producers increased from 30 to 49 percent of the total number of mining firms, whereas the number of coal and metal producers declined from 56 to 38 percent of the total and nonmetallics producers remained at 13–14 percent.

Among mineral and metal processors in 1939–47, the number of firms smelting, refining, and semifabricating metals expanded 63 percent, the number fabricating metal products gained 70 percent, and the number manufacturing stone, clay, and glass products increased 85 percent. The notable increase in the last-named group occurred abruptly in 1946; to the 8,000 producers of stone, clay, and glass products in the fall of 1945 were added in 1946 6,000 new producers, while only 1,000 discontinued business.

[2] Churchill, Betty C., Revised Estimates of the Business Population, 1929–48: Survey of Current Business, vol. 29, No. 6, June 1949, pp. 19–24.

Number of mining and mineral and metal processing firms in the United States on Sept. 30, 1939–47

[U. S. Department of Commerce]

Year	Mining firms				Mineral- and metal-processing firms			
	Metal and coal mining	Petroleum and natural gas	Nonmetallic mining	Total mining	Metal smelting and refining	Fabricated metal products	Products of petroleum and coal	Stone, clay, and glass products
1939	20,200	10,900	5,000	36,100	3,800	10,500	1,200	7,100
1940	20,100	12,600	5,000	37,700	4,000	10,800	1,300	7,200
1941	21,000	13,600	4,700	39,300	4,200	11,500	1,300	7,500
1942	16,600	14,100	4,500	35,200	4,300	11,700	1,300	7,500
1943	12,500	14,600	4,000	31,100	4,300	11,800	1,200	7,300
1944	11,900	15,200	3,900	31,000	4,500	12,400	1,200	7,200
1945	11,700	15,900	3,700	31,300	5,000	13,700	1,300	7,900
1946	12,200	16,500	4,200	32,900	6,000	16,300	1,400	12,600
1947	13,000	16,800	4,400	34,200	6,200	17,900	1,400	13,100

National Income.—Two percent of the national income of the United States in 1947 originated at mines, according to the United States Department of Commerce. Products of mines, however, were the basis of a substantial part of the manufacturing industries, where 30 percent of the national income originated, and they directly or indirectly were responsible for much of the commerce, construction, and services (private and public), where 58 percent originated. The basic food and raw-material production industries contributed 23 billion dollars to the national income in 1947, of which 81.4 percent was from farms, 17.8 percent from mines, 0.6 percent from fisheries, and 0.2 percent from forests. Of the 4-billion-dollar mine income, 50 percent was from coal mining, 29 percent from petroleum and natural-gas extraction, 12 percent from metal mining, and 9 percent from nonmetallic minerals.

National income is defined as the aggregate earnings of labor and property that arise from the current production of goods and services by the Nation's economy. Its five principal components, together with the value of each for the mining industry in 1947, in millions of dollars, are as follows: Wages and salaries, 2,918. Supplements to wages and salaries (employer contributions for social insurance and private pension funds, pay of military reserve, etc.), 142. Income of corporate and unincorporated enterprises before taxes, 1,102. Inventory adjustment, −84. Net interest, 13. Total, 4,091.

National income originating in mining and related manufacturing industries in the United States, 1943–47, in millions of dollars

[U. S. Department of Commerce]

Industry	1943	1944	1945	1946	1947
Bituminous coal and lignite	1,130	1,271	1,204	1,248	1,718
Anthracite	211	238	219	281	304
Petroleum and natural gas	671	800	795	930	1,199
Metals	507	417	349	324	507
Nonmetallic minerals	238	224	222	293	363
Total mining	2,757	2,950	2,789	3,076	4,091
Iron and steel products [1]	9,099	9,081	7,376	5,544	7,607
Nonferrous metal products	1,939	1,942	1,659	1,774	2,136
Products of petroleum and coal	1,502	1,360	1,326	1,684	2,253
Stone, clay, and glass products	1,193	1,137	1,147	1,562	1,910

[1] Including ordnance.

Equipment and Materials.—The mining industry spent $690,000,000 for new plant and equipment in 1947 compared with $560,000,000 in

1946, according to the United States Department of Commerce. Corresponding expenditures for prewar years were $680,000,000 in 1941, $560,000,000 in 1940, and $380,000,000 in 1939.

Apparent consumption of industrial explosives in the United States was at the record high of 598,365,298 pounds in 1947 compared with 499,491,102 pounds in 1946, as tabulated by the Bureau of Mines. The 1947 usage comprised 122,348,571 pounds of permissible high explosives, 476,016,727 pounds of high explosives other than permissibles, 36,464,100 pounds of black blasting powder, and 16,561,539 pounds of liquid-oxygen explosive.[3] Of these, 47 percent was sold for coal mining, 16–17 percent each for metal mining, nonmetallic mining (including quarrying), and construction (railway and other), and 3 percent for other purposes.

Productivity.—Output of bituminous coal per man-day worked and of usable iron ore per man-hour were 22 and 8 percent, respectively, higher in 1947 than in 1939, according to the Bureau of Mines. On the other hand, output of anthracite per man-day was 8 percent lower. Production of recoverable copper per man-hour in 1947 was 9 percent above that of 1939, as reported by the Bureau of Labor Statistics, but recoverable lead and zinc was 9 percent below.

CONSUMPTION

Nine important minerals that were consumed in record quantities in 1946 met continued increases in demand in 1947, again achieving record consumption: Petroleum, natural gas, natural gasoline (plus liquefied petroleum gases), phosphate rock, potash, titanium, carbon black, barite, and feldspar. In addition, consumption of sulfur, salt, lime, and stone were at all-time highs in 1947.

Consumption of bituminous coal increased 9 percent in 1947 compared with 1946, but anthracite declined 11 percent. The gain by petroleum was 8 percent, natural gas 10 percent, and natural gasoline and liquefied petroleum gases 15 percent. Consumption of iron ore, manganese ore, and molybdenum was 33, 25, and 35 percent, respectively, greater in 1947. The base metals (primary and secondary) were used in larger tonnages—copper 22 percent, lead 25 percent, and tin 9 percent—except that zinc withdrawals decreased 2 percent. The light metals aluminum and magnesium were absorbed by industry in 1947 in about the same quantities as in 1946, but shortages of electric power prevented aluminum production from meeting full demand. Similarly, the demand for titanium dioxide could not be met, because construction of manufacturing facilities lagged behind requirements for the pigment, yet consumption of titanium concentrates increased 23 percent. Consumption of major chemical and fertilizer minerals increased in 1947 as follows: Sulfur, phosphate rock, and fluorspar, 20–24 percent; potash and barite, 16–17 percent; salt, 7 percent; and carbon black, 0.2 percent. Cement, lime, sand and gravel, stone, and clay gained 10–16 percent.

Future trends in the use of petroleum, natural gas, gold, and base metals were suggested.[4] The uses of limestone were detailed.[5]

[3] The quantity of liquid-oxygen explosive is not included in the 1947 total in the preceding sentence because comparable figures for previous years are not available.

[4] Seventy-Five Years of Progress in the Mineral Industry, Am. Inst. Min. and Met. Eng., New York, 1947:
Wilson, Robert E., and Roberts, J. K., Petroleum and Natural Gas; Uses and Possible Replacements, pp. 722-744.
Anderson, P. M., The Future of Gold in World Economy, pp. 603-614.
Jeffries, Zay, Metals and Alloys of the Future, pp. 745-758.

[5] Bowles, Oliver, and Jensen, Nan C., Industrial Uses of Limestone and Dolomite: Bureau of Mines Inf. Circ. 7402, 1947, 19 pp.

STOCKS

Producers increased their stocks of anthracite 180 percent, phosphate rock 33 percent, and primary aluminum 6 percent, whereas they decreased stocks of slab zinc, refined primary lead, and potash 57–67 percent, refined primary copper 38 percent, and sulfur and cement 9–12 percent. Producers and consumers of pig iron and molybdenum added 8 and 23 percent, respectively, to their inventories. Consumers of bituminous coal, refined copper, and lead built up their stocks 11, 3, and 19 percent, respectively, but slab-zinc consumers used up 13 percent of their stocks during 1947. The quantity of pig tin and tin in ores and concentrates held by industry and by the Reconstruction Finance Corporation increased 10 percent during 1947, returning to the level extant at the end of 1945.

PRICES

Mineral prices in 1947 surged 21 percent higher than in 1946, according to the Bureau of Mines index of producers' realizations on 24 minerals representing about 96 percent of the total value of United States mineral production. As a group, fuels again showed the greatest price increase—24 percent; metals were up 18 percent and nonmetallics (other than fuels) 10 percent. Of the 24 major minerals, the sharpest price advances were for natural gasoline and cycle products (43 percent), crude petroleum (35 percent), lead (32 percent), and copper (30 percent). Bituminous coal and pig iron increased 20–24 percent; sand and gravel and phosphate rock, 12–16 percent; sulfur, salt, cement, and clay, about 10 percent; and anthracite, natural gas, ferro-alloys, and stone, about 5 percent. The prices of aluminum, magnesium, gold, and silver were steady during 1947, and those of zinc and molybdenum dipped 1 percent. The only appreciable decrease was for potash—down 5 percent. Highest prices on record were paid in 1947 for bituminous coal, anthracite, and lead. Furthermore, the average prices of petroleum (Oklahoma-Kansas), steel, copper, zinc, and tin were at levels unsurpassed since 1920, as also was that of silver, except for 1946.

Weighted average price index of 24 major mineral commodities, 1941–47

[1940=100]

	1941	1942	1943	1944	1945	1946 [1]	1947 [2]
Minerals (all groups)	109.4	114.7	119.7	122.7	125.3	138.7	167.8
Metals [3]	109.2	114.2	117.1	118.0	120.9	132.4	156.6
Mineral fuels	110.7	116.2	122.6	126.9	129.5	145.3	180.4
Nonmetals (other than fuels)	103.1	108.8	112.0	113.7	115.4	122.2	134.6

[1] Revised figures. [2] Subject to revision. [3] Includes bonus payments on copper, lead, and zinc, 1942–47.

The Bureau of Labor Statistics index (1926=100) of wholesale prices for all commodities rose 26 percent from 121.1 in 1946 to 152.1 in 1947, and for farm products alone 22 percent from 148.9 to 181.2. The indexes for various mineral products in 1946 and 1947, respectively, were as follows: Bituminous coal, 133 and 158; coke, 140 and 167; anthracite, 109 and 118; petroleum products, 68 and 90; gas, 80 and 85; iron and steel, 110 and 134; structural steel, 118 and 135; nonferrous metals, 100 and 140; fertilizer materials, 87 and 106; cement, 104 and 116; brick and tile, 123 and 140; paint and paint materials, 119 and 163.

Salient statistics of production and payments under the Premium Price Plan are presented in the Copper, Lead, and Zinc chapters of this volume. Costs, income, and operating margins of mines receiving premium payments were reviewed by Jesse L. Maury, formerly of the Civilian Production Administration Premium Price Quota Committee.[6]

A comparison of the prices of fuels used competitively for space heating, power plants, railroads, and ships was made by an economist of the Socony-Vacuum Oil Co.[7]

FOREIGN TRADE

United States exports of mineral products were double imports in 1939, some 85 percent of imports in 1946, and a third more than imports in 1947. The reversal of trend in 1946 was due to unusually strong postwar demand in the United States and to weakened demand in Europe and the Orient, where the destruction of factories and transport affected purchasing power and, temporarily, the ability to utilize raw materials.

The principal mineral imports, in order of value in 1947, were petroleum, copper, diamonds, and tin. The leading exports were coal, copper, and petroleum. The position of coal as the greatest mineral export is a temporary situation brought about by the dislocation of coal mining in Europe.

Principal mineral products imported into and exported from the United States, 1939 and 1946–47

[U. S. Department of Commerce]

Mineral	Quantity			Value (thousand dollars)		
	1939	1946	1947	1939	1946	1947
IMPORTS						
Fuels: Petroleum (thousand barrels)	28, 562	89, 210	99, 284	19, 570	101, 656	161, 535
Ores and concentrates:						
Bauxite (long tons)	520, 179	852, 005	1, 821, 580	3, 765	5, 965	11, 870
Chromite (short tons)	355, 612	757, 391	1, 106, 180	3, 815	11, 459	18, 867
Copper (short tons of metal)	7, 292	22, 666	48, 823	1, 155	5, 293	19, 165
Iron ore (thousand long tons)	2, 413	2, 754	4, 903	5, 866	10, 371	22, 096
Lead (short tons of metal)	12, 317	28, 377	44, 442	1, 064	3, 056	8, 561
Manganese ore (thousand short tons)	702	1, 515	1, 298	8, 498	29, 658	21, 291
Tin (long tons of metal)	500	38, 070	30, 510	418	26, 969	20, 245
Tungsten (short tons of metal)	743	3, 435	3, 009	998	5, 929	6, 422
Metals (including scrap):						
Aluminum (short tons)	14, 336	57, 100	31, 329	3, 385	12, 236	6, 300
Copper (short tons)	8, 398	272, 071	339, 846	1, 537	66, 436	133, 281
Lead (short tons)	6, 742	103, 345	176, 414	386	14, 435	41, 525
Nickel (short tons)	64, 796	104, 734	88, 408	29, 078	49, 858	45, 596
Platinum group (troy ounces)	268, 418	339, 836	265, 486	8, 839	11, 940	9, 885
Tin (long tons)	70, 102	15, 520	24, 899	70, 591	18, 507	42, 685
Zinc (short tons)	31, 341	108, 152	77, 170	1, 927	16, 777	15, 267
Nonmetallic minerals:						
Asbestos (short tons)	242, 561	456, 688	594, 839	9, 095	18, 731	29, 822
Diamonds (thousand carats):						
Industrial	3, 569	4, 625	3, 920	9, 726	14, 298	12, 841
Gem	642	1, 649	1, 423	35, 374	166, 637	96, 523
Mica (short tons)	6, 280	13, 944	11, 685	1, 059	7, 119	7, 469

[6] Maury, Jesse L., Production Costs Under Premium Price Plan: Eng. and Min. Jour., vol. 148, No. 7, July 1947, pp. 86–87.

[7] McIntosh, A. J., Competitive Fuel Prices: Min. and Met., vol. 28, No. 489, September 1947, pp. 447–450.

Principal mineral products imported into and exported from the United States, 1939 and 1946–47—Continued

Mineral	Quantity			Value (thousand dollars)		
	1939	1946	1947	1939	1946	1947
EXPORTS						
Fuels:						
Anthracite (thousand short tons)	2, 590	6, 497	8, 510	19, 920	63, 844	90, 220
Bituminous coal (thousand short tons)	11, 590	41, 209	68, 606	42, 778	238, 087	528, 198
Petroleum (thousand barrels)	72, 064	42, 574	46, 356	92, 790	74, 132	99, 074
Metals (including scrap):						
Aluminum (short tons)	37, 108	17, 334	63, 121	20, 892	10, 132	33, 188
Copper (short tons)	427, 517	97, 475	196, 999	97, 160	38, 575	102, 456
Iron, scrap (thousand short tons)	4, 015	149	194	55, 912	3, 385	9, 800
Molybdenum (short tons)	21, 777	282	1, 495	14, 067	371	2, 232
Nickel (short tons)	10, 167	7, 977	12, 037	6, 318	7, 408	12, 156
Zinc (short tons)	11, 223	61, 070	117, 567	1, 596	12, 691	27, 051
Nonmetallic minerals:						
Cement (thousand barrels)	1, 146	5, 163	6, 771	2, 353	13, 485	21, 827
Phosphate rock (long tons)	949, 006	633, 340	753, 317	5, 233	5, 453	7, 005
Potash materials (short tons)	140, 329	120, 727	124, 909	5, 255	8, 039	8, 686
Sulfur, native (thousand long tons)	653	1, 246	1, 350	11, 682	24, 215	27, 707

EMPLOYMENT, WAGES, AND SAFETY

The mining industry in 1947 maintained 8 percent more employees than in 1946 and 13 percent more than in 1939, according to the Bureau of Labor Statistics. However, there were fewer metal and anthracite miners in 1947 than in 1939.

Employee earnings in the mining industry in 1947 were 15 percent above those in 1946. The average annual earnings per full-time employee were $1,526 in 1929, dropped to $990 by 1933, and then climbed steadily (except for a moderate dip in 1938) to $2,719 in 1946 and $3,114 in 1947. The greatest gain was by soft-coal miners, whose earnings were 91 percent of the national average of all workers in 1929 and 124 percent in 1947.

Number of employees and average earnings in mining and related manufacturing industries, 1939 and 1946–47

[U. S. Bureau of Labor Statistics]

Industry	Number of full-time equivalent employees (thousands)			Average annual earnings per full-time employee		
	1939	1946	1947	1939	1946	1947
Bituminous coal and lignite	381	391	428	$1, 197	$2, 724	$3, 213
Anthracite	88	82	80	1, 406	2, 890	3, 125
Petroleum and natural gas	187	221	234	1, 684	2, 819	3, 167
Metals	103	88	100	1, 518	2, 636	2, 990
Nonmetallic minerals	73	89	95	1, 171	2, 371	2, 663
Total mining	832	871	937	1, 367	2, 719	3, 114
Iron and steel products [1]	1, 155	1, 670	1, 863	1, 549	2, 696	3, 063
Nonferrous metal products	284	498	483	1, 521	2, 717	2, 963
Products of petroleum and coal	135	219	228	1, 852	3, 183	3, 610
Stone, clay, and glass products	343	474	503	1, 359	2, 380	2, 674

[1] Including ordnance.

The average number of days worked by the mining and metallurgical industries (exclusive of the oil and gas industry) was 259 in 1947, according to the Bureau of Mines. This was 6 percent more than the 244 active days in 1946 but still 5 percent less than the 273 active days in 1945.

The safety record of the mineral industries improved in 1947 and was better than in 14 of the preceding 16 years. The frequency of injuries decreased from 55.5 per million man-hours of work in 1946 to 53.4 in 1947. The gain was entirely in nonfatal injuries (54.7 to 52.5), however, for the frequency of fatal injuries worsened from 0.86 per million man-hours in 1946 to 0.95 in 1947. The actual number of fatalities was 1,167 in 1946 and 1,406 in 1947. The preceding figures exclude the oil and gas industry, which experienced 14.9 injuries per million man-hours in 1946 and 15.1 in 1947; its fatalities numbered 169 in 1946 and 149 in 1947.

Detailed monthly statistics on employment, wages, and safety in the mining industry during World War II and immediately thereafter, compiled by the War Production Board and Civilian Production Administration, were published.[8]

INCOME AND TAXATION

The income of all enterprises in the mining industry was 1,102 million dollars in 1947 compared with 687 in 1946 and 529 in 1945. These totals are before deduction of depletion charges and taxes. Federal and State taxes on corporate income in the mining industry ranged between 27 and 34 percent in 1942–47 and were 32 percent in 1947.

Distribution of corporate income and total income of unincorporated mining and related manufacturing enterprises in the United States in 1947, in millions of dollars [1]

[U. S. Department of Commerce]

Industry	Corporate income				Income of unincorporated enterprises	Total income of all enterprises
	Taxes (Federal and State)	Dividend payments	Undistributed	Total		
Bituminous coal and lignite	85	43	97	225	50	275
Anthracite	14	17	11	42	3	45
Petroleum and natural gas	81	89	126	296	139	435
Metals	72	79	73	224	8	232
Nonmetallic minerals	32	27	49	108	7	115
Total mining	284	255	356	895	207	1,102
Iron and steel products [2]	838	358	796	1,992	139	2,131
Nonferrous metal products	287	144	313	744	123	867
Products of petroleum and coal	396	391	717	1,504	5	1,509
Stone, clay, and glass products	210	110	197	517	62	579

[1] Before deduction of depletion charges.
[2] Including ordnance.

RESERVES

A study in great detail of the mineral reserves of the United States was made by the Bureau of Mines and Geological Survey in 1945 and published in 1947.[9] There was considerable comment on the domestic iron-ore position.[10] The imminent shortages of various

[8] Croston, John, Jr., and Butcher, Helen A., Employment, Production, Wage and Safety Statistics in the Mining Industry, 1939–46: Am. Min. Cong., 1947, 189 pp.

[9] Staffs of the Bureau of Mines and Geological Survey, Mineral Position of the United States: Hearings Before a Subcommittee of the Committee on Public Lands, U. S. Senate, 80th Cong., 1st Sess., May 15–20, 1947, appendix, pp. 165–310. Summarized in Engineering and Mining Journal, Interior Department Revises Mineral Reserve Estimates: Vol. 148, No. 6, June 1947, pp. 80–83.

[10] Davis, E. W., Iron-Ore Reserves of the Lake Superior District: Min. and Met., vol. 28, No. 481, January 1947, pp. 15–18.

Park, Charles F., Jr., What To Do About Our Iron-Ore Reserves: Min. and Met., vol. 28, No. 484, April 1947, pp. 192–196.

White, C. M., Iron Ore and the Steel Industry: Seventy-five Years of Progress in the Mineral Industry, Am. Inst. Min. and Met. Eng., New York, 1947, pp. 559–586.

minerals means that greater attention must be directed toward finding more ore and getting better recoveries from known deposits.[11]

The following text and illustrations are quoted from the summary, prepared by Samuel G. Lasky and E. W. Pehrson, of the Bureau of Mines and Geological Survey reserve study cited in the preceding paragraph.

Owing to the nature of mineral occurrence and the relatively small quantity of available information on the economic geology of the United States, it must be recognized that present knowledge of the country's mineral resources represents only a fraction of that needed for a comprehensive and reliable appraisal of our ultimate mineral wealth. Consequently, the data on resources presented in this report are restricted to deposits in known mineralized areas as appraised on the basis of current information. No allowances have been made for future discoveries in new areas. The quantitative estimates presented herein include measured, indicated, and inferred reserves, as defined elsewhere in this study. Inferred reserves comprise material of which there is little if any visual evidence, although its occurrence can reasonably be inferred from geologic evidence. Many of the estimates include substantial proportions of inferred ore, so that, in general, they are considerably more inclusive than those ordinarily used in commercial practice.

Resources are classified further as commercial and submarginal. For the purpose of this report, commercial reserves are broadly defined for most minerals as material available under the economic and technologic conditions prevailing in 1944. For a few minerals, estimates were based on good prewar conditions. Submarginal resources include deposits that cannot be exploited with monetary profit, except under more favorable economic conditions, improved technology, or both. Because the estimates of commercial reserves have been based on economic conditions considerably more favorable than the average prevailing in the past, the term "commercial" has been used broadly and should not be interpreted as implying that the reserve is commercially available in the sense in which the term usually is employed. In the accompanying illustrations, the word "commercial" has been set off in quotation marks to indicate that it has been used in a qualified sense.

Figure 3 compares the estimated commercial reserves of 41 commodities in known deposits with the average annual production and consumption during the decade 1935 to 1944. The reserves of 15 of the minerals shown in the graph are equivalent to more than half a century of requirements at the 1935–44 rate of consumption. This group includes coal and iron ore and the fertilizer minerals, phosphate rock, potash, and nitrates. The reserves of magnesium, derived chiefly from sea water and underground brines, are virtually unlimited. This is true also of nitrates, obtained from atmospheric nitrogen, and of salt, available in vast underground deposits and in sea water. The United States has a monopoly on commercial supplies of helium, and the known reserves are relatively large in terms of the rate at which it has been used. The United States also produces most of the world's molybdenum, and the reserve position is favorable. This country has sizable reserves of the titanium minerals, rutile and ilmenite, but heretofore they have supplied only part of its needs.

The estimated commercial reserves of three minerals—sulfur (all forms), bismuth, and fluorspar—are equivalent to 33 to 39 years of supply at the average rate of use from 1935 to 1944, and those of the remaining 23 commodities shown in figure 3 are equivalent to less than 25 years. This group includes such highly essential minerals as bauxite, zinc, copper, petroleum, lead, most of the ferro-alloying minerals, tin, and several nonmetallic minerals that have very important uses.

Attention is called to the fact that the estimates of natural-gas and petroleum reserves contain only "proved" reserves. If estimates also included the indicated and inferred categories, these two commodities would doubtless occupy a much more favorable position in the chart.

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[11] Cates, Louis S., and Bancroft, Howland, Techniques of Mineral Exploitation of the Future: Seventy-five Years of Progress in the Mineral Industry, Am. Inst. Min. and Met. Eng., New York, 1947, pp. 759–790.
Lasky, Samuel G., The Search for Concealed Deposits—A Reorientation of Philosophy: Am. Inst. Min. and Met. Eng. Tech. Pub. 2146, Min. Technol., vol. 11, No. 3, May 1947, 8 pp.

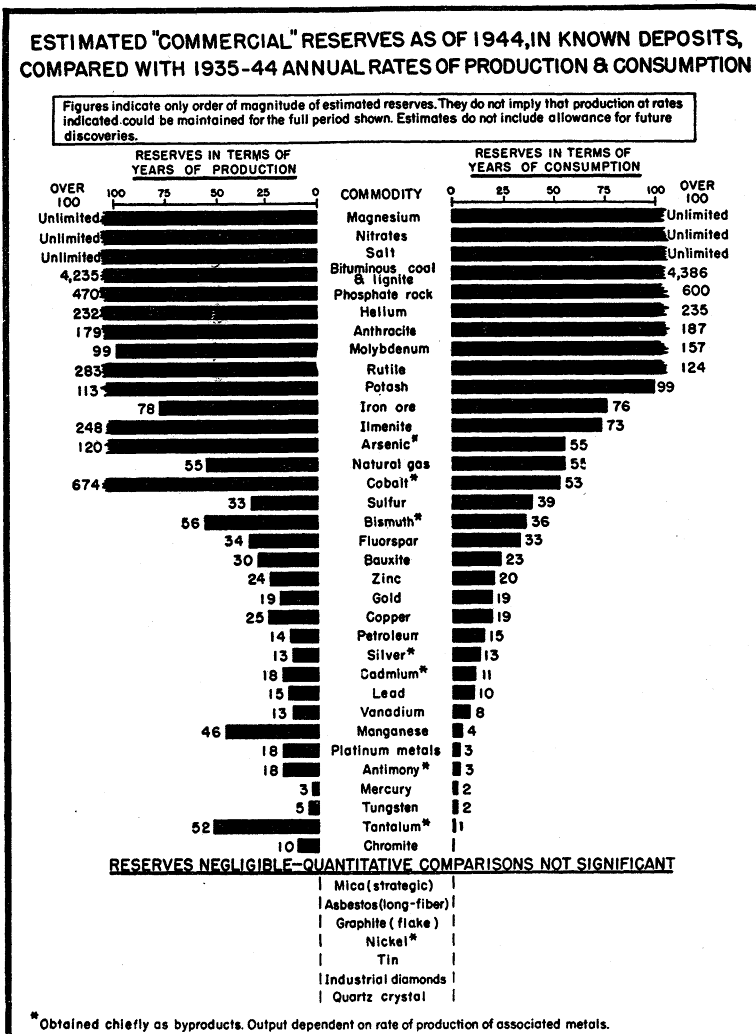

FIGURE 3.—Estimated "commercial" reserves in known deposits in the United States compared with average annual rates of domestic production and consumption, 1935–44.

The size of the reserves, in terms of past production, presents a somewhat different pattern. Since the United States produced considerably more phosphate rock, molybdenum, and sulfur than it consumed during the decade the size of the reserves in years of production is substantially less than in years of consumption. To a smaller extent the same is true of bituminous coal and lignite, anthracite, helium, and petroleum, of which America was a net exporter from 1935 to 1944.

Production and consumption of natural gas were about equal during the 10-year period. Because the monetary status of gold and silver provides a ready market for all that is produced, for the purposes of figure 3 consumption of these metals was considered equal to the production. Consequently the size of reserves of natural gas, gold, and silver is the same whether computed on the basis of consumption or of production. Production of all other commodities shown in the chart was less than the consumption in varying degrees; for this reason, the reserve expressed in years of production is larger than when expressed in years of consumption. The great disparity shown for cobalt is due to the fact that pro-

U. S. MINERAL POSITION—RELATIVE SELF-SUFFICIENCY

Based on known "commercial" reserves, outlook for noteworthy discovery, and the possibility that known submarginal resources can be made available by technologic progress and improved economic conditions

ACTUAL AND IMPENDING

(Based on present technologic and economic conditions and on known "commercial" reserves)

A. Virtual Self-sufficiency Assured for a Long Time

Bituminous coal and lignite	Magnesium	Fluorspar (metallurgical)
Anthracite	Molybdenum	Helium
Natural gas		Magnesite
		Nitrates
		Phosphate rock
		Potash
		Salt
		Sulfur

B. Complete or Virtual Dependence on Foreign Sources

1. Small or remote expectation of improving position through discovery:

Chromite	Industrial diamonds
Ferro-grade manganese	Quartz crystal
Nickel*	Asbestos (spinning quality)
Platinum metals	
Tin	

2. Good expectation of improving position through discovery:

Cobalt*	Graphite (flake)

C. Partial Dependence on Foreign Sources, Actual or Impending

1. Good expectation of improving position through discovery:

Petroleum	Arsenic*	Fluorspar (acid-grade)
	Bismuth*	
	Cadmium*	
	Copper	
	Iron ore	
	Lead	
	Mercury	
	Tantalum*	
	Titanium	
	Tungsten	
	Zinc	

2. Little hope of improving position through discovery:

Antimony*	High-grade bauxite
Vanadium	Strategic mica

**Domestic production chiefly byproduct.*

POTENTIAL

(If technologic and economic changes permit use of known submarginal resources)

A. Virtual Self-sufficiency

Bituminous coal and lignite	Aluminum ores	Fluorspar (all grades)
Anthracite	~~Copper~~	Graphite (flake)
Natural gas	Iron ore	Helium
Petroleum	Magnesium	Magnesite
	Manganese	Nitrates
	Molybdenum	Phosphate rock
	Titanium	Potash
	Vanadium	Salt
		Sulfur

B. Complete or Virtual Dependence on Foreign Sources

Platinum metals	Industrial diamonds
Tin	Quartz crystal
	Asbestos (spinning quality)

C. Partial Dependence on Foreign Sources

Antimony	Strategic mica
Arsenic	
Bismuth	
Cadmium	
Cobalt	
Chromite	
Lead	
Mercury	
Nickel	
Tantalum	
Tungsten	
Zinc	

FIGURE 4.—United States mineral position in 1944; relative self-sufficiency of principal metals and minerals.

duction represented a very small fraction of the consumption. The lack of sizable production was due to the limitations imposed by the byproduct nature of cobalt in much of the reserve and the economic unavailability of other portions of the reserve. Commercial reserves of manganese and tantalum are relatively very small; but the output also has been small, so that in terms of years of production the reserve appears to be relatively large.

The commercial reserves of strategic mica, long-fiber asbestos, flake graphite, nickel, tin, industrial diamonds, and quartz crystal either are nonexistent or so small that quantitative comparison with past production and consumption would have no significance. * * *

Opinions differ on the outlook for an improved position in minerals through discovery of new deposits. Geologists in general believe that reserves in addition to those estimated will be found in present producing areas and in areas adjoining them as known deposits are worked out. They also are confident that the development of new techniques for ore finding will make possible larger-scale discovery in areas not now productive. On the other hand, the fact that the United States has been heavily prospected by traditional methods so that most of the easily discovered deposits already have been found and the slowing up of discovery in recent decades leads some students of the resource problem to hold a contrary view. In their judgment, the capital risks involved in exploring for hidden ore bodies on geological or geophysical inference will discourage large-scale prospecting. Nevertheless, there is general agreement that the search for new mineral deposits must be pushed vigorously but that meanwhile other national policies should be based on the known resources.

The Nation's submarginal resources offer an additional base for improving its mineral position. With modern research techniques, many of the problems involved in employing some of them can be solved in a relatively short time. The technologic advances that have made it possible to utilize resources previously considered worthless are likely to be matched by similar gains in the future—any assumption to the contrary underestimates the potentialities of engineering and metallurgical research. Progress in technology can increase the availability of those minerals that are already widely used and bring into service some of the more plentiful elements in the earth's crust that as yet have not been extensively employed in industry. Research can point the way to changes in trade practices that will make possible economic use of domestic resources not suited to present industrial processes, and the conversion of submarginal resources to commercial reserves will stimulate the search for new deposits. However, large submarginal resources are not known for all of the deficient minerals.

Figure 4 presents, in a generalized manner, the United States mineral position based on the outlook for future discovery and on the possibility that technologic and economic changes will permit use of known submarginal resources.

MINERAL POLICY DEVELOPMENTS

Economic Cooperation with Europe.—The war's aftermath presented no more urgent task than the recovery of Europe, where existed democratic institutions and industrial organization essential to world stability and progress. The United States was ready to furnish a substantial part of the money, food, and materials needed for the task, Secretary of State Marshall announced June 5, 1947.[12] As a result, the following month 16 countries of western Europe formed in Paris the Committee for European Economic Cooperation. By fall President Truman had received reports, estimating the amount of foreign aid required and its impact on our economy, from three groups he had appointed—one headed by Secretary of Interior Krug, another by Secretary of Commerce Harriman, and the third by Chairman Nourse of the President's Council of Economic Advisers. The program was outlined by the President in a message to Congress December 19, 1947.[13]

[12] Marshall, George C., European Initiative Essential to Economic Recovery: U. S. Dept. of State Bull., vol. 16, No. 415, June 15, 1947, pp. 1159–1160.

[13] Truman, Harry S., A Program for United States Aid to European Recovery: U. S. Dept. of State Bull., vol. 17, No. 443, Dec. 28, 1947, pp. 1233–1243.

National Strategic Stock Pile.—By the end of 1947 Congress had appropriated $200,000,000 for expenditure and had authorized the obligation of an additional $75,000,000 on contracts for the purchase of strategic materials for the National Strategic Stock Pile. Of these appropriations, $32,200,000 was spent for actual deliveries (all in 1947; none in 1946), and $183,600,000 was obligated in contracts for future delivery ($148,700,000 in 1947; $34,900,000 in 1946). An additional $320,000,000 worth of war-surplus materials had been or was about to be transferred to the stock pile from various Government agencies; the quantities of some of these materials exceeded stock-pile objectives and therefore resulted in unbalanced procurement. The strategic minerals subject to stock piling are defined and listed in Minerals Yearbook, 1946 (pp. 7–8). The program was authorized by the Strategic and Critical Materials Stock-Piling Act, the text of which is quoted in Minerals Yearbook, 1945 (pp. 14–17).

The stock-pile procurement program during the latter half of 1947 was governed by the following principles, according to the public supplement to the Munitions Board semiannual report of January 23, 1948:

(*a*) Every effort, short of interference with the concurrent needs of industry, has been made to procure those materials in which the stock piles are most lacking.

(*b*) All materials have been purchased at not higher than current market prices and, in most instances, at prices a bit lower than current market prices. Unless the material in question was far behind the required acquisition schedule even the current market price was not paid if this was felt to be out of line with commodity prices in general.

(*c*) Considering (*a*) and (*b*) above, every effort was made to advance the general progress of the stock-piling program. This should not be taken to indicate that any particular effort was made to spend the available funds as rapidly as possible. On the contrary, many purchase opportunities were passed over in instances where the immediate further acquisition of the material was not of great urgency and where the possibility existed of a tight, but urgently needed material becoming available in the near future.

Premium Prices.—The Premium Price Plan, under which the Metals Reserve Company since February 1942 made payments for overquota domestic mine production of copper, lead, and zinc, expired June 30, 1947. Congress passed the Allen bill (H. R. 1602) proposing to prolong these subsidies and to include manganese in the payments. However, President Truman vetoed the bill August 8.

Government Organization.—The Solid Fuels Administration for War was liquidated June 30, 1947, pursuant to Executive Order 9847 of May 6.

Some of the preceding issues of this chapter have listed the names and titles of various United States Government officials closely identified with mineral policy and administration. Such a list has been omitted from this chapter to provide space for additional economic data, but the pertinent names and titles may be found in the United States Government Manual and in the Congressional Directory, both published periodically by the Government Printing Office.

A comprehensive study of the national economy was published,[14] which, among other relationships, shows the way in which the mineral industry meshes with the rest of the economy. Specialists reported

[14] Dewhurst, J. Frederic, and associates, America's Needs and Resources: Twentieth Century Fund, New York, 1947, 812 pp. Fritz, Wilbert G., Natural Resources, chap. 23, pp. 573–598.

the economics of mineral-industry activity in 1947.[15] One of the articles emphasized mineral-policy developments.[16]

TECHNOLOGY

Technologic developments in mining, milling, metallurgy, and fuel utilization in 1947 were reported.[17] Twelve articles reviewed the progress between 1871 and 1946 in mining and metallurgical practice.[18] A paper explained the formation of coal and described its types.[19] Operations at the Robena mine of the H. C. Frick Coke Co.—largest coal mine in the world—were detailed.[20] Experiments were conducted on burning coal in place.[21]

Approaching exhaustion of the high-grade Lake Superior iron ores prompted progress in beneficiation.[22] Staff members of the St. Joseph Lead Co. detailed the history, geology, mining, milling, and smelter operations of its enterprises in southeastern Missouri, New York State, and Argentina.[23] The director of the General Electric Co. nucleonics project explained some of engineering problems that must be solved before industry can utilize atomic energy.[24]

WORLD REVIEW

The most notable increases in world mineral production in 1947 compared with 1939 were for native sulfur (78 percent), bauxite (49 percent), petroleum (45 percent), and chromite (43 percent). On the other hand, world output of silver decreased 41 percent, tungsten 40 percent, magnesium metal 38 percent, and tin (smelter) 31 percent. There was furthermore a decline in 1947 equivalent to a fourth of 1939 output for iron ore, manganese ore, lead, gold, and gem diamonds.

[15] Engineering and Mining Journal, vol. 149, No. 2, February 1948, pp. 67–95.
Mining and Metallurgy, vol. 29, No. 494, February 1948, pp. 66–69, 93–94, 99–110, 127–145.

[16] Pehrson, Elmer W., Annual Review—Mineral Economics: Min. and Met., vol. 29, No. 494, February 1948, pp. 66–69.

[17] Dean, R. S., and Silkes, B., Metallurgical Research Program of the Bureau of Mines Relating to the Nonferrous Metals: Bureau of Mines Rept. of Investigations 4064, 1947, 22 pp.
Engineering and Mining Journal, vol. 149, No. 2, February 1948, pp. 96–117.
Fieldner, A. C. and Ambrose, P. M., Annual Report of Research and Technologic Work on Coal: Bureau of Mines Rept. of Investigations 7417, 1947, 142 pp.
Hyslop, M. R. (ed.), ASM Review of Metal Literature: Am. Soc. for Metals, vol. 4, 1947, 720 pp.
Mining and Metallurgy, vol. 29, No. 494, February 1948, pp. 71–92, 95–98, 111–126.

[18] American Institute of Mining and Metallurgical Engineers, Seventy-Five Years of Progress in the Mineral Industry: New York, 1947, pp. 1–400.

[19] Thiessen, Reinhardt, What is Coal? Bureau of Mines Inf. Circ. 7397, 1947, 53 pp.

[20] Mining Congress Journal, Robena—The World's Largest Coal Mine: Vol. 33, No. 3, March 1947, pp. 22–34.

[21] Dowd, James J., and others, Experiment in Underground Gasification of Coal, Gorgas, Ala.: Bureau of Mines Rept. of Investigations 4164, 1947, 62 pp.
McCabe, Louis C., Gasification of Coal Underground: Min. Cong. Jour., vol. 33, No. 8, August 1947, pp. 42–45.
World Petroleum, Russian Progress in Underground Gasification of Coal: Vol. 18, No. 12, December 1947, pp. 60–61.

[22] Holt, Grover, J., Research Widens Field for Iron-Ore Beneficiation: Eng. and Min. Jour., vol. 148, No. 2, February 1947, pp. 108–111.
Tartaron, Francis X., Iron-Ore Beneficiation Shows Healthy Growth: Eng. and Min. Jour., vol. 149, No. 2, February 1948, pp. 110–113.
Zapffe, Carl, Technology Will Solve Our Iron-Ore Problems: Eng. and Min. Jour., vol. 148, No. 7, July 1947, pp. 88–90.

[23] Mining and Metallurgy, vol. 28, No. 488, August 1947, pp. 362–411.

[24] Winne, H. A., and Prentice, B. R., Application of Atomic Energy to Industry: Am. Inst. Min. and Met. Eng., Seventy-Five Years of Progress in the Mineral Industry, 1871–1946, 1947, pp. 706-721.

Comparison of world and United States production of principal minerals in 1939 and 1947 [1]

[Compiled by B. B. Mitchell and P. Roberts]

Mineral	1939			1947		
	World	United States		World	United States	
	Thousand metric tons		Percent of world	Thousand metric tons		Percent of world
Fuels:						
Anthracite	119,096	46,708	39	120,279	51,882	43
Bituminous coal and lignite	1,527,904	358,205	23	1,518,721	561,544	37
Petroleum (thousand barrels)	2,086,160	1,264,962	61	3,022,030	1,856,107	61
Metals: [2]						
Aluminum (smelter)	721	148	21	1,073	519	48
Antimony [4]	39	(3)	1	35	4	11
Arsenic (smelter)	57	20	35	53	17	32
Bauxite	4,344	381	9	6,469	1,221	19
Chromite	1,163	4	(5)	1,650	1	(5)
Copper	2,192	661	30	2,210	769	35
Copper (smelter)	2,174	698	32	2,230	857	38
Gold (thousand troy oz.)	40,040	4,621	12	28,800	2,165	8
Iron ore	204,000	52,562	26	182,000	94,586	52
Iron, pig	102,029	32,322	32	99,000	54,559	55
Lead (smelter)	1,733	404	23	1,282	400	31
Magnesium (smelter)	29	3	10	18	11	61
Manganese ore	5,175	30	1	3,800	119	3
Mercury (thousand flasks)	145	19	13	144	23	16
Molybdenum	15	14	93	14	12	86
Nickel	122	(3)	(5)	138	1	1
Platinum group (thousand troy oz.)	543	41	8	491	18	4
Silver (thousand troy oz.)	266,902	63,872	24	165,600	38,587	23
Tin (thousand long tons)	173	(3)	(5)	112	(3)	(5)
Tin (smelter; thousand long tons)	181	-----	-----	125	33	26
Tungsten concentrates [6]	[4] 42	4	[4] 10	26	3	12
Zinc (smelter)	1,650	460	28	1,580	728	46
Nonmetallic minerals:						
Asbestos	560	14	3	873	22	3
Cement	93,000	21,267	23	84,267	32,315	38
Diamonds, gem (thousand carats)	12,501	-----	-----	9,737	-----	-----
Fluorspar	[4] 577	166	[4] 29	660	299	45
Gypsum [4]	8,031	2,927	36	13,500	5,632	42
Magnesite	2,000	181	9	1,800	341	19
Mica [4]	37	23	62	65	45	69
Phosphate rock	11,583	3,817	33	[4] 14,404	9,233	[4] 64
Potash (K_2O equivalent)	3,250	283	9	2,989	956	32
Pyrites	10,000	528	5	8,000	956	12
Salt, common	36,000	8,417	23	40,309	14,640	36
Sulfur, native (thousand long tons)	2,700	2,091	77	4,800	4,441	93
Talc and pyrophyllite [4]	510	230	45	850	468	55

[1] Partly estimated, particularly regarding U. S. S. R.
[2] Outputs designated as smelter are from both imported and domestic ores.
[3] Less than 500 tons.
[4] Exclusive of U. S. S. R.
[5] Less than 0.5 percent.
[6] 60 percent WO_3 equivalent.

World reserves, by individual countries, of coal [25] and the major nonferrous metals [26] were tabulated. International trends in petroleum were analyzed.[27] A proposed charter for an international trade organization within the United Nations was drafted. The charter includes provisions for intergovernmental commodity arrangements.[28] The problems of international control of atomic energy were explained by the United States Representative at the United Nations, Warren R. Austin,[29] and of American mining abroad, by Assistant Secretary of State Spruille Braden.[30]

Supplements to Bureau of Mines Mineral Trade Notes in 1947 chronicled the history of mining in Mexico and described in detail vanadium in Peru, antimony in Bolivia, corundum in southern Africa, and ferro-alloys, molybdenum, aluminum, lead, tungsten, and pyrophyllite in Japan. Elsewhere were published notable articles on postwar problems in French mines,[31] mining in German-occupied Norway,[32] the technology and economics of potash in Germany,[33] Allied control of production in Germany,[34] and the difficulties of restoring Malayan tin production.[35]

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25 Carlow, C. Augustus, World Coal Resources: Seventy-Five Years of Progress in the Mineral Industry, Am. Inst. Min. and Met. Eng., New York, 1947, pp. 634–684.

26 Shea, William P., Foreign Ore Reserves of Copper, Lead, and Zinc: Eng. and Min. Jour., vol. 148, No. 1, January 1947, pp. 53–58.

27 Baker, Warren L., and Logan, L. J., Significance of World Petroleum Production Trends: Am. Inst. Min. and Met. Eng. Tech. Pub. 2228, Petrol. Technol., vol. 10, No. 4, July 1947, 10 pp.

Fraser, William, International Aspects of the Petroleum Industry of the Future: Seventy-Five Years of Progress in the Mineral Industry, Am. Inst. Min. and Met. Eng., New York, 1947, pp. 587–595.

World Petroleum, International Oil Flow Changing: Vol. 18, No. 9, September 1947, pp. 80–82.

28 U. S. Department of State Bulletin, vol. 16, No. 393, Jan. 12, 1947, pp. 68–73; No. 398, Feb. 16, 1947, pp. 266–270; vol. 17, No. 434, Oct. 26, 1947, pp. 787–790.

Thorp, Willard L., Tariffs, Cartels, and the Mineral Industry: Seventy-Five Years of Progress in the Mineral Industry, Am. Inst. Min. and Met. Eng., New York, 1947, pp. 615–622.

29 Austin, Warren R., The Atomic Energy Issue in the United Nations: U. S. Dept. of State Bull., vol. 17, No. 441, Dec. 14, 1947, pp. 1176–1180.

30 Braden, Spruille, American Mining Enterprise in Foreign Countries: Seventy-Five Years of Progress in the Mineral Industry, Am. Inst. Min. and Met. Eng., New York, 1947, pp. 791–796.

31 Marsh, Michael, War Damage, Obsolescence Problems for French Mines: Eng. and Min. Jour., vol. 148, No. 6, June 1947, pp. 97–99.

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Statistical Summary of Mineral Production

(General United States Summary and Detailed Production by States)

By JOHN HOZIK AND K. JOYCE D'AMICO

THE general tables in this report present the value of mineral production since 1880 as accounted for by the three major groups (metals, fuels, and other nonmetallics), the output and value of over 100 mineral products for 1945–47, and the total value of mineral production by States, 1943–47. The tables on pages 26 to 32 list alphabetically the different minerals produced, rank in value held by each mineral 1946–47, and the four principal producing States arranged both as to quantity and value. This is followed by tables listing the States, with the relative rank of each in dollar value of its mineral output, percent of total value of the United States, and the four principal mineral products produced in each State for 1946–47.

State tables beginning on page 34 show the quantity and value of each mineral produced within the State, insofar as the Bureau of Mines is at liberty to publish the figures.

The fuel statistics for 1947, except for Pennsylvania anthracite, are preliminary.

STATISTICAL PROCEDURE

Coverage.—Statistics used in this chapter to derive total mineral production of the United States and of individual States represent primary products only; that is, they exclude products from scrap. Insofar as practicable, the figures pertain to production exclusively from domestic mines. Geographically, the figures represent the 48 States, the District of Columbia, the Philippine Islands (through 1945 only), and the Territories of Alaska, Hawaii, and Puerto Rico. Data for United States possessions, such as the Canal Zone, Guam, and Virgin Islands, are not compiled. The Bureau of Mines does not canvass producers of gem stones, carbon dioxide, and mineral waters, but estimates for gem stones and mineral waters are included in the United States total. The lime statistics apply to open-market lime and exclude nearly all captive tonnages.

Units of Measurements.—In expressing quantities of minerals, the Bureau of Mines has adopted the weight units (or in some instances, the volume or piece units) commonly employed by each individual industry. The unit of value is the United States dollar. No adjustment is made for fluctuations in the purchasing power of the dollar.

Stage of Production Measured.—Measuring the total mineral production of the United States and individual States at the crude-ore stage (rather than at the refined stage) would provide statistics most indicative of mine and well output. However, totals have not been derived strictly for the crude stage alone, largely because of the impracticability of obtaining meaningful values for ores of gold, silver, copper, lead, and zinc. Instead, the State totals in this chapter represent each mineral at the earliest stage of production for which a value is reported. The United States totals are on the same basis, except that they include iron, ferro-alloy metals, and aluminum valued at the smelter rather than at the mine.

Relationship of United States Totals to State Totals.—The total of United States mineral production differs from the sum of those of the 48 States, the District of Columbia, and Alaska in that the United States total includes: (1) Pig iron valued at the smelter instead of iron ore at the mine; (2) aluminum and ferro-alloy metals valued at the smelter and regardless of whether from foreign or domestic ores; (3) gold, silver, lead, copper, and zinc mint, refinery, and smelter production rather than mine output; (4) natural gas valued at points of consumption instead of at wells;[1] (5) certain lead and zinc pigments—sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide—and certain smelter and refinery byproducts, such as arsenic, bismuth, cadmium, minor metals, and sulfuric acid, whose States of origin are not reported; (6) estimates for gem stones and mineral waters, for which no canvasses are conducted; and (7) data for Hawaii, the Philippine Islands (through 1945), and Puerto Rico.

Elimination of Duplication.—In numerous instances in the tables of this chapter, production is shown both in the crude and in the refined stages, but in virtually every instance duplication is eliminated by including in the totals the value of each mineral at one stage only. For example, the values of coke made from coal, oil asphalt from petroleum, and lead and zinc pigments from metal are excluded from the totals. Likewise (but in these instances discounting the crude material rather than the refined product), the values of clay used in making heavy-clay products or cement, and of limestone used in making lime or cement, are excluded from the totals.

Changes in Natural-Gas Series.—In preceding editions of the Statistical Summary chapter, the historical series of statistics representing natural gas valued that gas at points of consumption. In order that the natural-gas values be more comparable with other minerals, whose values are reported on a mine or well basis, in the State tables for 1947 the natural gas is valued at wells. Revisions reflecting this change in series have been made in the State tables for 1943–46. Natural gas delivered to the point of consumption has a value approximately four times its value at the well (using United States averages for comparison).

[1] Both the United States total and the State totals include natural gas valued at points of consumption for years prior to 1943.

GENERAL TABLES

The following tables present salient production data of the mineral industry of the United States as a whole.

Value of mineral products of the United States, 1880–1947 [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	899,000,000	6,077,000,000	8,417,000,000
1945	1,975,000,000	5,212,000,000	954,000,000	6,166,000,000	8,141,000,000
1946	1,825,000,000	5,760,000,000	1,311,000,000	7,071,000,000	8,896,000,000
1947 [3]	2,915,000,000	7,843,000,000	1,635,000,000	9,478,000,000	12,393,000,000
Grand total	62,450,027.000	120,318,252.000	36,610,510.000	156,928,762,000	219,378,789,000

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

Mineral products of the United States, 1945–47 [1]

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
METALLIC						
Aluminum ---- short tons (2,000 pounds)	495,060	$140,864,000	409,630	$115,812,000	571,750	$161,626,000
Antimonial lead ---- do	[2] 56,495	(2)	[2] 50,480	(2)	[2] 86,075	(2)
Antimony:						
Metal ---- do	(3)	(3)	(3)	(3)	(3)	(3)
Ore and concentrates ---- do	14,966	561,630	13,962	797,715	20,020	3,272,079
Bauxite ---- long tons (dried equivalent)	981,009	5,591,084	1,104,054	6,892,864	1,202,055	6,884,666
Beryllium concentrates ---- short tons	39	6,133	100	17,787	145	25,214
Cadmium:						
Metal ---- pounds	7,938,658	6,106,992	6,180,265	6,094,572	7,852,907	12,358,526
In compounds ---- do	451,050	347,308	270,789	267,033	500,859	788,352
Chromite ---- short tons	13,973	532,382	4,107	105,041	948	(4)
Cobalt ---- pounds	1,281,681	(4)	(4)	(4)	(4)	(4)
Copper (smelter output from domestic ores) ---- short tons	782,726	[5] 184,723,000	599,656	[5] 172,701,000	862,872	[5] 360,680,000
Ferro-alloys ---- do	1,661,657	210,509,657	1,551,624	176,273,655	1,841,682	220,021,974
Gold (mint output) [6] ---- troy ounces	928,893	32,511,255	1,462,354	51,182,390	2,165,318	75,786,130
Indium ---- do	57,434	146,139	9,667	16,618	13,908	23,901
Iron:						
Ore [7] ---- long tons (2,240 pounds)	88,136,715	[7] 243,760,986	70,090,410	[7] 215,006,427	93,314,635	[7] 320,864,981
Pig ---- short tons	53,265,353	1,172,435,165	45,075,890	1,103,928,986	58,367,510	1,770,658,663
Lead (refinery output from domestic ores) ---- do	356,535	[5] 45,636,000	293,309	[5] 49,276,000	380,757	[5] 108,897,000
Magnesium (new ingot) ---- do	43,496	17,874,418	8,916	3,654,164	5,264	(4)
Manganese ore (35 percent or more Mn) ---- do	182,337	7,320,309	143,635	4,811,068	131,627	4,200,947
Manganiferous ore (5 to 35 percent Mn) ---- do	1,522,854	3,513,666	1,171,183	3,126,711	1,174,355	3,447,149
Mercury ---- flasks (76 pounds net)	30,763	4,149,621	25,348	2,490,188	23,244	1,946,453
Molybdenum ---- pounds	33,683,000	23,976,000	16,786,600	11,529,000	22,189,800	15,178,000
Nickel ---- short tons	1,155	(4)	352	(4)	646	(4)
Ores (crude), old tailings, etc.:						
Copper ---- do	76,856,000	(8)	61,741,000	(8)	87,633,000	(8)
Dry and siliceous (gold and silver) ---- do	1,984,000	(8)	2,995,000	(8)	4,235,000	(8)
Lead ---- do	6,730,000	(8)	5,651,000	(8)	6,165,000	(8)
Lead-copper ---- do	168,000	(8)	144,000	(8)	183,000	(8)
Zinc ---- do	16,308,000	(8)	14,895,000	(8)	10,045,000	(8)
Zinc-copper ---- do	812,000	(8)	654,000	(8)	350,000	(8)
Zinc-lead ---- do	12,355,000	(8)	12,730,000	(8)	12,530,000	(8)
Zinc-lead-copper ---- do	12,000	(8)	12,000	(8)	11,000	(8)
Platinum metals (refined) (value at New York City) ---- troy ounces	33,592	1,543,000	30,237	1,802,000	17,442	990,000
Radium ---- milligrams	200	3,700	200	3,700	16,400	303,400
Selenium ---- pounds	604,445	(4)	405,226	(4)	494,982	(4)
Silver (mint output) [9] ---- troy ounces	29,063,255	20,667,205	21,103,269	19,099,524	38,587,069	34,923,246
Tantalum and columbium concentrates ---- pounds	6,649	13,653	3,475	8,793	3,259	8,677
Tellurium ---- do	60,328	(4)	38,523	(4)	71,300	(4)
Tin (metal content of ore) ---- short tons	----	----	----	----	1	2,200

Titanium concentrates:						
Ilmenite do	308,518	7,359,170	282,708	4,878,917	336,061	5,029,490
Rutile do	6,837	869,920	7,514	996,989	5,157	533,548
Tungsten concentrates short tons (60 percent WO_3 basis)	5,534	7,692,691	5,193	6,283,413	3,094	4,349,851
Vanadium pounds	2,963,913	1,766,500	1,272,148	710,582	2,117,962	1,285,026
Zinc (smelter output from domestic ores) short tons	467,084	[5] 80,338,000	459,205	[5] 81,738,000	510,058	[5] 109,152,000
Other metallic [10]		1,459,341		1,851,846		2,636,551
Total value of metallic products (approximate)		1,975,000,000		1,825,000,000		2,915,000,000
NONMETALLIC						
Arsenious oxide (white arsenic) short tons	24,810	1,197,061	12,039	655,077	18,188	1,533,756
Asbestos do	12,226	446,045	14,075	504,764	24,035	918,558
Asphalt:						
Native do	703,873	3,816,471	845,898	4,262,886	1,071,922	5,503,048
Oil (including road oil) [7] do	6,311,815	[7] 68,930,149	7,056,882	[7] 82,910,877	8,165,631	[7] 116,002,372
Barite (crude) do	696,062	5,348,652	724,362	5,242,755	834,082	6,171,342
Boron minerals do	325,935	7,635,365	430,689	9,575,866	501,935	11,844,108
Bromine pounds	79,709,857	14,796,229	42,780,925	8,560,434	78,177,650	14,837,104
Calcium-magnesium chloride short tons	218,320	1,818,219	262,147	2,278,954	271,206	2,650,205
Cement barrels (376 pounds net)	107,833,108	175,430,858	172,100,699	296,551,514	190,419,754	361,978,374
Clay:						
Products, heavy clay (other than pottery and refractories)		[11] 86,275,352		[11] 178,756,000		[11] 219,004,000
Raw short tons	[12] 18,627,607	[12] 39,795,315	[12] 30,265,194	[12] 57,160,315	[12] 33,270,405	[12] 69,612,873
Coal:						
Bituminous [13] do	577,617,327	1,768,204,320	533,922,068	1,835,539,476	619,000,000	2,562,375,000
Pennsylvania anthracite do	54,933,909	323,944,435	60,506,873	413,417,070	57,190,009	413,019,486
Coke [7] do	67,308,181	[7] 508,540,042	58,497,848	[7] 486,729,382	73,445,850	[7] 776,405,520
Diatomite do	(14)	(14)	(14)	(14)	(14)	(14)
Emery do	7,856	75,977	6,188	62,099	5,798	66,927
Feldspar (crude) long tons	373,054	2,021,529	508,380	2,594,099	459,910	2,410,940
Flint lining for tube mills short tons	1,982	45,933	2,375	44,247	1,496	40,303
Fluorspar do	323,961	9,896,879	277,940	9,038,969	329,484	10,954,875
Fuller's earth do	296,368	3,463,913	298,752	3,702,993	329,068	4,660,614
Garnet for abrasive purposes do	6,306	375,198	7,743	570,186	8,722	614,071
Gem stones		(15)		(15)		(15)
Graphite (amorphous and crystalline) short tons	5,334	289,207	4,844	252,596	5,207	221,260
Grindstones and pulpstones do	(14)	(14)	11,677	505,324	10,696	481,787
Gypsum (crude) do	3,811,723	6,984,324	5,629,398	12,441,829	6,208,216	16,529,884
Helium [16] cubic feet	128,440,909	937,283	63,403,345	478,654	63,198,650	541,307
Iodine pounds	(14)	(14)	(14)	(14)	(14)	(14)
Kyanite short tons	(14)	(14)	(14)	(14)	(14)	(14)
Lime do	5,920,579	45,918,468	5,992,700	51,032,517	6,778,979	63,826,387
Lithium minerals do	2,446	285,520	3,065	303,892	2,441	151,113
Magnesite (crude) do	336,458	2,324,957	324,640	2,225,850	375,993	2,596,747
Magnesium compounds [17] short tons (MgO equivalent)	269,806	9,675,149	215,372	8,316,300	146,000	9,110,000
Marl:						
Calcareous short tons	154,122	188,311	213,448	248,530	176,187	235,190
Greensand do	4,986	477,919	5,140	424,900	8,337	432,980
Mica:						
Scrap do	41,060	812,322	53,602	1,041,423	49,797	1,095,578
Sheet pounds	1,298,587	737,342	1,078,867	217,955	415,589	116,110

See footnotes at end of table.

Mineral products of the United States, 1945–47 [1]—Continued

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
NONMETALLIC—continued						
Millstones		$15,018		$14,780		$23,189
Mineral pigments:						
Natural pigments and manufactured iron oxide pigments ... short tons	101,014	8,825,174	115,097	10,004,150	115,367	11,167,161
Zinc and lead pigments [18] ... do	194,448	26,555,658	[18] 225,822	[18] 32,354,517	[18] 242,230	[18] 46,508,398
Mineral waters	(15)	(15)	(15)	(15)	(15)	(15)
Natural gas (valued at point of consumption) ... M cubic feet	3,918,686,000	837,852,000	4,030,605,000	885,878,000	4,444,693,000	1,032,200,000
Natural gasoline and allied products:						
Natural gasoline and cycle products ... gallons	3,290,949,000	145,570,000	3,451,688,000	146,202,000	3,654,520,000	218,800,000
Liquefied petroleum gases ... do	1,413,224,000	41,994,000	1,409,345,000	36,079,000	1,889,524,000	68,200,000
Oilstones, etc. ... short tons	(14)	(14)	(14)	(14)	(14)	(14)
Olivine ... do	(14)	(14)	7,649	92,868	10,838	129,094
Peat ... do	107,000	821,000	140,707	1,006,231	136,232	868,979
Pebbles for grinding ... do	8,615	201,806	4,652	102,043	5,860	122,883
Perlite (crude or refined) (sales) ... do			3,022	46,103	9,265	94,309
Petroleum ... barrels (42 gallons)	1,713,655,000	2,094,250,000	1,733,939,000	2,442,550,000	1,856,107,000	3,548,266,000
Phosphate rock ... long tons	5,806,723	23,951,077	6,860,713	31,043,821	9,087,199	47,461,981
Potassium salts ... short tons (K_2O equivalent)	870,370	30,313,919	928,374	32,175,716	1,053,266	34,716,051
Pumice ... short tons	157,011	1,051,037	319,883	1,585,753	442,552	2,021,880
Pyrites ... long tons	722,596	2,700,000	813,372	3,228,000	940,652	4,070,000
Salt (sodium chloride) ... short tons	15,394,141	43,914,406	15,132,145	44,912,586	16,138,374	52,276,180
Sand and gravel:						
Glass sand ... do	4,681,920	8,374,218	4,848,602	9,541,405	5,321,247	11,395,245
Sand (molding, building, etc.) and gravel ... do	190,842,000	120,463,000	249,282,000	161,845,000	282,338,000	205,474,000
Silica (quartz) ... do	57,764	236,803	73,179	293,852	73,347	368,977
Silica sand and sandstone ... do	533,656	3,709,597	575,888	4,125,398	651,120	5,181,113
Slate ... do	551,890	5,658,913	759,770	8,844,106	876,010	11,685,554
Sodium salts (carbonates and sulfates) (natural) ... do	372,241	4,559,277	414,406	5,122,499	550,345	9,191,272
Stone [19] ... do	153,405,210	179,307,902	178,852,360	234,339,486	207,554,790	289,344,482
Strontium minerals ... do	2,784	27,840	243	3,726		
Sulfur ... long tons	3,833,294	61,300,000	4,128,212	66,100,000	4,828,103	85,200,000
Sulfuric acid (60° Baumè) (byproduct) [20] ... short tons	1,084,891	10,136,598	922,127	8,226,751	933,690	9,178,402
Sulfur ore ... long tons	1,615	12,170	6,344	95,531	4,303	65,124
Talc, pyrophyllite, and ground soapstone [21] ... short tons	398,384	5,407,235	457,066	6,445,344	516,094	7,682,481
Topaz, industrial ... do	765	13,500	700	10,500	2,294	45,873
Tripoli ... do	18,247	306,829	28,955	549,099	34,578	751,422
Vermiculite ... do	64,808	648,077	86,390	867,973	131,385	1,338,572
Other nonmetallic [22]		(14)		(14)		(14)
Total value of nonmetallic products (approximate)		6,166,000,000		7,071,000,000		9,478,000,000

SUMMARY						
Total value:						
Metallic	----------	1,975,000,000	----------	1,825,000,000	----------	2,915,000,000
Nonmetallic:						
Fuels	----------	5,212,000,000	----------	5,760,000,000	----------	7,843,000,000
Other	----------	954,000,000	----------	1,311,000,000	----------	1,635,000,000
Grand total approximate value of mineral products	----------	8,141,000,000	----------	8,896,000,000	----------	12,393,000,000

[1] In this general statement most of the figures represent shipments rather than quantity mined, and some of the figures for 1947 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] Value included in total value of metallic products; Bureau of Mines not at liberty to publish figure.
[5] Value does not include premiums paid to miners by the Government. Total overceiling payments for copper, lead, and zinc amounted to approximately $79,000,000 in 1945, $77,000,000 in 1946, and $21,000,000 in 1947. In addition, exploration premiums totaling $6,213,545 were paid to miners from July 1, 1946 through Dec. 31, 1947, to encourage exploration and development of copper, lead, and zinc deposits.
[6] According to Bureau of the Mint. Valued at $35 per ounce.
[7] Value not included in total value.
[8] Value figure not available.
[9] According to Bureau of the Mint.
[10] Includes value of bismuth, germanium, thallium, and zircon.
[11] Figures obtained through cooperation with Bureau of the Census.
[12] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value of nonmetallic products.
[13] Includes brown coal and lignite, and anthracite mined elsewhere than in Pennsylvania.
[14] Value included in total value of nonmetallic products. Bureau of Mines not at liberty to publish figure.
[15] No canvass. Estimate of value included in total value of nonmetallic products.
[16] Figures cover fiscal year ended June 30 of year stated.
[17] Includes compounds from raw sea water, well brines, sea-water bitterns, brucite, and serpentine only. Data for 1945–46 are not quite comparable with 1947 in that the former are on a gross-weight basis and include some compounds made from a combination of sea water and dolomite and of well brines and dolomite.
[18] Includes sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide except that in 1946–47 data for sublimed blue and white lead are excluded from this grouping; however, the value is included in the total value of nonmetallic products.
[19] Excludes limestone for cement and lime.
[20] From copper, lead, and zinc smelters and zinc roasters.
[21] Figures for soapstone used as dimension stone included in figures for stone.
[22] Includes the following: 1945—andalusite, crude aplite, dumortierite, and wollastonite; 1946—crude aplite and wollastonite; 1947—andalusite, crude aplite, and wollastonite

Value of mineral products of the United States, 1943–47, by States [1]

	1943	1944	1945	1946	1947
Alabama	$102,584,000	$109,149,000	$110,360,000	$123,029,000	$159,788,000
Alaska	9,055,000	6,903,000	10,174,000	12,426,000	18,387,000
Arizona	124,584,000	115,592,000	98,574,000	118,086,000	186,751,000
Arkansas	77,191,000	64,079,000	58,257,000	65,985,000	90,833,000
California	477,278.000	506,216,000	515,214,000	592,294,000	855,553,000
Colorado	87,335,000	79,137,000	77,236.000	77,573,000	105,135,000
Connecticut	4,835,000	4,496,000	3,498,000	5,584,000	5,677,000
Delaware	367,000	182,000	131,000	491,000	613,000
District of Columbia	100,000	111,000	229,000	710,000	746,000
Florida	25,070,000	21,896,000	24,928,000	31,093,000	45,992,000
Georgia	20,927,000	19,005,000	19,988,000	30,449,000	37,137,000
Idaho	57,475,000	51,321,000	44,348,000	44,444.000	67,786,000
Illinois	320,077,000	329,147,000	330,184,000	358,628,000	428,327,000
Indiana	82,524,000	89,760,000	88,802,000	107,479,000	141,086,000
Iowa	24,187,000	22,452,000	25,008,000	35,957,000	39,378,000
Kansas	177,308,000	170,560,000	166,644,000	194,563,000	267,020,000
Kentucky	210,352,000	250,735,000	250,919,000	272,558,000	395,745,000
Louisiana	198,258,000	217,733,000	222,413,000	273,882,000	397,312,000
Maine	2,720,000	2,150,000	2,521,000	4,389,000	6,049,000
Maryland	17,508,000	15,264,000	15,329,000	21,991,000	25,604,000
Massachusetts	5,441,000	5,263,000	5,450,000	9,745,000	11,859,000
Michigan	147,110,000	140,520,000	127,869,000	133,310,000	170,616,000
Minnesota	177,687,000	170,488,000	167,138,000	155,734,000	219,685,000
Mississippi	20,893,000	18,675,000	21,370,000	33,672,000	68,092,000
Missouri	72,156,000	72,890,000	74,347,000	88,357,000	107,021,000
Montana	85,208,000	82,290,000	68,829,000	62,114,000	87,167,000
Nebraska	6,800,000	5,060,000	4,963,000	7,277,000	7,383,000
Nevada	56,525,000	51,800,000	31,307,000	35.454,000	42,639,000
New Hampshire	1,350,000	1,164,000	802,000	1,451,000	1,574,000
New Jersey	37,583,000	33,828,000	31,267,000	33,518,000	44,250,000
New Mexico	111,142,000	112,180,000	104,234,000	111,938,000	156,554,000
New York	84,410,000	84,286,000	88,678,000	103,571,000	130.735,000
North Carolina	22,172,000	22,199,000	14,766,000	20,428,000	23,699,000
North Dakota	4,367.000	4,334,000	4,505,000	5,118,000	7,629,000
Ohio	170,726,000	174,582,000	179,682,000	221,356,000	296,147,000
Oklahoma	221,631,000	225,833,000	243,314,000	263,282,000	351,578,000
Oregon	12,267,000	9,657,000	9,463,000	11,807,000	16,658,000
Pennsylvania	865,282,000	962,208,000	913,232,000	1,074,004,000	1,266,285,000
Rhode Island	808,000	612,000	508,000	561,000	785,000
South Carolina	4,759,000	4,192,000	5,043,000	8,189,000	10,362,000
South Dakota	8,606,000	5,471,000	7,137,000	18,389,000	23,636,000
Tennessee	64,480,000	63,994,000	58,672,000	68,031,000	84.425,000
Texas	936,034,000	1,133,756,000	1,150,597,000	1,313,003,000	1,926,699,000
Utah	163,341,000	148,308,000	127,961,000	95,506,000	206,639,000
Vermont	6,404,000	7,672,000	8,249,000	12,096,000	14,818,000
Virginia	85,758,000	86,951,000	81,965,000	90,823,000	128,700,000
Washington	37,593,000	36,483,000	31,301,000	33,029,000	40,027,000
West Virginia	500,099,000	547,851,000	537,212,000	588,925,000	855,150,000
Wisconsin	18,930,000	22,798,000	22,217,000	28,596,000	34,942,000
Wyoming	64,925,000	68,034,000	74,620,000	78,745,000	118,422,000

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation. The many revisions in State totals result from the substitution of data for natural gas valued at points of consumption by data for natural gas valued at wells.

Mineral products of the United States and principal producing States in 1946

Rank in value	Product	Principal producing States [1]: In order of quantity	Principal producing States [1]: In order of value
14	Aluminum	Washington, Tennessee, New York, Alabama.	Rank same as for quantity.
[2]	Antimonial lead	Not separable by States	Not separable by States.
62	Antimony ore	Idaho, Washington, Nevada, Oregon.	Rank same as for quantity.
83	Aplite (crude)	Virginia	Do.
67	Arsenious oxide	Montana, Utah	Do.
72	Asbestos	Vermont, Arizona, North Carolina, Georgia.	Vermont, Arizona, California, North Carolina.
	Asphalt:		
45	Native	Texas, Oklahoma, Kentucky, Utah.	Utah, Kentucky, Texas, Oklahoma.
15	Oil	Not separable by States	Not separable by States.

See footnotes at end of table.

Mineral products of the United States and principal producing States in 1946—Continued

Rank in value	Product	Principal producing States [1]	
		In order of quantity	In order of value
40	Barite (crude)	Arkansas, Missouri, Georgia, Tennessee.	Missouri, Arkansas, Georgia, Tennessee.
36	Bauxite	Arkansas, Georgia, Alabama, Virginia.	Rank same as for quantity.
93	Beryllium concentrates	South Dakota, New Hampshire	Do.
58	Bismuth	Not separable by States	Not separable by States.
30	Boron minerals	California	Rank same as for quantity.
33	Bromine	Texas, Michigan, California, West Virginia.	Do.
38	Cadmium	Not separable by States	Not separable by States.
53	Calcium-magnesium chloride.	Michigan, West Virginia, California.	Michigan, California, West Virginia.
5	Cement	Pennsylvania, California, Texas, New York.	Rank same as for quantity.
84	Chromite	Oregon, California	Do.
	Clay:		
10	Products, heavy clay (other than pottery and refractories).		Ohio, Pennsylvania, Illinois, California.
18	Raw (sold or used by producers).	Ohio, Pennsylvania, Illinois, Missouri.	Georgia, Pennsylvania, Ohio, Missouri.
2	Coal:		
	Bituminous	West Virginia, Pennsylvania, Kentucky, Illinois.	Rank same as for quantity.
	Pennsylvania anthracite.	Pennsylvania	Do.
75	Cobalt	Pennsylvania, Missouri	Do.
4	Coke	Pennsylvania, Ohio, Indiana, New York.	Do.
12	Copper	Arizona, Utah, Montana, New Mexico.	Do.
44	Diatomite	California, Oregon, Nevada, Washington.	Do.
88	Emery	New York	Do.
51	Feldspar (crude)	North Carolina, South Dakota, New Hampshire, Colorado.	North Carolina, New Hampshire, South Dakota, Virginia.
11	Ferro-alloys	Pennsylvania, New York, Ohio, West Virginia.	Pennsylvania, New York, West Virginia, Alabama.
91	Flint lining for tube mills	Minnesota, Wisconsin, North Carolina.	Rank same as for quantity.
31	Fluorspar	Illinois, Kentucky, Colorado, New Mexico.	Do.
47	Fuller's earth	Texas, Georgia, Florida, Illinois	Georgia, Texas, Florida, Illinois.
68	Garnet (abrasive)	New York, Idaho	Rank same as for quantity.
[3]	Gem stones	No canvass for 1946	No canvass for 1946.
92	Germanium	Not separable by States	Not separable by States.
19	Gold	California, South Dakota, Alaska, Utah.	Rank same as for quantity.
81	Graphite:		
	Amorphous	Rhode Island	Do.
	Crystalline	Texas, Alabama, Pennsylvania	Do.
71	Grindstones and pulpstones.	Ohio, West Virginia, Washington	Do.
27	Gypsum (crude)	Michigan, New York, Texas, California.	Do.
73	Helium	Texas, Kansas	Do.
94	Indium	Not separable by States	Not separable by States.
63	Iodine (natural)	California	Rank same as for quantity.
	Iron:		
7	Ore	Minnesota, Michigan, Alabama, Utah.	Minnesota, Michigan, Alabama, New York.
3	Pig	Pennsylvania, Ohio, Indiana, Illinois.	Rank same as for quantity.
79	Kyanite	Virginia, Georgia, California	Do.
21	Lead	Missouri, Idaho, Utah, Arizona	Do.
20	Lime	Ohio, Pennsylvania, Missouri, West Virginia.	Do.
77	Lithium minerals	California, South Dakota, New Mexico, Colorado.	Do.
54	Magnesite (crude)	Washington, Nevada, California, Texas.	Do.
48	Magnesium	Texas, Michigan, California	Do.
34	Magnesium compounds (natural).	Michigan, California, Nevada, New Jersey.	Michigan, California, New Jersey, Texas.
43	Manganese ore	Montana, Washington, Virginia, New Mexico.	Montana, Washington, New Mexico, Nevada.

See footnotes at end of table.

Mineral products of the United States and principal producing States in 1946—Continued

Rank in value	Product	Principal producing States [1] In order of quantity	Principal producing States [1] In order of value
50	Manganiferous ore	Minnesota, New Mexico, Nevada Utah.	Minnesota, New Mexico, Utah, Nevada.
65	Manganiferous zincresiduum.	New Jersey	Rank same as for quantity.
	Marl:		
82	Calcareous	Virginia, Indiana, West Virginia, Michigan.	Virginia, West Virginia, Indiana, Nevada.
74	Greensand	New Jersey	Rank same as for quantity.
52	Mercury	California, Nevada, Oregon, Idaho	Do.
57	Mica	North Carolina, California, Colorado, South Dakota.	North Carolina, South Dakota, New Hampshire, Colorado.
	Scrap	do	North Carolina, South Dakota, Colorado, Georgia.
	Sheet	North Carolina, New Hampshire, Connecticut, South Dakota.	Rank same as for quantity.
95	Millstones		New York, North Carolina, Virginia.
	Mineral pigments:		
29	Natural pigments and manufactured iron oxide pigments.	Pennsylvania, Illinois, Virginia, New Jersey.	Pennsylvania, Illinois, New Jersey, Virginia.
23	Lead and zinc pigments.	Pennsylvania, Illinois, Kansas, Ohio.	Rank same as for quantity.
(3)	Mineral waters	No canvass for 1946	No canvass for 1946.
28	Molybdenum	Colorado, Utah, New Mexico, Arizona.	Rank same as for quantity.
8	Natural gas [4]	Texas, Louisiana, California, Oklahoma.	Texas, California, West Virginia, Pennsylvania.
9	Natural gasoline and allied products:		
	Natural gasoline and cycle products.	Texas, California, Louisiana, Oklahoma.	Rank same as for quantity.
	Liquefied petroleum gases.	Texas, California, Oklahoma, Louisiana.	Texas, California, Louisiana, Illinois.
76	Nickel	Not separable by States	Not separable by States.
78	Oilstones, etc	Arkansas, Ohio, Indiana, New Hampshire.	Arkansas, Ohio, New Hampshire, Indiana.
87	Olivine	North Carolina, Washington	Rank same as for quantity.
(5)	Ores (crude), etc.:		
	Copper	Arizona, Utah, New Mexico, Nevada.	Value not available.
	Dry and siliceous (gold and silver).	South Dakota, Colorado, California, Nevada.	Do.
	Lead	Missouri, Idaho, California, Illinois.	Do.
	Lead-copper	Missouri, Utah, Arizona, Idaho	Do.
	Zinc	Oklahoma, Kansas, Tennessee, Missouri.	Do.
	Zinc-copper	Washington, California, Arizona	Do.
	Zinc-lead	Oklahoma, Idaho, Kansas, Missouri.	Do.
	Zinc-lead-copper	Arizona	Do.
59	Peat	Maine, New Jersey, Florida, Ohio	Ohio, New Jersey, Michigan, California.
85	Pebbles for grinding	Minnesota, Wisconsin, North Carolina, Texas.	North Carolina, Minnesota, Wisconsin, Texas.
90	Perlite	Arizona	Rank same as for quantity.
1	Petroleum	Texas, California, Louisiana, Oklahoma.	Do.
25	Phosphate rock	Florida, Tennessee, Idaho, Montana.	Do.
55	Platinum metals	Alaska, California	Do.
24	Potassium salts	New Mexico, California, Utah, Maryland.	Do.
56	Pumice	Idaho, California, New Mexico, Kansas.	California, New Mexico, Idaho, Kansas.
49	Pyrites	Tennessee, Virginia, California, Montana.	Tennessee, California, Virginia, New York.
100	Radium	Colorado, Utah	Rank same as for quantity.
22	Salt	Michigan, New York, Ohio, Louisiana.	Michigan, New York, Louisiana, Ohio.
13	Sand and gravel	California, Illinois, Michigan, Wisconsin.	California, Illinois, Ohio, Pennsylvania.
64	Selenium	Not separable by States	Not separable by States.
80	Silica (quartz)	Washington, North Carolina, California, Wisconsin.	North Carolina, California, Washington, Oregon.
46	Silica sand and sandstone (ground).	Illinois, New Jersey, Pennsylvania, Ohio.	Illinois, Ohio, New Jersey, Pennsylvania.

See footnotes at end of table.

Mineral products of the United States and principal producing States in 1946—Continued

Rank in value	Product	Principal producing States [1] In order of quantity	In order of value
26	Silver	Idaho, Utah, Montana, Arizona	Rank same as for quantity.
32	Slate		Pennsylvania, Vermont, New York, Georgia.
41	Sodium salts (carbonates and sulfates) (natural).	California, Texas, Wyoming	Rank same as for quantity.
6	Stone	Pennsylvania, Ohio, Illinois, Michigan.	Pennsylvania, Ohio, Illinois, New York.
99	Strontium minerals	California	Rank same as for quantity.
17	Sulfur	Texas, Louisiana	Do.
35	Sulfuric acid from copper, lead, and zinc smelters and zinc roasters.	Pennsylvania, Illinois, Tennessee, Indiana.	Do.
86	Sulfur ore	Texas, California, Colorado, Nevada.	Do.
37	Talc, pyrophyllite, and ground soapstone.[6]	New York, North Carolina, California, Vermont.	New York, California, North Carolina, Vermont.
98	Tantalum concentrates	New Mexico, South Dakota	Rank same as for quantity.
89	Tellurium	Not separable by States	Not separable by States.
97	Thallium	do	Do.
	Titanium concentrates:		
42	Ilmenite	New York, Florida, Virginia, North Carolina.	New York, Florida, North Carolina, Virginia.
60	Rutile	Florida, Virginia	Rank same as for quantity.
96	Topaz (industrial)	South Carolina	Do.
70	Tripoli	Illinois, Missouri, Pennsylvania	Do.
39	Tungsten concentrates	Nevada, California, Idaho, North Carolina.	Do.
66	Vanadium	Colorado, Idaho, Utah, Arizona	Do.
61	Vermiculite	Montana, Wyoming, South Carolina, Texas.	Montana, South Carolina, Wyoming, Texas.
101	Wollastonite	New York	Rank same as for quantity.
16	Zinc	Idaho, Oklahoma, New Jersey, Kansas.	Do.
69	Zircon	Florida	Do.

[1] Rank of States in metal production (except aluminum, ferro-alloys, and pig iron) arranged according to mine reports, not smelter output.
[2] Separate figures for antimonial lead from primary sources not available.
[3] No canvass for 1946.
[4] The rank of natural gas in this table (in contrast to corresponding tables in earlier editions of Minerals Yearbook) is based on value at wells rather than value at points of consumption.
[5] Value not available.
[6] Exclusive of soapstone used as dimension stone (all from Virginia), which is included in figures for stone.

Mineral products of the United States and principal producing States in 1947

Rank in value	Product	Principal producing States [1] In order of quantity	In order of value
14	Aluminum	Washington, Tennessee, New York, Oregon.	Rank same as for quantity.
102	Andalusite	Nevada	Do.
(2)	Antimonial lead	Not separable by States	Not separable by States.
50	Antimony ore	Idaho, Nevada, Washington, Alaska.	Rank same as for quantity.
76	Aplite (crude)	Virginia	Do.
58	Arsenious oxide	Montana, Utah	Do.
65	Asbestos	Vermont, Arizona, North Carolina, Georgia.	Vermont, Arizona, California, North Carolina.
	Asphalt:		
41	Native	Texas, Kentucky, Oklahoma, Utah.	Utah, Kentucky, Texas, Oklahoma.
15	Oil	Not separable by States	Not separable by States.
40	Barite (crude)	Arkansas, Missouri, Georgia, Nevada.	Missouri, Arkansas, Georgia, Tennessee.
39	Bauxite	Arkansas, Alabama, Georgia	Rank same as for quantity.
95	Beryllium concentrates	South Dakota, New Hampshire, Connecticut, Colorado.	South Dakota, New Hampshire, Connecticut, Maine.
57	Bismuth	Not separable by States	Not separable by States.
31	Boron minerals	California	Rank same as for quantity.
29	Bromine	Texas, Michigan, West Virginia, California.	Do.
30	Cadmium	Not separable by States	Not separable by States.

See footnotes at end of table.

Mineral products of the United States and principal producing States in 1947—Continued

Rank in value	Product	Principal producing States [1] In order of quantity	In order of value
51	Calcium-magnesium chloride.	Michigan, West Virginia, California.	Michigan, California, West Virginia.
5	Cement	Pennsylvania, California, Texas, New York.	Rank same as for quantity.
98	Chromite	California	Do.
	Clay:		
12	Products, heavy clay (other than pottery and refractories).		Ohio, Pennsylvania, California, Illinois.
20	Raw (sold or used by producers).	Ohio, Pennsylvania, Illinois, California.	Georgia, Pennsylvania, Ohio Missouri.
2	Coal:		
	Bituminous	West Virginia, Pennsylvania, Kentucky, Illinois.	Rank same as for quantity.
	Pennsylvania anthracite.	Pennsylvania	Do.
79	Cobalt	Pennsylvania, Missouri	Do.
4	Coke	Pennsylvania, Ohio, Indiana, Alabama.	Pennsylvania, Indiana, Ohio, New York.
6	Copper	Arizona, Utah, New Mexico, Montana.	Rank same as for quantity.
43	Diatomite	California, Oregon, Nevada, Washington.	Do.
89	Emery	New York	Do.
53	Feldspar (crude)	North Carolina, South Dakota, Colorado, Virginia.	North Carolina, South Dakota, Virginia, Colorado.
11	Ferro-alloys	Pennsylvania, New York, Ohio, West Virginia.	Pennsylvania, New York, West Virginia, Ohio.
92	Flint lining for tube mills.	Minnesota, Wisconsin, North Carolina.	Rank same as for quantity.
34	Fluorspar	Illinois, Kentucky, Colorado, New Mexico.	Do.
45	Fuller's earth	Georgia, Texas, Florida, Illinois	Do.
70	Garnet (abrasive)	New York, Idaho	Do.
(3)	Gem stones	No canvass for 1947	No canvass for 1947.
93	Germanium	Not separable by States	Not separable by States.
19	Gold	California, Utah, South Dakota, Alaska.	Rank same as for quantity.
82	Graphite:		
	Amorphous	Rhode Island	Do.
	Crystalline	Texas, Alabama, Pennsylvania	Do.
74	Grindstones and pulpstones.	Ohio, West Virginia, Washington.	Do.
27	Gypsum (crude)	Michigan, New York, Texas, California.	Do.
71	Helium	Texas	Do.
96	Indium	Not separable by States	Not separable by States.
63	Iodine (natural)	California	Rank same as for quantity.
	Iron:		
7	Ore	Minnesota, Michigan, Alabama, Utah.	Minnesota, Michigan, Alabama, New York.
3	Pig	Pennsylvania, Ohio, Indiana, Illinois.	Rank same as for quantity.
77	Kyanite	Virginia	Do.
17	Lead	Missouri, Idaho, Utah Arizona	Do.
21	Lime	Ohio, Pennsylvania, Missouri, West Virginia.	Do.
83	Lithium minerals	South Dakota, California, New Mexico, Colorado.	California, South Dakota, New Mexico, Colorado.
52	Magnesite (crude)	Washington, Nevada, California, Texas.	Rank same as for quantity.
55	Magnesium	Texas	Do.
37	Magnesium compounds (natural).	Nevada, California, Texas, Michigan.	Michigan, Nevada, California, Texas.
47	Manganese ore	Montana, New Mexico, Arkansas, Arizona.	Rank same as for quantity.
49	Manganiferous ore	Minnesota, New Mexico, Nevada, Utah.	Do.
67	Manganiferous zinc residuum.	New Jersey	Do.
	Marl:		
81	Calcareous	Virginia, Indiana, West Virginia, Minnesota.	Virginia, Nevada, West Virginia, Indiana.
75	Greensand	New Jersey	Rank same as for quantity.
56	Mercury	California, Nevada, Oregon, Idaho.	Do.

See footnotes at end of table.

Mineral products of the United States and principal producing States in 1947—Continued

Rank in value	Product	Principal producing States [1] In order of quantity	In order of value
61	Mica	North Carolina, California, South Dakota, Colorado.	North Carolina, California, South Dakota, Georgia.
	Scrap	North Carolina, California, South Dakota, Colorado.	Do.
	Sheet	North Carolina, South Dakota, Georgia, Maine.	Rank same as for quantity.
97	Millstones		North Carolina, New York, Virginia.
	Mineral pigments:		
33	Natural pigments and manufactured iron oxide pigments.	Pennsylvania, Illinois, New Jersey, Virginia.	Pennsylvania, New Jersey, Illinois, Ohio.
23	Lead and zinc pigments.	Pennsylvania, Illinois, Kansas, Ohio.	Rank same as for quantity.
(3)	Mineral waters	No canvass for 1947	No canvass for 1947.
28	Molybdenum	Colorado, Utah, New Mexico, Arizona.	Colorado, Utah, Arizona, New Mexico.
10	Natural gas [4]	Texas, Louisiana, California, Oklahoma.	Texas, California, West Virginia, Pennsylvania.
9	Natural gasoline and allied products:		
	Natural gasoline and cycle products.	Texas, California, Louisiana, Oklahoma.	Rank same as for quantity.
	Liquefied petroleum gases.	Texas, California, Oklahoma, Louisiana.	Texas, California, Louisiana, Oklahoma.
73	Nickel	Not separable by States	Not separable by States.
87	Oilstones, etc	Arkansas, New Hampshire, Indiana, Ohio.	Rank same as for quantity.
84	Olivine	North Carolina, Washington	Do.
(5)	Ores (crude), etc.:		
	Copper	Arizona, Utah, New Mexico, Nevada.	Value not available.
	Dry and siliceous (gold and silver).	Colorado, South Dakota, Idaho, Nevada.	Do.
	Lead	Missouri, Idaho, California, Colorado.	Do.
	Lead-copper	Missouri, Idaho, Arizona, Colorado.	Do.
	Zinc	Oklahoma, Kansas, Tennessee, Missouri.	Do.
	Zinc-copper	Washington, Arizona, California	Do.
	Zinc-lead	Idaho, Oklahoma, Kansas, Utah	Do.
	Zinc-lead-copper	Arizona, Colorado, Utah, Nevada	Do.
66	Peat	Florida, New Jersey, Ohio, Illinois	Ohio, New Jersey, Florida, Illinois.
85	Pebbles for grinding	Minnesota, Wisconsin, Texas, North Carolina.	Rank same as for quantity.
86	Perlite (crude or refined)	Arizona, Oregon, Nevada	Do.
1	Petroleum	Texas, California, Louisiana, Oklahoma.	Do.
24	Phosphate rock	Florida, Tennessee, Idaho, Montana.	Do.
64	Platinum metals	Alaska, California	Do.
26	Potassium salts	New Mexico, California, Utah, Michigan.	Do.
54	Pumice	California, Idaho, New Mexico, Oregon.	California, New Mexico, Idaho, Oregon.
48	Pyrites	Tennessee, California, Virginia, Montana.	Tennessee, California, Virginia, New York.
80	Radium	Colorado, Utah	Rank same as for quantity.
22	Salt	Michigan, Ohio, New York, Louisiana.	Michigan, New York, Ohio, Louisiana.
13	Sand and gravel	California, Michigan, Wisconsin, Illinois.	California, Ohio, Illinois, Pennsylvania.
62	Selenium	Not separable by States	Not separable by States.
78	Silica (quartz)	Washington, California, North Carolina, Wisconsin.	California, Washington, North Carolina, Arizona.
42	Silica sand and sandstone (ground).	Illinois, New Jersey, Pennsylvania, Ohio.	Illinois, New Jersey, Ohio, Pennsylvania.
25	Silver	Idaho, Utah, Montana, Arizona	Rank same as for quantity.
32	Slate		Pennsylvania, Vermont, New York, Georgia.
35	Sodium salts (carbonates and sulfates) (natural).	California, Texas, Wyoming	Rank same as for quantity.
8	Stone	Pennsylvania, Ohio, Michigan, Illinois.	Pennsylvania, Ohio, Illinois, New York.
18	Sulfur	Texas, Louisiana	Rank same as for quantity.
36	Sulfuric acid from copper, lead, and zinc smelters and zinc roasters.	Pennsylvania, Illinois, Utah, Indiana.	Pennsylvania, Illinois, Indiana Utah.

See footnotes at end of table.

Mineral products of the United States and principal producing States in 1947—Continued

Rank in value	Product	Principal producing States[1] In order of quantity	In order of value
90	Sulfur ore	Texas, California, Colorado, Nevada.	Texas, Colorado, California, Nevada.
38	Talc, pyrophyllite and ground soapstone.[6]	New York, North Carolina, California, Vermont.	New York, California, North Carolina, Vermont.
99	Tantalum concentrates	New Mexico	Rank same as for quantity.
88	Tellurium	Not separable by States	Not separable by States.
94	Thallium	do	Do.
100	Tin	Alaska	Rank same as for quantity.
	Titanium concentrates:		
44	Ilmenite	New York, Florida, Virginia, North Carolina.	New York, Virginia, Florida, North Carolina.
72	Rutile	Florida, Virginia	Rank same as for quantity.
91	Topaz (industrial)	South Carolina	Do.
68	Tripoli	Missouri, Illinois, Pennsylvania	Do.
46	Tungsten concentrates	Nevada, North Carolina, California, Colorado.	Nevada, North Carolina, California, Idaho.
60	Vanadium	Colorado, Idaho, Utah, New Mexico.	Rank same as for quantity.
59	Vermiculite	Montana, South Carolina, Wyoming, Colorado.	Do.
101	Wollastonite	New York	Do.
16	Zinc	Idaho, New Jersey, Arizona, Oklahoma.	Do.
69	Zircon	Florida	Do.

[1] Rank of States in metal production (except aluminum, ferro-alloys, and pig iron) arranged according to mine reports, not smelter output.
[2] Separate figures for antimonial lead from primary sources not available.
[3] No canvass for 1947.
[4] The rank of natural gas in this table (in contrast to corresponding tables in earlier editions of Minerals Yearbook) is based on value at wells rather than value at points of consumption.
[5] Value not available.
[6] Exclusive of soapstone used as dimension stone (all from Virginia), which is included in figures for stone

States and their principal mineral products in 1946 [1]

State	Rank	Percent of total value for United States	Principal mineral products in order of value
Alabama	13	1.74	Coal, iron ore, cement, clay products.
Alaska	38	.17	Gold, coal, platinum metals, sand and gravel.
Arizona	14	1.67	Copper, zinc, lead, gold.
Arkansas	24	.93	Petroleum, coal, bauxite, aluminum.
California	3	8.37	Petroleum, natural gas, natural gasoline, cement.
Colorado	22	1.10	Coal, petroleum, zinc, molybdenum.
Connecticut	44	.08	Clay products, stone, sand and gravel, lime.
Delaware	50	.01	Clay products, sand and gravel, stone.
District of Columbia	48	.01	Clay products, raw clay.
Florida	32	.44	Phosphate rock, stone, cement, sand and gravel.
Georgia	33	.43	Raw clay, stone, clay products, cement.
Idaho	26	.63	Zinc, lead, silver, phosphate rock.
Illinois	5	5.06	Coal, petroleum, stone, clay products.
Indiana	16	1.52	Coal, cement, petroleum, stone.
Iowa	27	.51	Cement, clay products, stone, coal.
Kansas	10	2.75	Petroleum, zinc, cement, natural gas.
Kentucky	7	3.85	Coal, petroleum, natural gas, stone.
Louisiana	6	3.87	Petroleum, natural gasoline, natural gas, sulfur.
Maine	46	.06	Cement, stone, sand and gravel, slate.
Maryland	35	.31	Coal, sand and gravel, cement, stone.
Massachusetts	41	.14	Stone, sand and gravel, clay products, lime.
Michigan	12	1.88	Iron ore, petroleum, cement, salt.
Minnesota	11	2.20	Iron ore, stone, sand and gravel, manganiferous ore.
Mississippi	29	.47	Petroleum, sand and gravel, clay products, raw clay
Missouri	20	1.25	Lead, cement, coal, stone.
Montana	25	.88	Copper, petroleum, coal, manganese ore.
Nebraska	43	.10	Cement, sand and gravel, clay products, stone.
Nevada	28	.50	Copper, zinc, tungsten ore, gold.
New Hampshire	47	.02	Sand and gravel, feldspar, stone, clay products.
New Jersey	30	.47	Zinc, sand and gravel, stone, clay products.
New Mexico	15	1.58	Petroleum, potassium salts, copper, zinc.
New York	17	1.46	Petroleum, cement, stone, salt.
North Carolina	36	.29	Stone, clay products, sand and gravel, feldspar.
North Dakota	45	.07	Coal, sand and gravel, clay products, natural gas.
Ohio	9	3.13	Coal, clay products, stone, cement.
Oklahoma	8	3.72	Petroleum, zinc, natural gasoline, natural gas.
Oregon	40	.17	Sand and gravel, cement, stone, clay products.
Pennsylvania	2	15.17	Coal, petroleum, cement, stone.
Rhode Island	49	.01	Stone, sand and gravel, graphite.

See footnote at end of table.

States and their principal mineral products in 1946 [1]—Continued

State	Rank	Percent of total value for United States	Principal mineral products in order of value
South Carolina	42	.11	Stone, raw clay, clay products, sand and gravel.
South Dakota	37	.26	Gold, stone, cement, sand and gravel.
Tennessee	23	.96	Coal, cement, stone, phosphate rock.
Texas	1	18.55	Petroleum, natural gasoline, natural gas, sulfur.
Utah	18	1.35	Copper, coal, zinc, lead.
Vermont	39	.17	Stone, slate, copper, talc.
Virginia	19	1.28	Coal, stone, sand and gravel, zinc.
Washington	31	.47	Cement, coal, sand and gravel, stone.
West Virginia	4	8.32	Coal, natural gas, petroleum, stone.
Wisconsin	34	.40	Stone, sand and gravel, iron ore, zinc.
Wyoming	21	1.11	Petroleum, coal, natural gasoline, natural gas.

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation. The rank of natural gas in this table (in contrast to corresponding tables in earlier editions of Minerals Yearbook) is based on value at wells rather than value at points of consumption.

States and their principal mineral products in 1947 [1]

State	Rank	Percent of total value for United States	Principal mineral products in order of value
Alabama	15	1.64	Coal, iron ore, cement, clay products.
Alaska	38	.19	Gold, sand and gravel, coal, stone.
Arizona	13	1.92	Copper, zinc, lead, silver.
Arkansas	23	.93	Petroleum, coal, bauxite, natural gasoline.
California	3	8.79	Petroleum, natural gas, natural gasoline, cement.
Colorado	22	1.08	Petroleum, coal, zinc, molybdenum.
Connecticut	46	.06	Clay products, stone, sand and gravel, lime.
Delaware	50	.01	Clay products, sand and gravel, stone.
District of Columbia	49	.01	Clay products, raw clay.
Florida	28	.47	Phosphate rock, stone, cement, sand and gravel.
Georgia	33	.38	Raw clay, stone, clay products, cement.
Idaho	27	.70	Lead, zinc, silver, phosphate rock.
Illinois	5	4.40	Coal, petroleum, stone, cement.
Indiana	17	1.45	Coal, cement, petroleum, stone.
Iowa	32	.41	Cement, clay products, stone, coal.
Kansas	10	2.75	Petroleum, cement, natural gas, zinc.
Kentucky	7	4.07	Coal, petroleum, natural gas, stone.
Louisiana	6	4.08	Petroleum, natural gasoline, natural gas, sulfur.
Maine	45	.06	Cement, stone, sand and gravel, slate.
Maryland	35	.26	Coal, sand and gravel, cement, clay products.
Massachusetts	41	.12	Stone, sand and gravel, clay products, lime.
Michigan	14	1.75	Iron ore, petroleum, cement, salt.
Minnesota	11	2.26	Iron ore, sand and gravel, stone, manganiferous ore.
Mississippi	26	.70	Petroleum, natural gas, sand and gravel, clay products.
Missouri	21	1.10	Lead, cement, coal, stone.
Montana	24	.90	Copper, petroleum, zinc, coal.
Nebraska	44	.08	Cement, sand and gravel, clay products, stone.
Nevada	30	.44	Copper, zinc, gold, tungsten ore.
New Hampshire	47	.02	Sand and gravel, stone, clay products, feldspar.
New Jersey	29	.46	Zinc, clay products, sand and gravel, stone.
New Mexico	16	1.61	Petroleum, potassium salts, copper, zinc.
New York	18	1.34	Cement, petroleum, iron ore, stone.
North Carolina	36	.24	Clay products, stone, sand and gravel, talc and pyrophyllite.
North Dakota	43	.08	Coal, sand and gravel, clay products, natural gas.
Ohio	9	3.04	Coal, clay products, stone, lime.
Oklahoma	8	3.61	Petroleum, natural gasoline, natural gas, coal.
Oregon	39	.17	Sand and gravel, stone, cement, clay products.
Pennsylvania	2	13.02	Coal, cement, petroleum, stone.
Rhode Island	48	.01	Stone, sand and gravel, graphite.
South Carolina	42	.11	Stone, clay products, raw clay, sand and gravel.
South Dakota	37	.24	Gold, stone, raw clay, sand and gravel.
Tennessee	25	.87	Coal, cement, stone, phosphate rock.
Texas	1	19.80	Petroleum, natural gasoline, natural gas, sulfur.
Utah	12	2.12	Copper, coal, gold, lead.
Vermont	40	.15	Stone, slate, talc, copper.
Virginia	19	1.32	Coal, stone, zinc, clay products.
Washington	31	.41	Cement, coal, sand and gravel, stone.
West Virginia	4	8.79	Coal, natural gas, petroleum, natural gasoline.
Wisconsin	34	.36	Stone, sand and gravel, iron ore, zinc.
Wyoming	20	1.22	Petroleum, coal, natural gasoline, raw clay.

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation. The rank of natural gas in this table (in contrast to corresponding tables in earlier editions of Minerals Yearbook) is based on value at wells rather than value at points of consumption.

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Mineral products of the United States, 1945–47, by States

ALABAMA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	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 (dried equivalent)	([1])	([1])	([1])	([1])	([1])	([1])
Cement ... barrels	[3] 5,682,692	[3] $8,359,286	[3] 8,071,979	[3] $13,120,084	[3] 9,509,697	[3] $16,663,543
Clay:						
Products, heavy clay (other than pottery and refractories)	----	[4] 2,515,068	----	[4] 4,419,000	----	[4] 5,089,000
Raw ... short tons	[5] 735,504	[5] 715,274	[5] 1,064,000	[5] 1,073,052	[5] 1,135,386	[5] 1,096,414
Coal ... do	18,236,539	76,404,636	16,183,298	77,867,999	18,572,000	101,403,000
Coke ... do	5,400,925	[2] 33,448,229	4,665,939	[2] 32,669,886	5,869,738	[2] 47,086,856
Ferro-alloys ... do	145,377	[2] 14,636,471	137,042	[2] 14,510,937	132,603	[2] 15,030,000
Gold ... troy ounces	5	175	1	35	----	----
Graphite, crystalline ... pounds	([1])	([1])	([1])	([1])	([1])	([1])
Iron:						
Ore ... long tons	6,038,631	14,547,223	5,993,800	17,458,295	7,207,556	23,436,620
Pig ... short tons	3,588,863	[2] 65,991,229	3,145,303	[2] 66,517,978	3,928,007	[2] 110,436,827
Lime ... do	315,559	2,076,768	294,654	2,164,209	345,160	2,727,464
Manganese ore ... do	32	([1])	----	----	----	----
Mica:						
Scrap ... do	----	----	338	6,621	([1])	([1])
Sheet ... pounds	420	1,629	289	74	([1])	([1])
Mineral waters	([6])	([6])	([6])	([6])	([6])	([6])
Ore (dry and siliceous) (gold and silver) ... short tons	400	([7])	----	----	----	----
Petroleum ... barrels	181,000	([1])	380,000	([1])	396,000	([1])
Sand and gravel ... short tons	2,541,769	1,580,687	2,923,240	1,937,576	3,400,103	2,271,534
Silver ... troy ounces	1	1	----	----	----	----
Stone ... short tons	2,238,740	3,326,753	1,874,330	3,385,892	2,795,240	4,624,892
Miscellaneous [8]	----	12,223,870	----	10,804,325	----	15,007,280
Total value, eliminating duplications	----	110,360,000	----	123,029,000	----	159,788,000

[1] Value included with "Miscellaneous."
[2] Value not included in total value for State.
[3] Exclusive of puzzolan, value for which is included with "Miscellaneous."
[4] Figure obtained through cooperation with Bureau of the Census.
[5] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included with the metals.
[8] Includes minerals indicated by "1" and "3" above.

ALASKA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Antimony ore (concentrates)....short tons..					40	$16,056
Arsenic....do....	(1)	(1)	(1)	(1)		
Coal....do....	297,644	$1,868,592	366,809	$2,354,952	349,000	(2)
Copper....pounds..	10,000	1,350	4,000	648	24,000	5,040
Gem stones....		(3)		(3)		(3)
Gold....troy ounces..	68,117	2,384,095	226,781	7,937,335	279,988	9,799,580
Lead....short tons..	11	1,892	115	25,070	264	76,032
Mercury....flasks (76 pounds)..	(2)	(2)	699	68,670	127	10,635
Ores (crude), etc.:						
Copper....short tons..	6	(4)				
Dry and siliceous (gold and silver)....do....	6,506	(4)	8,979	(4)	8,327	(4)
Lead....do....			1,819	(4)	5,064	(4)
Zinc....do....					500	(4)
Platinum metals (crude)....troy ounces..	26,505	(2)	22,882	(2)	13,512	(2)
Sand and gravel....short tons..	(2)	(2)	(2)	(2)	(2)	(2)
Silver....troy ounces..	9,983	7,099	41,793	33,769	66,150	59,866
Stone....short tons..	(2)	(2)	(2)	(2)	(2)	(2)
Tin....do....					1	2,200
Tungsten concentrates....short tons (60-percent WO_3 basis)..			19	(2)	13	(2)
Zinc....short tons..					25	6,050
Miscellaneous [5]....		5,910,704		2,005,241		8,411,319
Total value, eliminating duplications....		10,174,000		12,426,000		18,387,000

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

Mineral products of the United States, 1945–47, by States—Continued

ARIZONA

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Arsenious oxide, short tons	(1)	(1)	(1)	(1)	(1)	(1)
Asbestos, do.	1,273	$63,736	(2)	(2)	(2)	(2)
Barite, do.	----	----	(2)	(2)	(2)	(2)
Bismuth, pounds	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	----	(2 3)	----	[3] $479,000	----	[3] $752,000
Raw, short tons	[4] 124,166	[4] 204,680	[4] 168,081	[4] 230,703	[4] 184,345	[4] 292,193
Coal, do.	3,853	13,487	6,414	24,304	7,000	(2)
Copper, pounds	574,406,000	77,544,810	578,446,000	93,708,252	732,436,000	153,811,560
Diatomite, short tons	(2)	(2)	(2)	(2)	----	----
Feldspar (crude), long tons	(2)	(2)	(2)	(2)	(2)	(2)
Fluorspar, short tons	1,126	21,016	389	7,959	1,601	(2)
Gem stones	----	(5)	----	(5)	----	(5)
Gold, troy ounces	77,223	2,702,805	79,024	2,765,840	95,860	3,355,100
Gypsum (crude), short tons	(2)	(2)	(2)	(2)	23,980	128,725
Lead, do.	22,867	3,933,124	23,930	5,216,740	28,566	8,227,008
Lime, do.	58,736	522,609	50,354	489,091	54,562	582,074
Manganese ore, do.	1,093	45,521	----	----	133	(2)
Manganiferous ore, do.	56	(2)	----	----	62	(2)
Mercury, flasks (76 pounds)	(2)	(2)	95	9,333	----	----
Mica:						
Scrap, short tons	(2)	(2)	----	----	(2)	(2)
Sheet, pounds	(2)	(2)	----	----	----	----
Molybdenum, do.	635,572	472,760	(2)	(2)	(2)	(2)
Ores (crude), etc.:						
Copper, short tons	30,644,470	(6)	30,386,149	(6)	37,810,448	(6)
Dry and siliceous (gold and silver), do.	19,506	(6)	53,094	(6)	73,190	(6)
Lead, do.	21,340	(6)	13,441	(6)	24,478	(6)
Lead-copper, do.	2	(6)	1,066	(6)	12	(6)
Zinc, do.	8,914	(6)	13,233	(6)	16,619	(6)
Zinc-copper, do.	81,123	(6)	63,854	(6)	82,192	(6)
Zinc-lead, do.	480,061	(6)	515,047	(6)	624,397	(6)
Zinc-lead-copper, do.	11,488	(6)	12,295	(6)	4,944	(6)
Perlite, do.	----	----	3,022	46,103	(2)	(2)
Sand and gravel, do.	528,059	442,959	1,098,791	974,347	1,607,758	1,368,080
Sand and sandstone (ground), do.	(2)	(2)	----	----	----	----
Silica (quartz), do.	(2)	(2)	(2)	(2)	(2)	(2)
Silver, troy ounces	3,558,216	2,530,287	3,268,765	2,641,162	4,569,084	4,135,021
Stone, short tons	404,170	376,200	[7] 191,430	[7] 269,279	353,880	219,891
Sulfuric acid (60° B.)[8], do.	(2 9)	(2 9)	(2 9)	(2 9)	----	----
Tungsten concentrates, short tons (60-percent WO_3 basis)	97	(2)	20	27,080	13	(2)

Vanadium .... pounds	(2)	(2)	(2)	(2)	(2)	(2)
Zinc .... short tons	40,226	9,251,980	43,665	10,654,260	54,644	13,223,848
Miscellaneous [10]	----	707,383	----	633,805	----	742,266
Total value, eliminating duplications	----	98,574,000	----	118,086,000	----	186,751,000

[1] Figure not available.
[2] Value included with "Miscellaneous."
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included with the metals.
[7] Exclusive of granite and sandstone, values for which are included with "Miscellaneous."
[8] From copper smelting.
[9] Value not included in total value for State.
[10] Includes minerals indicated by "2" and "7" above.

ARKANSAS

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Aluminum .... short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Antimony ore (concentrates) .... do	----	----	----	----	2	$669
Barite .... do	260,660	$1,934,098	288,286	$1,844,982	376,017	2,390,643
Bauxite .... long tons (dried equivalent)	910,049	5,196,927	1,050,347	6,578,270	1,153,563	6,583,538
Cement .... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	----	[3] 794,498	----	[3] 1,276,000	----	[3] 1,688,000
Raw .... short tons	[4] 279,397	[4] 427,038	[4] 388,606	[4] 712,906	[4] 403,137	[4] 887,112
Coal .... do	1,853,926	9,365,577	1,631,474	9,494,194	1,806,000	(1)
Gem stones	----	(5)	----	(5)	----	(5)
Gypsum (crude) .... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Lead .... do	1	172	2	436	18	5,184
Lime .... do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore .... do	6,663	228,476	1,101	28,237	841	(1)
Manganiferous ore .... do	14,806	(1)	1,964	(1)	2,094	(1)
Mercury .... flasks (76 pounds)	(1)	(1)	11	1,081	----	----
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) .... M cubic feet	46,600,000	1,146,000	45,177,000	1,107,000	50,440,000	1,811,000
Natural gasoline and allied products:						
Natural gasoline .... gallons	53,832,000	2,585,000	50,830,000	2,077,000	53,047,000	3,191,000
Liquefied petroleum gases .... do	32,109,000	833,000	33,677,000	839,000	40,155,000	1,485,000
Oilstones and whetstones .... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Ores (crude), etc.:						
Lead .... do	----	----	2	(6)	31	(6)
Zinc .... do	14,891	(6)	4,300	(6)	265	(6)
Zinc-lead .... do	----	----	----	----	109	(6)
Petroleum .... barrels	28,613,000	30,720,000	28,375,000	35,750,000	29,990,000	53,273,000
Sand and gravel .... short tons	2,688,622	1,930,780	[7] 2,203,647	[7] 1,821,423	[7] 2,690,163	[7] 2,267,203
Slate	----	50,000	----	(1)	----	(1)

See footnotes at end of table.

Mineral products of the United States, 1945–47, by States—Continued

ARKANSAS—Continued

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Stone ... short tons	[8] 932,320	[8] $926,763	995,720	$1,135,856	[8] 210,100	[8] $448,650
Zinc ... do	303	69,690	85	20,740	18	4,356
Miscellaneous [9]		13,405,590		9,794,737		27,594,989
Total value, eliminating duplications		58,257,000		65,985,000		90,833,000

[1] Value included with "Miscellaneous."
[2] Value not included in total value for State.
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included with the metals.
[7] "Commercial." Value of "Government-and-contractor" included with "Miscellaneous."
[8] Exclusive of sandstone in 1945 and unclassified stone in 1947, values for which are included with "Miscellaneous."
[9] Includes minerals indicated by "1", "7", and "8" above.

CALIFORNIA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Andalusite ... short tons	(1)	(1)				
Arsenious oxide ... do	(2)	(2)	(2)	(2)	(2)	(2)
Asbestos ... do	31	$2,597	(1)	(1)	(1)	(1)
Asphalt (native) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Barite ... do	(1)	(1)	(1)	(1)	(1)	(1)
Boron minerals ... do	325,935	7,635,365	430,689	$9,575,866	501,935	$11,844,108
Bromine ... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Calcite (Iceland spar) ... do			(2)	(3)	(3)	(3)
Calcium chloride ... short tons	7,165	126,377	9,979	170,994	7,968	111,950
Cement ... barrels	15,921,965	23,517,146	20,173,231	33,906,675	22,846,458	46,539,749
Chromite ... short tons	9,607	364,715	(1)	(1)	948	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)		[4] 5,728,220		[4] 12,175,000		[4] 16,793,000
Raw ... short tons	[5] 1,212,372	[5] 2,111,918	[5] 1,670,305	[5] 2,254,164	[5] 1,950,076	[5] 2,965,360
Coke ... do	256,092	(1 6)	260,470	(1 6)	332,244	(1 6)
Copper ... pounds	12,946,000	1,747,710	8,480,000	1,373,760	4,814,000	1,010,940
Diatomite ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Feldspar (crude) ... long tons	(1)	(1)			(1)	(1)

Ferro-alloys	short tons	5,382	(1 6)	7,414	(1 6)	5,278	(1 6)
Fuller's earth	do	(1)	(1)	(1)	(1)	(1)	(1)
Gem stones		-------	(3)	-------	(3)	-------	(3)
Gold	troy ounces	147,938	5,177,830	356,824	12,488,840	431,415	15,099,525
Gypsum (crude)	short tons	455,319	967,507	574,345	1,315,699	811,798	1,996,157
Iodine	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Iron:							
Ore	long tons	326,295	1,050,338	226,062	(1)	373,574	(1)
Pig	short tons	313,883	(1 6)	344,024	(1 6)	453,376	(1 6)
Kyanite	do	-------	-------	(1)	(1)	-------	-------
Lead	do	7,224	1,242,528	9,923	2,163,214	10,080	2,903,040
Lime	do	135,158	1,515,497	172,623	2,144,712	181,296	2,615,599
Lithium minerals	do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesite	do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium	do	(1)	(1)	56	21,664	-------	-------
Magnesium compounds (from sea water)[7]	short tons MgO equivalent	54,573	2,642,666	55,953	2,814,979	40,000	1,784,000
Manganese ore	short tons	1,668	78,598	-------	-------	-------	-------
Manganiferous ore	do	12	(1)	-------	-------	-------	-------
Mercury	flasks (76 pounds)	21,199	2,859,533	17,782	1,746,904	17,165	1,437,397
Mica, scrap	short tons	3,582	5,373	(1)	(1)	(1)	(1)
Mineral waters		(3)	(3)	(3)	(3)	(3)	(3)
Molybdenum	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Natural gas (estimated value at wells)	M cubic feet	502,442,000	30,147,000	487,904,000	36,056,000	544,950,000	55,694,000
Natural gasoline and allied products:							
Natural gasoline and cycle products	gallons	731,422,000	29,473,000	734,227,000	32,085,000	837,313,000	45,812,000
Liquefied petroleum gases	do	160,331,000	5,259,000	176,311,000	4,933,000	233,546,000	8,174,000
Ores (crude), etc.:							
Copper	short tons	311,326	(8)	86,297	(8)	15,993	(8)
Dry and siliceous (gold and silver)	do	173,225	(8)	335,657	(8)	449,792	(8)
Lead	do	26,053	(8)	57,330	(8)	87,913	(8)
Zinc	do	60,105	(8)	45,043	(8)	49,651	(8)
Zinc-copper	do	112,861	(8)	99,176	(8)	35,745	(8)
Zinc-lead	do	34,399	(8)	4,264	(8)	9,695	(8)
Peat	do	6,185	85,877	8,137	105,242	(1)	(1)
Pebbles for grinding	do	(1)	(1)	74	927	(1)	(1)
Petroleum	barrels	326,482,000	347,330,000	314,713,000	387,100,000	333,102,000	571,688,000
Platinum metals (crude)	troy ounces	43	(1)	67	(1)	324	(1)
Potassium salts	short tons (K_2O equivalent)	(1)	(1)	(1)	(1)	(1)	(1)
Pumice	short tons	75,238	481,664	89,181	755,570	169,037	1,026,275
Pyrites	long tons	(1)	(1)	(1)	(1)	(1)	(1)
Salt (sodium chloride)	short tons	694,609	3,424,711	729,092	3,358,060	768,397	3,810,898
Sand and gravel	do	21,599,950	15,176,259	27,220,849	18,396,460	31,386,826	25,338,967
Sand and sandstone (ground)	do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz)	do	(1)	(1)	(1)	(1)	(1)	(1)
Silver	troy ounces	986,798	701,723	1,342,651	1,084,862	1,597,442	1,445,685
Slate		-------	(1)	-------	(1)	-------	(1)
Sodium salts (carbonates and sulfates) (natural)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Stone	do	9,636,810	8,554,461	[9] 8,950,320	[9] 8,452,083	[9] 12,757,790	[9] 13,012,556
Strontium minerals	do	(1)	(1)	243	3,726	-------	-------
Sulfuric acid (60° B.)[10]	do	(1 6)	(1 6)	(1 6)	(1 6)	(1 6)	(1 6)
Sulfur ore	long tons	-------	-------	757	11,835	698	9,074
Talc, pyrophyllite, and ground soapstone	short tons	67,321	1,254,143	78,170	1,434,978	91,537	1,595,422

See footnotes at end of table.

Mineral products of the United States, 1945–47, by States—Continued

CALIFORNIA—Continued

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Tungsten concentrates short tons (60-percent WO_3 basis)	1,073	$1,488,289	1,262	$1,117,855	394	$548,233
Zinc short tons	9,923	2,282,290	6,877	1,677,988	5,415	1,310,430
Miscellaneous [11]		23,312,132		25,336,529		35,427,429
Total value, eliminating duplications		515,214,000		592,294,000		855,553,000

[1] Value included with "Miscellaneous."
[2] Figure not available.
[3] No canvass.
[4] Figure obtained through cooperation with Bureau of the Census.
[5] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[6] Value not included in total value for State.
[7] Comprises all compounds from raw sea water and bitterns. Data for 1945–46 are not quite comparable with 1947 in that the former are on a gross-weight basis and include some compounds made from dolomite in combination with sea water.
[8] Not valued as ore; value of recoverable metal content included with the metals.
[9] Exclusive of marble, value for which is included with "Miscellaneous."
[10] From lead smelting.
[11] Includes minerals indicated by "1" and "9" above.

COLORADO

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Arsenious oxide short tons	(1)	(1)	(1)	(1)	(1)	(1)
Beryllium concentrates do					(2)	(2)
Bismuth pounds	(1)	(1)	(1)	(1)	(1)	(1)
Cement barrels	(2)	(2)	(2)	(2)	(2)	(2)
Clay:						
Products, heavy clay (other than pottery and refractories)		[3] $782,003		[3] $2,192,000		[3] $2,362,000
Raw short tons	[4] 161,266	[4] 216,348	[4] 301,107	[4] 367,686	[4] 377,036	[4] 478,247
Coal do	7,621,012	28,084,634	5,913,508	23,914,584	6,266,000	(2)
Coke do	711,777	(2 5)	617,306	(2 5)	871,186	(2 5)
Copper pounds	2,970,000	400,950	3,508,000	568,296	4,300,000	903,000
Feldspar (crude) long tons	26,279	105,021	37,312	145,975	43,676	218,593
Ferro-alloys short tons					11,296	(2 5)
Fluorspar do	52,437	1,333,735	32,539	925,867	32,153	950,882
Gem stones		(6)		(6)		(6)
Gold troy ounces	100,935	3,532,725	142,613	4,991,455	168,279	5,889,765
Gypsum (crude) short tons	(2)	(2)	(2)	(2)	(2)	(2)
Iron:						
Ore long tons	117	(2)	340	(2)		
Pig short tons	(2 5)	(2 5)	(2 5)	(2 5)	(2 5)	(2 5)
Lead do	17,044	2,931,568	17,036	3,713,848	18,696	5,384,448
Lime do	(2)	(2)	(2)	(2)	(2)	(2)

Lithium minerals...do	(2)	(2)	(2)	(2)	(2)	(2)
Manganiferous ore...do	47	(2)	---	---	37	(2)
Mica:						
Scrap...do	2,999	25,044	4,495	36,910	1,341	13,246
Sheet...pounds	---	---	272	93	---	---
Mineral waters	(6)	(6)	(6)	(6)	(6)	(6)
Molybdenum...pounds	23,215,832	(2)	8,670,855	(2)	10,783,200	(2)
Natural gas (estimated value at wells)...M cubic feet	4,914,000	239,000	6,728,000	314,000	8,259,000	650,000
Natural gasoline...gallons	351,000	21,000	840,000	50,000	640,000	47,000
Ores (crude), etc.:						
Copper...short tons	7,230	(7)	8,292	(7)	16,572	(7)
Dry and siliceous (gold and silver)...do	627,523	(7)	841,733	(7)	1,005,072	(7)
Lead...do	7,229	(7)	19,307	(7)	47,628	(7)
Lead-copper...do	---	---	5	(7)	6	(7)
Zinc...do	151,998	(7)	172,320	(7)	223,753	(7)
Zinc-copper...do	1,090	(7)	---	---	---	---
Zinc-lead...do	561,782	(7)	421,839	(7)	247,881	(7)
Zinc-lead-copper...do	699	(7)	---	---	3,782	(7)
Peat...do	(2)	(2)	(2)	(2)	(2)	(2)
Petroleum...barrels	5,036,000	5,780,000	11,856,000	15,650,000	15,748,000	30,217,000
Pumice...short tons	---	---	600	1,200	(2)	(2)
Pyrites...long tons	(2)	(2)	---	---	(2)	(2)
Radium (refined)...milligrams	[8] 190	[8] 3,515	[8] 190	[8] 3,515	15,400	284,900
Sand and gravel...short tons	1,800,405	1,147,027	2,532,946	1,796,395	3,524,653	2,323,736
Silver...troy ounces	2,226,780	1,583,488	2,240,151	1,810,042	2,557,653	2,314,676
Stone...short tons	671,620	923,797	612,000	818,606	1,069,250	1,406,989
Sulfur ore...long tons	315	5,670	(2)	(2)	(2)	(2)
Tungsten concentrates...short tons (60-percent WO_3 basis)	234	222,428	213	288,717	68	108,241
Vanadium...pounds	2,701,103	1,609,884	1,036,050	584,135	1,912,158	1,110,090
Vermiculite...short tons	(2)	(2)	(2)	(2)	(2)	(2)
Zinc...do	35,773	8,227,790	36,147	8,819,868	38,745	9,376,290
Miscellaneous [9]	---	38,794,721	---	29,236,192	---	83,341,097
Total value, eliminating duplications	---	77,236,000	---	77,573,000	---	105,135,000

[1] Figure not available.
[2] Value included with "Miscellaneous."
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is 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 with the metals.
[8] Estimated.
[9] Includes minerals indicated by "2" above.

Mineral products of the United States, 1945–47, by States—Continued

CONNECTICUT

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Beryllium concentrates ... short tons					([1])	([1])
Clay:						
Products, heavy clay (other than pottery and refractories)		[2] $925,933		[2] $2,128,000		[2] $1,949,000
Raw ... short tons	[3] 63,825	[3] 47,597	[3] 199,238	[3] 148,053	[3] 184,751	[3] 134,802
Coke ... do	([1][4])	([1][4])	([1][4])	([1][4])	([1][4])	([1][4])
Feldspar (crude) ... long tons	11,705	74,778	16,555	98,407	15,408	100,152
Lime ... short tons	([1])	([1])	([1])	([1])	([1])	([1])
Magnesium ... do	844	346,100				
Mica:						
Scrap ... do	70	1,752	([1])	([1])		
Sheet ... pounds	61,832	10,125	236,919	25,746		
Mineral waters	([5])	([5])	([5])	([5])	([5])	([5])
Peat ... short tons	3,467	22,085	4,563	27,027	5,061	25,705
Sand and gravel ... do	1,611,216	841,509	2,199,654	1,221,839	2,329,198	1,384,675
Stone ... do	817,670	1,166,288	1,324,160	1,878,793	[6] 1,362,840	[6] 1,929,548
Miscellaneous [7]		4,838,510		4,555,008		5,981,212
Total value, eliminating duplications		3,498,000		5,584,000		5,677,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; valve of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of dimension basalt, value for which is included with "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

DELAWARE

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Clay:						
Products, heavy clay (other than pottery and refractories)		([1][2])		([1][2])		([1][2])
Raw ... short tons	[3] 6,040	[3] $6,040	[3] 33,942	[3] $33,088	([2][3])	([2][3])
Sand and gravel ... do	82,674	43,678	187,229	123,532	235,464	$195,002
Stone ... do			23,070	57,662	([2])	([2])
Miscellaneous		86,897		310,000		471,161
Total value, eliminating duplications		131,000		491,000		613,000

[1] Figure obtained through cooperation with Bureau of the Census.
[2] Value included with "Miscellaneous."
[3] Sold or used; value of clay used in cement and heavy clay products not included in total value for State.

FLORIDA

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Cement .... barrels..	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	--------	(1 2)	--------	(1 2)	--------	(1 2)
Raw .... short tons..	3 61,204	3 $332,662	3 80,379	3 $486,791	3 96,147	3 $527,976
Ferro-alloys .... do....	--------	--------	--------	--------	(1 4)	(1 4)
Fuller's earth .... do....	(1)	(1)	(1)	(1)	(1)	(1)
Lime .... do....	18,431	211,077	(1)	(1)	(1)	(1)
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) .... M cubic feet..	6,000	180	6,000	193	8,000	258
Peat .... short tons..	15,194	66,747	19,979	81,832	42,300	126,000
Petroleum .... barrels..	30,000	(1)	57,000	(1)	259,000	(1)
Phosphate rock .... long tons..	4,238,228	16,298,474	5,005,511	21,017,174	6,482,027	32,920,252
Sand and gravel .... short tons..	1,314,011	1,074,055	1,534,667	1,320,819	2,067,401	1,880,866
Stone .... do....	6 2,617,180	6 3,024,465	6 7 2,863,070	6 7 3,212,135	3,534,010	4,511,894
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 8	--------	3,941,233	--------	5,005,456	--------	6,083,838
Total value, eliminating duplications	--------	24,928,000	--------	31,093,000	--------	45,992,000

1 Value included with "Miscellaneous."
2 Figure obtained through cooperation with Bureau of the Census.
3 Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
4 Value not included in total value for State.
5 No canvass.
6 Exclusive of unclassified stone, value for which is included with "Miscellaneous."
7 Exclusive of dimension limestone, value for which is included with "Miscellaneous."
8 Includes minerals indicated by "1", "6", and "7" above.

Mineral products of the United States, 1945–47, by States—Continued

GEORGIA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Asbestos ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Barite ... do	110,393	$1,056,035	69,274	$686,583	61,202	$639,865
Bauxite ... long tons (dried equivalent)	(1)	(1)	(1)	(1)	(1)	(1)
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)		(1 2)		(1 2)		[2] 5,667,000
Raw ... short tons	[3] 1,256,664	[3] 7,108,321	[3] 1,641,660	[3] 10,222,165	[3] 1,918,546	[3] 13,436,317
Coal ... do	42,568	163,837	113,763	534,687	20,000	(1)
Feldspar (crude) ... long tons			(1)	(1)	(1)	(1)
Fuller's earth ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Gem stones		(4)		(4)		(4)
Gold ... troy ounces			21	735	76	2,660
Iron ore ... long tons	276,050	616,524	284,614	613,745	295,992	693,485
Kyanite ... short tons			(1)	(1)		
Lime ... do	3,864	32,797	2,691	33,251	10,141	110,983
Magnesium sulfate (from serpentine) ... short tons MgO equivalent	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore ... short tons	1,056	25,387				
Mica:						
Scrap ... do	616	14,780	1,092	30,248	1,102	22,985
Sheet ... pounds	30,960	41,594	17,242	4,004	(1)	(1)
Mineral waters	(4)	(4)	(4)	(4)	(4)	(4)
Ores (crude), etc.:						
Dry and siliceous (gold and silver) ... short tons					130	(5)
Peat ... do	(1)	(1)	3,218	51,286	(1)	(1)
Sand and gravel ... do	605,036	350,264	893,290	523,102	927,330	575,115
Sand and sandstone (ground) ... do	7,190	27,858	4,406	25,993	11,031	57,820
Silver ... troy ounces					13	12
Slate		(1)		(1)		(1)
Stone ... short tons	[6] 1,514,710	[6] 4,799,320	2,417,340	8,538,435	2,960,520	9,977,938
Talc ... do	32,433	296,163	36,410	380,477	49,441	673,251
Miscellaneous [7]		5,884,492		9,374,762		5,989,151
Total value, eliminating duplications		19,988,000		30,449,000		37,137,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included with the metals.
[6] Exclusive of crushed unclassified stone, value for which is included with "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

IDAHO

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Antimony ore (concentrates) short tons	14,465	$545,334	13,732	$784,489	18,258	$3,193,806
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, heavy clay (other than pottery and refractories)		(2 3)		[3] 149,000		[3] 131,000
Raw short tons	[4] 9,635	[4] 14,648	[4] 18,696	[4] 24,802	[4] 31,920	[4] 33,262
Copper pounds	3,096,000	417,960	2,076,000	336,312	3,280,000	688,800
Garnet, abrasive short tons	(2)	(2)	(2)	(2)	(2)	(2)
Gem stones		(5)		(5)		(5)
Gold troy ounces	17,780	622,300	42,975	1,504,125	64,982	2,274,370
Lead short tons	68,447	11,772,884	59,987	13,077,166	78,944	22,735,872
Mercury flasks (76 pounds)	627	84,576	868	85,272	886	74,194
Mica:						
Scrap short tons	199	3,178				
Sheet pounds	48,018	111,008				
Ores (crude), etc.:						
Copper short tons	8,569	(6)	903	(6)	3,303	(6)
Dry and siliceous (gold and silver) do	235,188	(6)	256,001	(6)	765,765	(6)
Lead do	107,511	(6)	113,175	(6)	165,218	(6)
Lead-copper do	67	(6)	119	(6)	27	(6)
Zinc do	100,039	(6)	104,585	(6)	67,133	(6)
Zinc-lead do	2,687,912	(6)	2,407,404	(6)	2,716,251	(6)
Phosphate rock long tons	123,340	673,627	(2)	(2)	(2)	(2)
Pumice short tons	(2)	(2)	108,847	163,515	98,618	119,882
Sand and gravel do	1,597,112	952,971	2,082,874	1,572,088	3,209,766	2,067,891
Silver troy ounces	8,142,667	5,790,341	6,491,104	5,244,812	10,345,779	9,362,930
Stone short tons	247,140	293,980	548,870	568,159	[7] 1,044,780	[7] 991,599
Tungsten concentrates short tons (60-percent WO_3 basis)	2,130	(2)	641	(2)	61	(2)
Vanadium pounds	(2)	(2)	(2)	(2)	(2)	(2)
Zinc short tons	83,463	19,196,490	71,507	17,447,708	83,069	20,102,698
Miscellaneous [8]		3,870,822		3,494,386		6,025,400
Total value, eliminating duplications		44,348,000		44,444,000		67,786,000

[1] Figure not available.
[2] Value included with "Miscellaneous."
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included with the metals.
[7] Exclusive of unclassified stone, value for which is included with "Miscellaneous."
[8] Includes minerals indicated by "2" and "5" above.

Mineral products of the United States, 1945–47, by States—Continued

ILLINOIS

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	4,189,449	$7,089,118	6,675,584	$11,646,747	7,155,280	$13,219,260
Clay:						
Products, heavy clay (other than pottery and refractories)		[1] 6,578,677		[1] 12,812,000		[1] 12,876,000
Raw ... short tons	[2] 1,366,815	[2] 1,529,760	[2] 2,325,047	[2] 2,248,471	[2] 2,197,240	[2] 2,560,188
Coal ... do	73,011,192	170,782,671	63,468,585	165,350,367	65,750,000	206,455,000
Coke ... do	3,681,516	[3] 32,377,629	3,192,395	[3] 32,241,972	3,805,374	[3] 49,267,806
Fluorspar ... do	147,251	5,014,807	154,525	5,493,642	167,157	6,148,654
Fuller's earth ... do	43,664	403,084	33,134	296,637	37,740	388,955
Graphite, artificial ... pounds					([3] [4])	([3] [4])
Iron, pig ... short tons	5,061,368	[3] 116,303,897	4,359,719	[3] 109,717,853	5,607,680	[3] 173,679,369
Lead ... do	3,005	516,860	3,865	842,570	2,325	669,600
Lime ... do	287,607	2,229,335	280,051	2,365,455	299,187	2,736,262
Marl, calcareous ... do	10,119	7,464	7,299	7,132	([4])	([4])
Mineral paints (zinc and lead pigments) ... do	([3] [4])	([3] [4])	([3] [4])	([3] [4])	([3] [4])	([3] [4])
Mineral waters	([5])	([5])	([5])	([5])	([5])	([5])
Natural gas (Estimated value at wells) ... M cubic feet	16,663,000	1,015,000	17,166,000	872,000	16,679,000	1,533,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	55,023,000	3,560,000	53,307,000	3,053,000	47,455,000	3,828,000
Liquified petroleum gases ... do	120,969,000	4,074,000	108,253,000	3,390,000	115,468,000	4,965,000
Ores (crude), etc.:						
Lead ... short tons			40,059	([6])	35,594	([6])
Zinc ... do	73,312	([6])	160,032	([6])	70,310	([6])
Zinc-lead ... do	203,947	([6])	192,342	([6])	213,199	([6])
Peat ... do	([4])	([4])	([4])	([4])	([4])	([4])
Petroleum ... barrels	75,094,000	105,130,000	75,297,000	119,720,000	66,459,000	138,786,000
Pyrites ... long tons	6,861	12,680	1,740	2,871		
Sand and gravel ... short tons	12,613,555	8,606,155	16,771,242	11,458,969	16,292,527	13,155,971
Sand and sandstone (ground) ... do	144,212	1,003,273	144,753	1,061,046	198,500	1,614,173
Silver ... troy ounces	2,198	1,563	2,302	1,860	1,790	1,620
Stone ... short tons	10,950,940	11,384,625	15,635,470	16,891,933	[7] 15,545,130	[7] 18,160,506
Sulfuric acid (60° B.) [8] ... do	216,482	[3] 2,186,468	187,082	[3] 1,825,920	223,091	[3] 2,315,685
Tripoli ... do	11,144	184,189	15,631	321,600	14,687	271,115
Zinc ... do	8,310	1,911,300	8,798	2,146,712	10,073	2,437,666
Miscellaneous [9]		5,288,334		6,088,950		11,603,763
Total value, eliminating duplications		330,184,000		358,628,000		428,327,000

[1] Figure obtained through cooperation with Bureau of the Census.
[2] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[3] Value not included in total value for State.
[4] Value included with "Miscellaneous."
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included with the metals.
[7] Exclusive of dimension sandstone, value for which is included with "Miscellaneous."
[8] From zinc smelting.
[9] Includes minerals indicated by "[4]" and "[7]" above.

INDIANA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	...	[2] $3,405,844	...	[2] $7,845,000	...	[2] $10,377,000
Raw ... short tons	[3] 434,530	[3] 429,868	[3] 983,669	[3] 1,004,877	[3] 1,181,878	[3] 1,354,908
Coal ... do	25,182,611	58,337,026	21,696,947	56,612,162	25,315,000	80,249,000
Coke ... do	7,814,247	[4] 68,458,007	6,651,567	[4] 59,312,827	8,785,687	[4] 117,614,296
Ferro-alloys ... do	(1 4)	(1 4)	...	...	(1 4)	(1 4)
Iron, pig ... do	5,981,937	[4] 138,253,310	4,823,257	[4] 122,786,881	6,385,503	[4] 195,211,140
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Marl, calcareous ... do	22,705	8,766	38,175	19,080	27,412	19,666
Mineral paints (zinc and lead pigments) ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) ... M cubic feet	1,543,000	169,000	1,094,000	113,000	666,000	78,000
Peat ... short tons	514	2,545	676	3,124	3,957	14,760
Petroleum ... barrels	4,868,000	6,890,000	6,726,000	10,690,000	5,853,000	12,287,000
Pyrites ... long tons	(1)	(1)	(1)	(1)	821	2,658
Rubbing stones and whetstones ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... do	6,947,958	4,115,842	8,752,267	5,656,047	9,231,649	6,687,082
Stone ... do	4,187,110	6,293,019	5,767,430	9,950,338	[6] 5,589,550	[6] 11,254,020
Sulphuric acid (60° B.) [7] ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Miscellaneous [8]	...	12,303,176	...	18,169,228	...	23,171,979
Total value, eliminating duplications	...	88,802,000	...	107,479,000	...	141,086,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is 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 with "Miscellaneous."
[7] From zinc-roasting operation.
[8] Includes minerals indicated by "1" and "6" above.

Mineral products of the United States, 1945–47, by States—Continued

IOWA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	3, 527, 838	$6, 220, 991	6, 145, 326	$11, 312, 627	6, 155, 670	$12, 054, 420
Clay:						
Products, heavy clay (other than pottery and refractories)		[1] 3, 578, 199		[1] 7, 095, 000		[1] 8, 526, 000
Raw ... short tons	[2] 455, 186	[2] 401, 870	[2] 696, 704	[2] 620, 916	[2] 896, 574	[2] 788, 795
Coal ... do	2, 045, 600	7, 178, 228	1, 788, 133	6, 573, 400	1, 790, 000	(3)
Ferro-alloys ... do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Gypsum (crude) ... do	430, 843	569, 964	560, 094	1, 172, 500	656, 982	1, 677, 217
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Peat ... short tons	(3)	(3)	(3)	(3)	(3)	(3)
Sand and gravel ... do	6, 030, 531	2, 091, 391	7, 938, 572	3, 059, 792	6, 473, 087	2, 795, 887
Stone ... do	[6] 4, 026, 460	[6] 5, 306, 299	5, 162, 540	6, 646, 273	5, 586, 460	7, 385, 436
Miscellaneous [7]		5, 474, 196		6, 129, 222		14, 762, 208
Total value, eliminating duplications		25, 008, 000		35, 957, 000		39, 378, 000

[1] Figure obtained through cooperation with Bureau of the Census.
[2] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[3] Value included with "Miscellaneous."
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of dimension limestone, value for which is included with "Miscellaneous."
[7] Includes minerals indicated by "3" and "6" above.

KANSAS

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	[1] 3, 298, 923	[1] $5, 157, 991	[1] 6, 894, 353	[1] $11, 574, 910	[1] 7, 208, 147	[1] $13, 017, 277
Clay:						
Products, heavy clay (other than pottery and refractories)		[2] 1, 593, 981		[2] 2, 771, 000		[2] 2, 229, 000
Raw ... short tons	[3] 254, 764	[3] 196, 950	[3] 464, 033	[3] 283, 350	[3] 535, 777	[3] 376, 961
Coal ... do	3, 228, 559	8, 310, 762	2, 493, 385	6, 931, 152	2, 680, 000	(4)
Gysum (crude) ... do	(4)	(4)	(4)	(4)	(4)	(4)
Helium ... cubic feet	[5] 58, 632, 455	[5] 477, 268	[5] 2, 909, 980	[5] 37, 742		
Lead ... short tons	7, 370	1, 267, 640	6, 445	1, 405, 010	7, 285	2, 098, 080
Mineral paints (zinc and lead pigments) ... do	(4 6)	(4 6)	(4 6)	(4 6)	(4 6)	(4 6)
Mineral waters	(7)	(7)	(7)	(7)	(7)	(7)
Natural gas (estimated value at wells) ... M cubic feet	145, 959, 000	7, 429, 000	165, 725, 000	8, 286, 000	202, 177, 000	10, 230, 000
Natural gasoline and allied products:						
Natural gasoline ... gallons	58, 309, 000	2, 687, 000	63, 666, 000	2, 455, 000	72, 239, 000	3, 629, 000
Liquefied petroleum gases ... do	14, 328, 000	379, 000	18, 925, 000	467, 000	27, 956, 000	1, 034, 000

Product	Quantity	Value	Quantity	Value	Quantity	Value
Ores (crude), etc.:						
Lead ..... short tons	-----	-----	3	(8)	774	(8)
Zinc ..... do	2,276,525	(8)	1,893,101	(8)	1,910,215	(8)
Zinc-lead ..... do	2,299,854	(8)	2,401,221	(8)	1,737,658	(8)
Petroleum ..... barrels	96,415,000	119,520,000	97,218,000	138,050,000	105,346,000	203,598,000
Pumice ..... short tons	47,484	187,651	35,466	105,084	(4)	(4)
Salt ..... do	855,806	3,837,850	815,018	4,014,919	904,398	4,534,406
Sand and gravel ..... do	3,082,392	1,674,742	4,443,086	2,505,822	4,351,920	2,330,435
Stone ..... do	[9] 3,666,000	[9] 2,847,200	3,653,640	3,908,588	4,792,850	4,867,789
Zinc ..... do	48,394	11,130,620	47,703	11,639,532	41,497	10,042,274
Miscellaneous [10]	-----	3,546,238	-----	5,044,818	-----	17,100,874
Total value, eliminating duplications	-----	166,644,000	-----	194,563,000	-----	267,020,000

[1] Exclusive of natural cement, value for which is included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] Value included with "Miscellaneous."
[5] Figure covers 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 with the metals.
[9] Exclusive of dimension sandstone, value for which is included with "Miscellaneous."
[10] Includes minerals indicated by "1," "4," and "9" above.

KENTUCKY

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Asphalt (native) ..... short tons	152,047	$1,037,068	(1)	(1)	(1)	(1)
Cement ..... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	-----	[2] 1,162,696	-----	[2] $1,971,000	-----	[2] $2,649,000
Raw ..... short tons	[3] 485,494	[3] 1,843,987	[3] 735,345	[3] 2,746,906	[3] 787,795	[3] 3,306,236
Coal ..... do	69,592,936	209,083,518	66,552,977	227,154,114	79,150,000	341,928,000
Coke ..... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Fluorspar ..... do	95,142	2,832,945	63,143	1,889,454	90,256	2,713,508
Iron, pig ..... do	631,105	(1 4)	624,174	(1 4)	661,925	(1 4)
Lead ..... do	129	22,188	95	20,710	214	61,632
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) ..... M cubic feet	81,714,000	12,510,000	70,396,000	10,426,000	80,040,000	11,974,000
Natural gasoline and allied products:						
Natural gasoline ..... gallons	9,395,000	505,000	9,062,000	472,000	9,741,000	574,000
Liquefied petroleum gases ..... do	37,484,000	817,000	44,800,000	986,000	50,450,000	1,312,000
Ores (crude), etc.:						
Lead ..... short tons	-----	-----	-----	-----	801	(6)
Zinc ..... do	-----	-----	15	(6)	-----	-----
Zinc-lead ..... do	6,836	(6)	12,255	(6)	18,999	(6)
Petroleum ..... barrels	10,325,000	15,260,000	10,578,000	17,030,000	9,397,000	19,798,000
Sand and gravel ..... short tons	1,174,510	1,033,424	2,163,734	1,802,063	2,454,492	1,997,368
Stone ..... do	[7] 3,470,770	[7] 3,740,716	[7] 4,745,560	[7] 5,205,820	[7] 4,990,170	[7] 5,875,574
Zinc ..... do	182	41,860	314	76,616	508	122,936

See footnotes at end of table.

Mineral products of the United States, 1945–47, by States—Continued

KENTUCKY—Continued

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Miscellaneous [8]		$17,165,075		$23,208,326		$32,490,343
Total value, eliminating duplications		250,919,000		272,558,000		395,745,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is 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 with the metals.
[7] Exclusive of dimension limestone in 1945 and 1947 and unclassified stone in 1946, values for which are included with "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

LOUISIANA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)		[2] $485,710		[2] $857,000		[2] $915,000
Raw ... short tons	[3] 66,891	[3] 69,357	[3] 178,331	[3] 141,526	[3] 215,199	[3] 153,236
Lime ... do	(1)	(1)	(1)	(1)		
Magnesium ... do	(1)	(1)				
Mineral waters	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas (estimated value at wells) ... M cubic feet	542,789,000	19,323,000	525,178,000	18,591,000	573,151,000	20,920,000
Natural gasoline and allied products:						
Natural gasoline and cycle products ... gallons	428,404,000	14,299,000	448,375,000	16,636,000	484,302,000	25,852,000
Liquefied petroleum gases ... do	120,830,000	4,669,000	118,421,000	4,243,000	146,017,000	6,863,000
Petroleum ... barrels	131,051,000	161,260,000	143,669,000	207,710,000	160,291,000	314,319,000
Salt ... short tons	1,867,689	4,465,643	1,846,522	4,612,359	1,955,382	5,898,828
Sand and gravel ... do	2,797,571	2,585,945	3,385,097	3,080,215	[5] 4,055,834	[5] 4,277,499
Stone ... do	1,000,040	756,341	(1)	(1)	892,110	827,184
Sulfur ... long tons	763,479	12,215,664	940,126	15,042,016	862,278	14,658,726
Miscellaneous [6]		2,323,193		3,095,648		2,780,789
Total value, eliminating duplications		222,413,000		273,882,000		397,312,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] No canvass.
[5] "Commercial." Value of "Government-and-contractor" included with "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

MAINE

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Beryllium concentrates .... short tons					(1)	(1)
Cement .... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)		(1 2)		[2] $191,000		[2] $286,000
Raw .... short tons	[3] 8,882	[3] $5,756	[3] 19,128	[3] 13,377	[3] 20,865	[3] 18,865
Feldspar (crude) .... long tons	10,974	62,287	18,922	110,237	16,898	97,565
Gem stones		(4)		(4)		(4)
Lime .... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Lithium minerals .... do			(1)	(1)		
Mica:						
Scrap .... do	32	768	24	607	18	460
Sheet .... pounds	(1)	(1)	(1)	(1)	4,393	686
Mineral waters	(4)	(4)	(4)	(4)	(4)	(4)
Peat .... short tons	17,131	75,614	22,522	92,710	2,647	72,875
Sand and gravel .... do	1,888,778	771,724	2,834,360	925,308	3,777,147	1,241,377
Silica (quartz) .... do	4	10				
Slate		(1)		(1)		(1)
Stone .... short tons	[5] 112,920	[5] 382,414	[5] 147,680	[5] 927,588	[5] 158,150	[5] 1,557,978
Miscellaneous [6]		1,228,227		2,141,310		2,792,178
Total value, eliminating duplications		2,521,000		4,389,000		6,049,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] No canvass.
[5] Exclusive of basalt in 1945 and 1946 and unclassified stone in 1947, values for which are included with "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

MARYLAND

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement .... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)		(1 2)		[2] $2,164,000		[2] $3,153,000
Raw .... short tons	[3] 208,229	[3] $360,181	[3] 402,232	[3] 497,279	[3] 602,634	[3] 908,755
Coal .... do	1,762,703	6,361,003	2,002,545	8,290,782	1,978,000	(1)
Coke .... do	2,024,609	(1 4)	1,661,606	(1 4)	1,975,201	(1 4)
Feldspar (crude) .... long tons					(1)	(1)
Iron, pig .... short tons	2,244,964	(1 4)	1,945,852	(1 4)	2,408,230	(1 4)
Lime .... do	66,675	502,376	83,580	692,262	71,892	673,241
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Potassium salts .... short tons (K_2O equivalent)	(1)	(1)	(1)	(1)	(1)	(1)

Mineral products of the United States, 1945–47, by States—Continued

MARYLAND—Continued

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Sand and gravel short tons	2,898,808	$2,694,876	4,001,071	$3,720,103	4,624,094	$4,792,554
Silica (quartz) do	(1)	(1)	(1)	(1)	(1)	(1)
Slate		(1)		(1)		(1)
Stone short tons	6 1,242,930	6 1,851,828	6 1,715,120	6 2,622,618	6 1,552,610	6 2,416,393
Talc and ground soapstone do	14,717	(1)	(1)	(1)	(1)	(1)
Miscellaneous 7		71,085,247		68,301,982		108,293,584
Total value, eliminating duplications		15,329,000		21,991,000		25,604,000

1 Value included with "Miscellaneous."
2 Figure obtained through cooperation with Bureau of the Census.
3 Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
4 Value not included in total value for State.
5 No canvass.
6 Exclusive of crushed unclassified stone, value for which is included with "Miscellaneous."
7 Includes minerals indicated by "1" and "6" above.

MASSACHUSETTS

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Clay:						
Products, heavy clay (other than pottery and refractories)		1 $506,848		1 $1,235,000		1 $1,380,000
Raw short tons	2 54,805	2 46,895	2 100,021	2 81,359	2 132,109	2 110,777
Coke do	1,149,448	(3 4)	1,046,267	(3 4)	1,196,010	(3 4)
Iron, pig do	(3 4)	(3 4)	9,878	(3 4)	203,844	(3 4)
Lime do	94,499	816,733	117,709	1,136,428	113,420	1,276,693
Mica, scrap do	(3)	(3)				
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Peat short tons	(3)	(3)	860	9,725	820	11,000
Sand and gravel do	2,928,420	1,696,387	4,641,685	2,909,784	4,942,920	3,511,855
Sand and sandstone (ground) do	2,350	11,600	2,000	10,000	1,944	11,628
Silica (quartz) do	696	6,349	829	7,715	1,019	9,185
Stone do	1,283,310	2,393,390	6 1,976,180	6 4,135,238	6 2,565,960	6 5,644,821
Miscellaneous 7		12,874,208		12,144,465		23,397,472
Total value, eliminating duplications		5,450,000		9,745,000		11,859,000

1 Figure obtained through cooperation with Bureau of the Census.
2 Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
3 Value included with "Miscellaneous."
4 Value not included in total value for State.
5 No canvass.
6 Exclusive of sandstone and unclassified stone in 1946 and crushed sandstone in 1947, values for which are included with "Miscellaneous."
7 Includes minerals indicated by "3" and "6" above.

MICHIGAN

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Bromine ... pounds	(1)	(1)	14,541,585	$3,736,118	18,802,636	$5,054,787
Calcium chloride ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Cement ... barrels	6,243,322	$9,937,834	9,974,692	16,727,145	10,470,766	18,868,187
Clay:						
Products, heavy clay (other than pottery and refractories)	----	[2] 1,248,901	----	[2] 2,962,000	----	[2] 3,240,000
Raw ... short tons	[3] 603,778	[3] 468,417	[3] 1,198,563	[3] 844,576	[3] 1,182,884	[3] 864,465
Coal ... do	125,704	687,281	79,990	516,043	18,000	(1)
Coke ... do	2,805,970	[4] 24,119,361	2,499,664	[4] 26,191,476	2,818,941	[4] 32,406,972
Copper ... pounds	60,802,000	8,208,270	43,326,000	7,018,812	48,368,000	10,157,280
Gem stones	----	(5)	----	(5)	----	(5)
Gypsum (crude) ... short tons	640,186	862,028	1,120,070	2,171,979	1,031,157	2,760,825
Iron:						
Ore ... long tons	11,833,055	35,313,135	8,477,425	28,297,890	12,965,482	46,782,975
Pig ... short tons	1,482,037	[4] 26,079,628	1,363,950	[4] 37,081,447	1,388,402	[4] 44,782,690
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium ... do	(1)	(1)	362	148,500	----	----
Magnesium compounds (from well brines) [6] ... short tons MgO equivalent	49,222	2,591,861	61,347	3,136,998	22,000	2,992,000
Manganiferous ore ... short tons	1,680	(1)	1,952	(1)	----	----
Marl, calcareous ... do	(1)	(1)	(1)	(1)	4,050	3,000
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) ... M cubic feet	21,874,000	2,898,000	20,879,000	2,681,000	25,479,000	3,231,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	5,310,000	295,000	4,624,000	216,000	3,640,000	248,000
Liquefied petroleum gases ... do	8,320,000	227,000	7,713,000	210,000	628,000	17,000
Ores (crude), etc.: Copper ... short tons	5,196,932	(7)	4,719,994	(7)	5,129,774	(7)
Peat ... do	6,559	99,752	8,620	122,250	(1)	(1)
Petroleum ... barrels	17,267,000	25,010,000	17,074,000	27,660,000	16,215,000	34,641,000
Potassium salts ... short tons (K_2O equivalent)	----	----	(1)	(1)	(1)	(1)
Salt ... short tons	4,285,493	14,942,443	4,334,202	15,711,074	4,531,761	15,127,549
Sand and gravel ... do	12,199,977	6,107,890	15,593,456	8,939,969	16,845,431	10,758,243
Silver ... troy ounces	21,863	15,547	----	----	3,089	2,796
Stone ... short tons	[8] 15,493,790	[8] 9,027,267	15,432,320	9,971,003	18,600,370	12,601,288
Miscellaneous [9]	----	10,334,181	----	3,011,741	----	4,064,231
Total value, eliminating duplications	----	127,869,000	----	133,310,000	----	170,616,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Data for 1945-46 not quite comparable with those for 1947 in that the former are on a gross-weight basis and include some compounds made from dolomite in combination with well brines.
[7] Not valued as ore; value of recoverable metal content included with the metals.
[8] Exclusive of dimension limestone, value for which is included with "Miscellaneous."
[9] Includes minerals indicated by "1" and "3" above.

Mineral products of the United States, 1945–47, by States—Continued

MINNESOTA

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	------	(1 2)	------	[2] $1,122,000	------	[2] $1,451,000
Raw ... short tons	[3] 13,220	[3] $19,717	[3] 62,961	[3] 64,717	[3] 148,188	[3] 142,806
Coke ... do	825,620	[4] 7,760,362	860,754	[4] 8,468,220	897,739	[4] 10,367,425
Flint lining for tube mills ... do	(1)	(1)	(1)	(1)	(1)	(1)
Gem stones	------	(5)	------	(5)	------	(5)
Iron:						
Ore ... long tons	61,569,976	156,942,255	49,055,340	142,049,316	62,436,102	203,614,336
Pig ... short tons	465,314	(1 4)	540,057	(1 4)	546,432	(1 4)
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Manganiferous ore ... do	1,406,847	(1)	1,070,694	2,609,446	1,044,961	2,739,340
Marl, calcareous ... do	2,970	2,200	1,500	1,200	10,100	9,575
Millstones	------	(1)	------	------	------	------
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Peat ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Pebbles for grinding ... do	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... do	9,125,117	2,402,530	10,814,635	3,221,434	13,510,136	4,194,268
Stone ... do	1,173,800	1,962,394	[6] 1,286,800	[6] 3,700,535	[6] 1,372,220	[6] 3,854,473
Miscellaneous [7]	------	16,264,417	------	16,567,825	------	20,493,981
Total value, eliminating duplications	------	167,138,000	------	155,734,000	------	219,685,000

1 Value included with "Miscellaneous."
2 Figure obtained through cooperation with Bureau of the Census.
3 Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
4 Value not included in total value for State.
5 No canvass.
6 Exclusive of sandstone in 1946 and basalt in 1947, values for which are included with "Miscellaneous."
7 Includes minerals indicated by "1" and "6" above.

MISSISSIPPI

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Clay:						
Products, heavy clay (other than pottery and refractories)		[1] $759,400		[1] $1,138,000		[1] $1,496,000
Raw ... short tons	[2] 212,199	[2] 432,546	[2] 413,562	[2] 732,131	[2] 383,593	[2] 1,067,584
Fuller's earth ... do					(3)	(3)
Mineral waters	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas (estimated value at wells) ... M cubic feet	4,587,000	216,000	7,225,000	332,000	39,987,000	1,987,000
Natural gasoline and allied products:						
Natural gasoline and cycle products ... gallons					14,401,000	790,000
Liquefied petroleum gases ... do					2,712,000	136,000
Petroleum ... barrels	19,062,000	19,240,000	24,298,000	30,130,000	35,017,000	60,726,000
Sand and gravel ... short tons	1,606,345	812,046	2,619,293	1,533,631	[5] 2,036,136	[5] 1,393,218
Stone ... do	(3)	(3)	(3)	(3)	(3)	(3)
Miscellaneous [6]		27,761		68,385		650,581
Total value, eliminating duplications		21,370,000		33,672,000		68,092,000

[1] Figure obtained through cooperation with Bureau of the Census.
[2] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[3] Value included with "Miscellaneous."
[4] No canvass.
[5] "Commercial." Value of "Government-and-contractor" included with "Miscellaneous."
[6] Includes minerals indicated by "3" and "5" above.

Mineral products of the United States, 1945–47, by States—Continued

MISSOURI

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Asphalt (native)....short tons..	(1)	(1)	(1)	(1)	(1)	(1)
Barite....do....	225,467	$1,841,959	270,850	$2,168,067	291,619	$2,405,249
Cement....barrels..	3,681,632	6,134,452	6,887,517	12,142,018	8,030,939	15,066,390
Clay:						
Products, heavy clay (other than pottery and refractories)....		[2] 1,462,818		[2] 3,963,000		[2] 4,123,000
Raw....short tons..	[3] 1,355,349	[2] 2,311,660	[3] 1,689,229	[3] 3,257,687	[3] 1,744,411	[3] 4,051,157
Coal....do....	3,982,724	10,322,177	3,732,815	10,432,591	4,020,000	(1)
Cobalt....pounds..	(1)	(1)	(1)	(1)	(1)	(1)
Coke....short tons..	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Copper....pounds..	6,798,000	917,730	3,714,000	601,668	3,520,000	739,200
Iron ore....long tons..	112,668	(1)	156,350	(1)	171,356	(1)
Lead....short tons..	176,575	30,370,900	139,112	30,326,416	132,246	38,086,848
Lime....do....	753,932	5,031,222	799,742	5,931,485	889,090	7,006,426
Mineral paints (zinc and lead pigments)....do....	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Mineral waters....	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells)....M cubic feet..	90,000	7,000	40,000	6,000	33,000	4,000
Nickel....short tons..	(1)	(1)	----	----	----	----
Ores (crude), etc.:						
Lead....do....	6,509,287	(6)	5,361,694	(6)	5,711,700	(6)
Lead-copper....do....	167,485	(6)	141,698	(6)	183,442	(6)
Zinc....do....	849,836	(6)	700,849	(6)	606,910	(6)
Zinc-lead....do....	1,131,228	(6)	1,297,689	(6)	804,755	(6)
Petroleum....barrels..	45,000	(1)	51,000	(1)	55,000	(1)
Sand and gravel....short tons..	3,489,775	2,780,467	5,136,904	4,070,448	[7] 4,597,495	[7] 4,193,474
Sand and sandstone (ground)....do....	(1)	(1)	(1)	(1)	(1)	(1)
Silver....troy ounces..	94,822	67,429	69,401	56,076	93,600	84,708
Stone....short tons..	[8] 5,314,160	[8] 6,055,747	7,258,990	8,996,440	[8] 8,438,320	[8] 11,195,993
Sulfuric acid (60° B.)[9]....do....	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Tripoli....do....	6,542	114,188	12,180	211,244	19,375	469,927
Zinc....do....	22,175	5,100,250	22,234	5,425,096	17,074	4,131,908
Miscellaneous[10]....		5,212,889		4,520,383		20,490,714
Total value, eliminating duplications....		74,347,000		88,357,000		107,021,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is 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 with the metals.
[7] "Commercial." Value of "Government-and-contractor" included with "Miscellaneous."
[8] Exclusive of sandstone, value for which is included with "Miscellaneous."
[9] From zinc smelting.
[10] Includes minerals indicated by "1", "7", and "8" above.

MONTANA

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Arsenious oxide (white arsenic) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Bismuth ... pounds	(2)	(2)	(2)	(2)	(2)	(2)
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	------	(1 3)	------	[3] $191,000	------	[3] $206,000
Raw ... short tons	[4] 24,778	[4] $33,778	[4] 56,423	[4] 187,201	[4] 67,912	[4] 156,094
Coal:						
Bituminous ... do	4,425,191	8,322,004	3,682,913	6,450,781	3,260,000	(1)
Lignite ... do	41,597	99,000	40,013	105,331		
Copper ... pounds	177,012,000	23,896,620	116,962,000	18,947,844	115,800,000	24,318,000
Gem stones	------	(5)	------	(5)	------	(5)
Gold ... troy ounces	44,597	1,560,895	70,507	2,467,745	90,124	3,154,340
Gypsum (crude) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Lead ... do	9,999	1,719,828	8,280	1,805,040	16,108	4,639,104
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore ... do	151,930	6,146,595	137,522	4,643,050	129,689	4,153,045
Manganiferous ore ... do	5,057	(1)	3,816	(1)	3,671	(1)
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) ... M cubic feet	31,829,000	1,499,000	30,713,000	1,419,000	32,549,000	1,481,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	2,876,000	187,000	2,624,000	183,000	2,638,000	216,000
Liquefied petroleum gases ... do	1,850,000	110,000	1,973,000	109,000	2,989,000	208,000
Ores (crude), etc.:						
Copper ... short tons	4,463,131	(6)	1,781,895	(6)	1,838,580	(6)
Dry and siliceous (gold and silver) ... do	188,713	(6)	149,611	(6)	287,730	(6)
Lead ... do	14,919	(6)	5,857	(6)	12,508	(6)
Zinc ... do	87,801	(6)	73,727	(6)	10,758	(6)
Zinc-lead ... do	164,998	(6)	223,868	(6)	950,437	(6)
Petroleum ... barrels	8,420,000	10,810,000	8,825,000	12,710,000	8,693,000	16,701,000
Phosphate rock ... long tons	150,858	916,288	179,944	1,207,054	236,229	1,549,317
Pumice ... short tons	------	------	------	------	2,035	9,476
Pyrites ... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... short tons	[7] 2,035,192	[7] 1,067,295	2,428,681	1,301,867	4,203,797	3,129,921
Silver ... troy ounces	5,942,070	4,225,472	3,273,140	2,644,697	6,326,190	5,725,202
Stone ... short tons	646,850	563,374	441,480	440,046	632,620	574,726
Talc ... do	(1)	(1)	(1)	(1)	(1)	(1)
Tungsten concentrates ... short tons (60-percent WO_3 basis)	(8)	(1)	84	(1)	4	(1)
Vermiculite ... short tons	(1)	(1)	(1)	(1)	(1)	(1)

See footnotes at end of table

Mineral products of the United States, 1945–47, by States—Continued

MONTANA—Continued

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Zinc ... short tons	17,403	$4,002,690	16,770	$4,091,880	45,679	$11,054,318
Miscellaneous [9]		3,693,239		3,235,005		9,934,126
Total value, eliminating duplications		68,829,000		62,114,000		87,167,000

[1] Value included with "Miscellaneous."
[2] Figure not available.
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included with the metals.
[7] "Commercial." Value of "Government-and-contractor" included with "Miscellaneous."
[8] 147 pounds.
[9] Includes minerals indicated by "1" and "7" above.

NEBRASKA

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Cement ... barrels	([1])	([1])	([1])	([1])	([1])	([1])
Clay:						
Products, heavy clay (other than pottery and refractories)		([1] [2])		([1] [2])		([1] [2])
Raw ... short tons	[3] 36,415	[3] $34,757	[3] 130,586	[3] $112,985	[3] 98,911	[3] $88,194
Mineral waters	([4])	([4])	([4])	([4])	([4])	([4])
Petroleum ... barrels	305,000	370,000	293,000	400,000	229,000	398,000
Pumice ... short tons	6,764	59,735	4,772	45,900	4,546	43,760
Sand and gravel ... do	3,882,461	1,956,560	3,969,811	1,962,560	3,792,622	2,135,625
Stone ... do	297,750	622,671	263,930	612,120	219,780	537,824
Miscellaneous [5]		1,952,776		4,254,178		4,266,588
Total value, eliminating duplications		4,963,000		7,277,000		7,383,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Andalusite short tons	--------	--------	--------	--------	(1)	(1)
Antimony ore (concentrates) do	65	$6,402	15	$1,593	1,352	$34,119
Arsenious oxide do	(2)	(2)	(2)	(2)	(2)	(2)
Barite do	28,919	106,052	(1)	(1)	37,388	261,168
Bismuth pounds	(2)	(2)	(2)	(2)	(2)	(2)
Clay:						
Products, heavy clay (other than pottery and refractories)	--------	(1 3)	--------	(1 3)	--------	(1 3)
Raw short tons	--------	--------	(1)	(1)	(1)	(1)
Copper pounds	105,190,000	14,200,650	97,232,000	15,751,584	99,206,000	20,833,260
Diatomite short tons	(1)	(1)	(1)	(1)	(1)	(1)
Dumortierite do	(1)	(1)	--------	--------	--------	--------
Fluorspar do	7,038	(1)	6,234	(1)	8,042	(1)
Fuller's earth do	(1)	(1)	(1)	(1)	(1)	(1)
Gem stones	--------	(4)	--------	(4)	--------	(4)
Gold troy ounces	92,265	3,229,275	90,680	3,173,800	89,063	3,117,205
Gypsum (crude) short tons	368,246	732,253	490,253	1,164,083	526,972	1,377,143
Iron ore long tons	6,196	(1)	3,299	(1)	5,452	(1)
Lead short tons	6,275	1,079,300	7,175	1,564,150	7,161	2,062,368
Lime do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesite do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium do	423	118,926	--------	--------	--------	--------
Magnesium oxide (from brucite) do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore do	960	(1)	1,064	(1)	67	(1)
Manganiferous ore do	2,212	(1)	12,468	(1)	13,117	(1)
Marl, calcareous do	(1)	(1)	(1)	(1)	(1)	(1)
Mercury flasks (76 pounds)	4,338	585,153	4,567	448,662	3,881	324,995
Mica, sheet pounds	(1)	(1)	--------	--------	--------	--------
Mineral waters	(4)	(4)	(4)	(4)	(4)	(4)
Molybdenum pounds	(1)	(1)	(1)	(1)	(1)	(1)
Ores (crude), etc.:						
Copper short tons	4,917,945	(5)	5,102,212	(5)	5,828,016	(5)
Dry and siliceous (gold and silver) do	202,767	(5)	329,575	(5)	462,088	(5)
Lead do	12,707	(5)	14,468	(5)	24,139	(5)
Zinc do	94,029	(5)	11,306	(5)	3,913	(5)
Zinc-lead do	147,225	(5)	268,244	(5)	223,291	(5)
Zinc-lead-copper do	--------	--------	--------	--------	188	(5)
Perlite do	--------	--------	--------	--------	(1)	(1)
Salt do	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel do	999,781	914,476	720,506	944,332	963,253	1,460,251
Silver troy ounces	1,043,380	741,959	1,250,651	1,010,526	1,377,579	1,246,709
Stone short tons	104,180	151,673	[6] 87,810	[6] 122,940	1,691,700	1,068,840
Sulfur ore long tons	--------	--------	42	3,396	(1)	(1)

See footnotes at end of table.

Mineral products of the United States, 1945–47, by States—Continued

NEVADA—Continued

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Talc and pinite short tons	11,780	$185,059	7,589	$141,180	9,767	$175,489
Tungsten concentrates short tons (60-percent WO_3 basis)	1,857	2,658,390	2,617	3,321,161	2,002	2,673,714
Vermiculite short tons			(1)	(1)		
Zinc do	21,457	4,935,110	22,649	5,526,356	16,970	4,106,740
Miscellaneous [7]		1,662,459		2,280,002		3,915,183
Total value, eliminating duplications		31,307,000		35,454,000		42,639,000

[1] Value included with "Miscellaneous."
[2] Figure not available.
[3] Figure obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included with the metals.
[6] Exclusive of limestone, value for which is included with "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

NEW HAMPSHIRE

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Beryllium concentrates short tons	1	$357	5	$365	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)		(1 2)		(1 2)		[2] $342,000
Raw short tons			[3] 18,108	[3] 12,381	[3] 28,605	[3] 21,456
Feldspar (crude) long tons	(1)	(1)	(1)	(1)	(1)	(1)
Gem stones		(4)		(4)		(4)
Mica:						
Scrap short tons	442	11,206	(1)	(1)	403	9,937
Sheet pounds	532,944	144,947	377,650	41,589		
Mineral waters	(4)	(4)	(4)	(4)	(4)	(4)
Peat short tons	(1)	(1)	(1)	(1)		
Sand and gravel do	[5] 943,076	[5] 93,812	[5] 1,434,880	[5] 138,789	[5] 1,737,084	[5] 198,748
Scythestones do	(1)	(1)	(1)	(1)	(1)	(1)
Stone do	3,760	93,089	68,530	385,828	109,230	399,879
Miscellaneous [6]		458,150		884,624		623,504
Total value, eliminating duplications		802,000		1,451,000		1,574,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] No canvass.
[5] "Government-and-contractor." Value of "Commercial" included with "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

NEW JERSEY

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Clay:						
Products, heavy clay (other than pottery and refractories)	----------	[1] $1,808,723	----------	[1] $3,780,000	----------	[1] $6,564,000
Raw .... short tons	[2] 252,664	[2] 794,564	[2] 488,161	[2] 1,296,358	[2] 571,504	[2] 1,407,301
Coke .... do	1,284,020	(3 4)	1,258,854	(3 4)	1,432,210	(3 4)
Ferro-alloys .... do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Iron ore .... long tons	428,747	2,956,510	419,274	3,052,831	468,895	3,689,832
Lime .... short tons	(3)	(3)	(3)	(3)	(3)	(3)
Magnesium oxide (from sea water) .... do	(3)	(3)	(3)	(3)	(3)	(3)
Manganiferous residuum .... do	224,331	(3)	205,786	(3)	227,547	(3)
Marl, greensand .... do	4,986	477,919	5,140	424,900	8,337	432,980
Mineral paints (zinc and lead pigments) .... do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Ore (zinc) .... short tons	522,177	(6)	413,755	(6)	499,067	(6)
Peat .... do	(3)	(3)	20,902	127,550	21,640	135,300
Sand and gravel .... do	4,506,379	4,652,938	5,123,324	5,404,206	[7] 5,532,011	[7] 6,335,343
Sand and sandstone (ground) .... do	(3)	(3)	105,985	649,828	118,446	772,213
Silica (quartz) .... do	(3)	(3)	----------	----------	----------	----------
Stone .... do	[8] 2,261,750	[8] 3,498,182	3,419,210	5,239,342	3,857,710	6,136,857
Zinc [9] .... do	81,392	14,299,032	64,454	11,701,346	76,871	17,420,052
Miscellaneous [10]	----------	14,496,937	----------	15,260,706	----------	18,293,785
Total value, eliminating duplications	----------	31,267,000	----------	33,518,000	----------	44,250,000

[1] Figure obtained through cooperation with Bureau of the Census.
[2] Sold or used; value of clay used in cement and heavy clay products is included here but it is not included in total value for State.
[3] Value included with "Miscellaneous." [4] Value not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included with the metal.
[7] "Commercial." Value of "Government-and contractor" included with "Miscellaneous."
[8] Exclusive of dimension basalt, value for which is included with "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 "3," "7," and "8" above.

NEW MEXICO

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Arsenious oxide .... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Beryllium concentrates .... do	----------	----------	----------	----------	(2)	(2)
Bismuth .... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	----------	(2 3)	----------	[3] $148,000	----------	[3] $183,000
Raw .... short tons	[4] 22,200	[4] $30,720	[4] 39,013	[4] 43,487	[4] 56,772	[4] 50,400
Coal .... do	1,483,686	5,637,434	1,280,279	5,297,841	1,426,000	(2)
Copper .... pounds	113,142,000	15,274,170	100,382,000	16,261,884	120,410,000	25,286,100
Fluorspar .... short tons	14,449	390,331	17,584	489,607	27,526	841,095

See footnotes at end of table.

Mineral products of the United States, 1945–47, by States—Continued

NEW MEXICO—Continued

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Gem stones		(5)		(5)		(5)
Gold troy ounces	5,604	$196,140	4,009	$140,315	3,146	$110,110
Iron ore long tons	369	(2)				
Lead short tons	7,662	1,317,864	4,899	1,067,982	6,383	1,838,304
Lime do	(2)	(2)				
Lithium minerals do			(2)	(2)	(2)	(2)
Manganese ore do	3,334	(2)	1,166	(2)	858	(2)
Manganiferous ore do	85,744	(2)	72,299	(2)	97,007	(2)
Mica:						
Scrap do	491	9,082				
Sheet pounds	(2)	(2)				
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Molybdenum pounds	(2)	(2)	(2)	(2)	(2)	(2)
Natural gas (estimated value at wells) M cubic feet	105,023,000	1,460,000	119,262,000	1,694,000	142,566,000	2,523,000
Natural gasoline and allied products:						
Natural gasoline gallons	86,043,000	4,794,000	87,677,000	3,759,000	92,450,000	5,639,000
Liquefied petroleum gases do	11,757,000	257,000	15,965,000	344,000	21,443,000	836,000
Ores (crude), etc.:						
Copper short tons	6,228,727	(6)	6,044,004	(6)	6,772,030	(6)
Dry and siliceous (gold and silver) do	14,483	(6)	11,228	(6)	1,165	(6)
Lead do	4,627	(6)	737	(6)	12,323	(6)
Zinc do	265,931	(6)	487,063	(6)	489,149	(6)
Zinc-lead do	329,559	(6)	51,858	(6)	78,278	(6)
Petroleum barrels	37,351,000	37,610,000	36,814,000	44,540,000	41,127,000	71,718,000
Potassium salts short tons (K_2O equivalent)	733,176	25,456,731	789,473	27,187,228	880,605	28,035,675
Pumice short tons	(2)	(2)	62,623	432,890	85,639	512,176
Salt do	9,980	20,694	8,677	16,399	12,006	19,239
Sand and gravel do	[7] 448,438	[7] 317,968	[7] 349,688	[7] 278,442	540,794	492,583
Silver troy ounces	465,127	330,757	338,000	273,104	515,833	466,829
Stone short tons	361,700	173,120	(2)	(2)	477,970	251,080
Talc do	(2)	(2)				
Tantalum and columbium ores pounds	(2)	(2)	1,772	5,547	3,259	8,677
Vanadium do					(2)	(2)
Zinc short tons	40,295	9,267,850	36,103	8,809,132	44,103	10,672,926
Miscellaneous [8]		1,702,895		1,184,025		7,108,503
Total value, eliminating duplications		104,234,000		111,938,000		156,554,000

1 Figure not available.
2 Value included with "Miscellaneous."
3 Figure obtained through cooperation with Bureau of the Census.
4 Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
5 No canvass.
6 Not valued as ore; value of recoverable metal content included with the metals.
7 "Commercial." Value of "Government-and-contractor" included with "Miscellaneous."
8 Includes minerals indicated by "2," and "7" above.

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Aluminum .... short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Cement .... barrels	[3] 5,578,906	[3] $9,009,454	[3] 10,514,431	[3] $17,547,319	[3] 11,592,821	[3] $21,060,957
Clay:						
Products, heavy clay (other than pottery and refractories)	....	[4] 2,376,670	....	[4] 7,289,000	....	[4] 9,021,000
Raw .... short tons	[5] 320,683	[5] 272,302	[5] 1,137,105	[5] 840,143	[5] 1,174,134	[5] 855,385
Coke .... do	5,789,974	[2] 46,676,238	5,042,674	[2] 44,316,777	5,670,333	[2] 58,629,308
Diatomite .... do	(1)	(1)	(1)	(1)	....	....
Emery .... do	7,856	75,977	6,188	62,099	5,798	66,927
Feldspar (crude) .... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Ferro-alloys .... short tons	286,895	[2] 48,245,824	321,817	[2] 45,255,465	346,330	[2] 52,912,305
Garnet, abrasive .... do	(1)	(1)	(1)	(1)	(1)	(1)
Gem stones	....	(6)	....	(6)	....	(6)
Graphite, artificial .... pounds	....	....	(1 2)	(1 2)	(1 2)	(1 2)
Gypsum (crude) .... short tons	557,902	1,262,989	814,999	1,961,157	949,375	2,613,094
Iron:						
Ore .... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Pig .... short tons	3,278,345	[2] 74,857,092	2,801,828	[2] 63,937,403	3,675,217	[2] 101,204,575
Lead .... do	862	148,264	1,073	233,914	1,496	430,848
Lime .... do	(1)	(1)	(1)	(1)	(1)	(1)
Marl (calcareous) .... do	....	....	....	....	500	3,000
Mica, scrap .... do	....	....	(1)	(1)	....	....
Millstones	....	3,577	....	(1)	....	(1)
Mineral waters	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas (estimated value at wells) .... M cubic feet	9,210,000	2,629,000	5,084,000	1,351,000	4,776,000	1,161,000
Natural gasoline .... gallons	8,000	(1)	9,000	(1)	10,000	1,000
Ores (crude), etc.:						
Zinc .... short tons	97,040	(7)	130,069	(7)	114,995	(7)
Zinc-lead .... do	228,062	(7)	262,197	(7)	322,898	(7)
Peat .... do	(1)	(1)	(1)	(1)	(1)	(1)
Petroleum .... barrels	4,648,000	17,470,000	4,863,000	18,630,000	4,762,000	20,075,000
Pyrites .... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Salt .... short tons	2,862,224	10,327,013	2,813,782	10,153,274	2,923,023	11,875,485
Sand and gravel .... do	7,477,628	5,049,905	12,079,249	8,907,100	13,820,196	10,906,224
Silver .... troy ounces	14,271	10,148	15,786	12,755	22,409	20,280
Slate	....	(1)	....	1,160,404	....	1,575,252
Stone .... short tons	7,900,560	9,133,781	9,939,440	12,086,748	11,197,990	14,992,064
Talc .... do	(1)	(1)	(1)	(1)	(1)	(1)
Titanium concentrates: Ilmenite .... do	240,090	(1)	209,009	(1)	(1)	(1)
Wollastonite .... do	(1)	(1)	(1)	(1)	80	1,600
Zinc .... do	24,978	5,744,940	32,515	7,933,660	34,116	8,256,072
Miscellaneous [8]	....	46,310,583	....	37,604,558	....	50,887,260
Total value, eliminating duplications	....	88,678,000	....	103,571,000	....	130,735,000

[1] Value included with "Miscellaneous."
[2] Value not included in total value for State.
[3] Exclusive of natural cement, value for which is included with "Miscellaneous."
[4] Figure obtained through cooperation with Bureau of the Census.
[5] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included with the metals.
[8] Includes minerals indicated by "1" and "2" above.

Mineral products of the United States, 1945–47, by States—Continued

NORTH CAROLINA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
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])				
Bromine ... pounds	([1])	([1])				
Clay: Products, heavy clay (other than pottery and refractories)		[3] $3,471,219		[3] $6,241,000		[3] $8,232,000
Raw ... short tons	[4] 525,506	[4] 783,220	[4] 914,999	[4] 1,178,030	[4] 1,068,572	[4] 1,314,976
Feldspar (crude) ... long tons	148,493	863,740	230,367	1,200,638	220,997	1,081,514
Flint lining for tube mills ... short tons	([1])	([1])	([1])	([1])	([1])	([1])
Gem stones		([5])		([5])		([5])
Lime ... short tons	([1])	([1])				
Lithium minerals ... do	([1])	([1])				
Mica: Scrap ... do	30,682	709,334	39,100	887,901	38,655	844,086
Sheet ... pounds	563,990	243,058	424,791	135,505	210,816	84,275
Millstones		([1])		([1])		([1])
Mineral waters	([5])	([5])	([5])	([5])	([5])	([5])
Olivine ... short tons	([1])	([1])	6,249	([1])	7,938	([1])
Pebbles for grinding ... do	3,644	116,300	([1])	([1])	([1])	([1])
Sand and gravel ... do	2,394,089	1,517,203	4,213,795	2,933,711	4,171,553	2,956,800
Silica (quartz) ... do	([1])	([1])	([1])	([1])	([1])	([1])
Stone ... do	[6] 2,297,670	[6] 2,965,458	4,505,880	6,835,448	5,018,060	7,561,167
Talc and pyrophyllite ... do	78,369	682,510	87,718	976,524	97,484	1,186,463
Tantalum and columbium ores: Columbium ore ... pounds	([1])	([1])				
Titanium concentrates: Ilmenite ... short tons	17,216	([1])	17,852	([1])	27,199	([1])
Tungsten concentrates ... short tons (60-percent WO_3 basis)	132	([1])	307	([1])	538	([1])
Vermiculite ... short tons	([1])	([1])	([1])	([1])	([1])	([1])
Miscellaneous [7]		12,668,510		7,685,377		8,177,101
Total value, eliminating duplications		14,766,000		20,428,000		23,699,000

[1] Value included with "Miscellaneous."
[2] Value not included in total value for State.
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[5] No canvass.
[6] Exclusive of marble and sandstone, values for which are included with "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

NORTH DAKOTA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Clay: Products, heavy clay (other than pottery and refractories)		([1 2])		([1 2])		([1 2])
Raw ... short tons	[3] 6,026	[3] $4,450	([1 3])	([1 3])	([1 3])	([1 3])
Coal (lignite) ... do	2,522,319	3,924,000	2,554,682	$4,301,603	2,767,000	([1])
Mineral waters	([4])	([4])	([4])	([4])	([4])	([4])
Natural gas (estimated value at wells) ... M cubic feet	217,000	7,000	344,000	10,000	387,000	$12,000
Sand and gravel ... short tons	1,769,086	523,163	2,304,694	726,422	2,383,021	920,111
Miscellaneous [5]		50,514		90,680		6,708,860
Total value, eliminating duplications		4,505,000		5,118,000		7,629,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

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OHIO

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	4,833,183	$7,356,271	8,187,531	$13,293,126	9,296,311	$16,611,421
Clay:						
Products, heavy clay (other than pottery and refractories)	-----	[1] 18,609,369	-----	[1] 39,729,000	-----	[1] 51,348,000
Raw ... short tons	[2] 2,385,764	[2] 4,048,315	[2] 4,047,818	[2] 6,113,837	[2] 4,562,985	[2] 7,714,329
Coal ... do	32,737,435	91,440,597	32,314,262	96,670,095	38,675,000	134,589,000
Coke ... do	9,405,710	[3] 70,381,885	8,451,580	[3] 69,357,225	10,069,237	[3] 98,973,704
Ferro-alloys ... do	189,619	[3] 11,166,247	201,682	[3] 8,884,960	247,035	[3] 15,976,882
Grindstones ... do	9,534	385,140	10,854	478,022	(4)	(4)
Gypsum (crude) ... do	(4)	(4)	(4)	(4)	(4)	(4)
Iron, pig ... do	11,264,024	[3] 258,959,815	9,647,981	[3] 240,218,956	12,322,330	[3] 380,383,106
Lime ... do	1,420,983	11,693,615	1,469,278	12,926,310	1,774,847	17,685,220
Magnesium ... do	(4)	(4)	-----	-----	-----	-----
Mineral paints (zinc and lead pigments) ... do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) ... M cubic feet	49,967,000	8,899,000	61,570,000	11,280,000	73,989,000	14,539,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	6,452,000	369,000	6,253,000	329,000	6,944,000	448,000
Liquefied petroleum gases ... do	-----	-----	-----	-----	187,000	6,000
Peat ... short tons	14,434	131,688	18,979	161,444	17,754	143,247
Petroleum ... barrels	2,828,000	7,240,000	2,908,000	7,710,000	3,108,000	10,441,000
Salt ... short tons	2,764,926	3,997,759	2,645,995	4,160,011	2,975,676	6,815,639
Sand and gravel ... do	9,420,380	7,985,018	13,266,074	11,105,652	15,388,990	14,195,288
Sand and sandstone (ground) ... do	(4)	(4)	(4)	(4)	(4)	(4)
Scythestones, whetstones, etc ... do	347	24,256	249	51,135	(4)	(4)
Stone ... do	[6] 13,279,800	[6] 13,966,710	[6] 16,991,440	[6] 19,069,169	[6] 18,710,890	[6] 23,633,433
Sulfuric acid (60° B.) [7] ... do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Miscellaneous [8]	-----	7,446,925	-----	3,774,430	-----	5,363,177
Total value, eliminating duplications	-----	179,682,000	-----	221,356,000	-----	296,147,000

[1] Figure obtained through cooperation with Bureau of the Census.
[2] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[3] Value not included in total value for State.
[4] Value included with "Miscellaneous."
[5] No canvass.
[6] Exclusive of unclassified stone in 1945 and 1947 and dimension limestone in 1946, values for which are included with "Miscellaneous."
[7] From zinc-roasting operation.
[8] Includes minerals indicated by "4" and "6" above.

Mineral products of the United States, 1945–47, by States—Continued

OKLAHOMA

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Asphalt (native) short tons	(1)	(1)	(1)	(1)	(1)	(1)
Cement barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	----------	[2] $707,272	----------	[2] $1,557,000	----------	[2] $1,563,000
Raw short tons	[3] 243,358	[3] 178,658	[3] 488,973	[3] 358,922	[3] 522,704	[3] 349,000
Coal do	2,908,976	10,487,344	2,647,380	9,926,836	3,098,000	(1)
Gypsum (crude) do	(1)	(1)	(1)	(1)	(1)	(1)
Lead do	12,664	2,178,208	13,697	2,985,946	14,289	4,115,232
Lime do	(1)	(1)	(1)	(1)	(1)	(1)
Mineral waters	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas (estimated value at wells) M cubic feet	357,530,000	12,764,000	380,938,000	12,342,000	393,216,000	15,493,000
Natural gasoline and allied products:						
Natural gasoline gallons	284,334,000	15,223,000	283,915,000	12,907,000	279,617,000	17,499,000
Liquefied petroleum gases do	131,850,000	3,276,000	131,076,000	2,955,000	166,306,000	5,987,000
Ores (crude), etc.:						
Lead short tons	6	(5)	2,236	(5)	103	(5)
Zinc do	9,545,153	(5)	9,067,673	(5)	4,451,405	(5)
Zinc-lead do	2,640,147	(5)	3,139,744	(5)	2,471,819	(5)
Petroleum barrels	139,299,000	177,050,000	134,794,000	194,100,000	141,019,000	270,908,000
Pumice short tons	----------	----------	----------	----------	(1)	(1)
Salt do	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel do	1,274,186	761,448	1,577,138	947,283	1,670,205	1,125,322
Stone do	3,894,720	1,572,772	3,413,430	2,624,579	2,610,770	2,679,855
Sulfuric acid (60° B.) [6] do	(1 7)	(1 7)	(1 7)	(1 7)	(1 7)	(1 7)
Zinc do	69,300	15,939,000	69,552	16,970,688	51,062	12,357,004
Miscellaneous [8]	----------	3,716,517	----------	6,359,531	----------	20,226,303
Total value, eliminating duplications	----------	243,314,000	----------	263,282,000	----------	351,578,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included with the metals.
[6] From zinc smelting.
[7] Value not included in total value for State.
[8] Includes minerals indicated by "1" above.

OREGON

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Aluminum ... short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Antimony ore (concentrates) ... do	436	$9,894	10	$1,593	33	$1,338
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Chromite ... short tons	4,366	167,667	(1)	(1)	---	---
Clay:						
Products, heavy clay (other than pottery and refractories)	---	[3] 463,647	---	[3] 788,000	---	[3] 1,038,000
Raw ... short tons	[4] 128,484	[4] 93,357	[4] 118,478	[4] 90,044	[4] 141,050	[4] 87,895
Coal ... do	16,500	65,786	17,153	75,515	18,000	(1)
Copper ... pounds	2,000	270	14,000	2,268	28,000	5,880
Diatomite ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Ferro-alloys ... do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Gem stones	---	(5)	---	(5)	---	(5)
Gold ... troy ounces	4,467	156,345	17,598	615,930	18,979	664,265
Lead ... short tons	1	172	2	436	12	3,456
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Mercury ... flasks (76 pounds)	2,500	337,225	1,326	130,266	1,185	99,232
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Ores (crude), etc.:						
Copper ... short tons	---	---	152	(6)	109	(6)
Dry and siliceous (gold and silver) ... do	1,378	(6)	3,094	(6)	3,168	(6)
Perlite ... do	---	---	---	---	(1)	(1)
Platinum metals (crude) ... troy ounces	3	(1)	---	---	---	---
Pumice ... short tons	(1)	(1)	3,004	12,532	33,240	111,380
Sand and gravel ... do	4,476,504	3,681,255	5,419,183	4,578,672	6,020,440	5,541,373
Silica (quartz) ... do	1,462	16,260	(1)	(1)	(1)	(1)
Silver ... troy ounces	10,461	7,439	6,927	5,597	30,379	27,493
Stone ... short tons	[7] 1,498,160	[7] 1,898,073	[7] 1,472,700	[7] 2,008,374	3,002,000	4,425,847
Zinc ... do	1	230	---	---	1	242
Miscellaneous [8]	---	11,230,845	---	6,535,529	---	24,871,806
Total value, eliminating duplications	---	9,463,000	---	11,807,000	---	16,658,000

[1] Value included with "Miscellaneous."
[2] Value not included in total value for State.
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included with the metals.
[7] Exclusive of sandstone and unclassified stone in 1945 and granite and dimension basalt in 1946, values for which are included with "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral products of the United States, 1945–47, by States—Continued

PENNSYLVANIA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	16,232,722	$25,549,621	29,686,909	$48,294,891	33,655,687	$60,998,207
Clay:						
Products, heavy clay (other than pottery and refractories)	----	[1] 8,233,763	----	[1] 18,764,000	----	[1] 22,831,000
Raw ... short tons	[2] 2,191,536	[2] 5,347,951	[2] 3,178,011	[2] 6,943,203	[2] 3,330,612	[2] 7,857,447
Coal:						
Anthracite ... do	54,933,909	323,944,435	60,506,873	413,417,070	57,190,009	413,019,486
Bituminous ... do	132,965,343	436,823,651	125,496,856	459,536,386	145,880,000	618,531,000
Cobalt ... pounds	(3)	(3)	(3)	(3)	(3)	(3)
Coke ... short tons	19,838,857	[4] 131,395,424	16,821,888	[4] 121,817,080	22,388,026	[4] 222,057,346
Copper [5] ... pounds	(3)	(3)	(3)	(3)	(3)	(3)
Feldspar (crude) ... long tons	(3)	(3)	----	----	----	----
Ferro-alloys ... short tons	594,888	[4] 88,579,690	444,442	[4] 58,712,282	564,386	[4] 79,956,306
Gem stones	----	(6)	----	(6)	----	(6)
Gold [5] ... troy ounces	1,588	55,580	1,150	40,250	1,518	53,130
Graphite, crystalline ... pounds	----	----	(3)	(3)	(3)	(3)
Iron:						
Ore ... long tons	(3)	(3)	(3)	(3)	(3)	(3)
Pig ... short tons	16,168,496	[4] 361,684,919	13,330,186	[4] 329,194,957	17,587,252	[4] 531,716,815
Lime ... do	903,914	7,221,808	972,311	8,272,202	1,045,566	9,861,812
Mica, scrap ... do	286	1,430	----	----	----	----
Mineral paints (zinc and lead pigments) ... do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Mineral waters	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas (estimated value at wells) ... M cubic feet	82,188,000	20,169,000	92,443,000	23,508,000	94,252,000	22,357,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	13,588,000	752,000	10,540,000	513,000	12,579,000	855,000
Liquefied petroleum gases ... do	593,000	51,000	463,000	40,000	593,000	51,000
Peat ... short tons	(3)	(3)	2,952	9,615	(3)	(3)
Petroleum ... barrels	12,515,000	46,680,000	12,996,000	49,640,000	12,690,000	53,323,000
Pyrites ... long tons	(3)	(3)	(3)	(3)	(3)	(3)
Sand and gravel ... short tons	6,768,944	7,247,613	10,773,213	10,984,330	11,543,971	13,006,644
Sand and sandstone (ground) ... do	(3)	(3)	(3)	(3)	(3)	(3)
Silver [5] ... troy ounces	10,434	7,420	7,887	6,373	9,863	8,926
Slate	----	1,929,741	----	3,197,745	----	4,318,196
Soapstone ... short tons	(3)	(3)	(3)	(3)	(3)	(3)
Stone ... do	[7] 17,708,390	[7] 22,266,706	18,883,740	25,872,596	[7] 22,352,810	[7] 31,938,877
Sulfuric acid (60° B.) [8] ... do	346,387	[4] 3,498,509	295,353	[4] 2,882,645	330,046	[4] 3,425,877
Tripoli (rottenstone) ... do	561	8,452	1,144	16,255	516	10,380
Miscellaneous [9]	----	22,221,467	----	25,858,979	----	33,660,156
Total value, eliminating duplications	----	913,232,000	----	1,074,004,000	----	1,266,285,000

[1] Figure obtained through cooperation with Bureau of the Census.
[2] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[3] Value included with "Miscellaneous."
[4] Value not included in total value for State.
[5] The magnetite-pyrite-chalcopyrite ore from which copper, gold, and silver are recovered is classed by the Bureau of Mines as iron ore.
[6] No canvass.
[7] Exclusive of crushed granite in 1945 and dimension basalt in 1947, values for which are included with "Miscellaneous."
[8] From zinc smelting.
[9] Includes minerals indicated by "3," and "7" above.

RHODE ISLAND

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Coke short tons	([1, 2])	([1, 2])	([1, 2])	([1, 2])	([1, 2])	([1, 2])
Graphite, amorphous do	([1])	([1])	([1])	([1])	([1])	([1])
Mineral waters	([3])	([3])	([3])	([3])	([3])	([3])
Sand and gravel short tons	317,300	$221,530	[4] 41,659	[4] $8,486	[4] 44,363	[4] 25,261
Stone do	[5] 11,280	[5] 219,263	[5] 4,860	[5] 274,130	[5] 32,090	[5] 400,602
Miscellaneous [6]		2,554,887		2,687,793		3,724,243
Total value, eliminating duplications		508,000		561,000		785,000

[1] Value included with "Miscellaneous."
[2] Value not included in total value for State.
[3] No canvass.
[4] "Government-and-contractor." Value of "Commercial" included with "Miscellaneous."
[5] Exclusive of unclassified stone, values for which are included with "Miscellaneous."
[6] Includes minerals indicated by "1," "4," and "5" above.

SOUTH CAROLINA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Clay:						
Products, heavy clay (other than pottery and refractories)		[1] $1,286,592		[1] $2,421,000		[1] $3,123,000
Raw short tons	[2] 380,769	[2] 1,659,268	[2] 614,403	[2] 2,795,123	[2] 708,705	[2] 3,124,510
Ferro-alloys do	([3, 4])	([3, 4])	([3, 4])	([3, 4])	([3, 4])	([3, 4])
Gem stones		([5])		([5])		([5])
Manganese ore short tons	41	([3])	78	([3])		
Mica:						
Scrap do			([3])	([3])		
Sheet pounds	275	889				
Mineral waters	([5])	([5])	([5])	([5])	([5])	([5])
Sand and gravel short tons	319,933	202,335	524,271	214,964	601,313	278,021
Stone do	[6] 1,380,800	[6] 2,041,202	1,979,270	2,990,678	2,207,840	3,921,465
Topaz, industrial do	765	13,500	700	10,500	2,294	45,873
Vermiculite do	([3])	([3])	([3])	([3])	([3])	([3])
Miscellaneous [7]		2,300,577		2,843,386		2,820,417
Total value, eliminating duplications		5,043,000		8,189,000		10,362,000

[1] Figure obtained through cooperation with Bureau of the Census.
[2] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[3] Value included with "Miscellaneous."
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of unclassified stone, value for which is included with "Miscellaneous."
[7] Includes minerals indicated by "3" and "6" above.

Mineral products of the United States, 1945–47, by States—Continued

SOUTH DAKOTA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Beryllium concentrates ... short tons	38	$5,776	95	$17,422	70	$11,762
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)		(1 2)		(1 2)		(1 2)
Raw ... short tons	[3] 194,929	[3] 1,214,132	[3] 247,257	[3] 1,428,703	[3] 248,863	[3] 2,107,365
Coal (lignite) ... do	24,445	53,000	16,946	36,362	28,000	(1)
Feldspar (crude) ... long tons	68,374	314,787	74,540	299,852	58,959	284,378
Gem stones		(4)		(4)		(4)
Gold ... troy ounces	55,948	1,958,180	312,247	10,928,645	407,194	14,251,790
Gypsum (crude) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron ore sold for paint ... long tons	4,162	(1)				
Lead ... short tons					8	2,304
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Lithium minerals ... do	225	8,370	813	30,610	(1)	(1)
Mica:						
Scrap ... do	1,192	21,534	2,806	63,692	1,499	37,225
Sheet ... pounds	56,570	178,696	17,400	8,432	188,380	28,704
Mineral waters	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas (estimated value at wells) ... M cubic feet	5,000	245	5,000	265	6,000	360
Ores (crude), etc.:						
Dry and siliceous (gold and silver) ... short tons	312,612	(5)	872,242	(5)	935,634	(5)
Zinc-lead ... do					3,750	(5)
Sand and gravel ... do	2,642,494	1,106,983	3,215,608	1,537,822	3,122,409	1,672,253
Silica (quartz) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Silver ... troy ounces	26,564	18,890	86,901	70,216	111,684	101,074
Stone ... short tons	[6] 303,500	[6] 1,605,904	379,880	2,385,543	885,650	3,554,096
Tantalum and columbium ores ... pounds	(1)	(1)	1,703	3,246		
Tungsten concentrates ... short tons (60-percent WO_3 basis)	4	(1)	1	(1)		
Zinc ... short tons					19	4,598
Miscellaneous [7]		662,163		1,612,755		1,616,549
Total value, eliminating duplications		7,137,000		18,389,000		23,636,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included with the metals.
[6] Exclusive of crushed granite and unclassified stone, values for which are included with "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Aluminum ... short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Barite ... do	32,812	$256,756	33,595	$272,169	31,476	$285,853
Cement ... barrels	2,898,053	4,669,330	5,372,964	9,386,582	6,101,108	11,017,225
Clay:						
Products, heavy clay (other than pottery and refractories)	----	[3] 1,988,736	----	[3] 3,691,000	----	[3] 4,044,000
Raw ... short tons	[4] 482,107	[4] 1,196,498	[4] 893,313	[4] 1,955,408	[4] 931,341	[4] 2,256,496
Coal ... do	6,270,708	21,478,639	5,618,352	21,556,537	6,590,000	(1)
Coke ... do	236,979	(1 2)	229,751	(1 2)	241,925	(1 2)
Copper ... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Ferro-alloys ... short tons	60,646	(1 2)	63,425	[2] 6,162,051	147,704	[2] 9,196,881
Fuller's earth ... do	(1)	(1)	(1)	(1)	(1)	(1)
Gold ... troy ounces	148	5,180	95	3,325	303	10,605
Iron:						
Ore (sinter from copper-iron ore) ... long tons	307,500	(1)	332,756	(1)	350,518	(1)
Pig ... short tons	(1 2)	(1 2)	32,688	(1 2)	(1 2)	(1 2)
Lead ... do	54	9,288	125	27,250	22	6,336
Lime ... do	207,587	1,373,268	160,698	1,232,480	181,039	1,533,737
Manganese ore ... do	----	----	----	----	39	(1)
Manganiferous ore ... do	1,000	(1)	----	----	----	----
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) ... M cubic feet	10,000	1,000	47,000	5,000	80,000	5,000
Ores (crude), etc.:						
Copper ... short tons	1,013,740	(6)	1,012,910	(6)	1,050,810	(6)
Lead ... do	575	(6)	1,600	(6)	400	(6)
Zinc ... do	1,322,799	(6)	798,409	(6)	1,097,670	(6)
Petroleum ... barrels	8,000	(1)	10,000	(1)	8,000	(1)
Phosphate rock ... long tons	1,289,231	6,027,987	(1)	(1)	1,411,848	7,778,619
Pyrites ... do	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... short tons	3,097,626	2,578,379	4,011,591	3,632,603	3,891,251	3,805,669
Silica (quartz) ... do	----	----	(1)	(1)	(1)	(1)
Silver ... troy ounces	35,391	25,167	18,016	14,557	79,147	71,628
Stone ... short tons	4,772,720	6,318,915	5,156,490	7,625,086	6,796,630	10,617,502
Sulfuric acid (60° B.) [7] ... do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Zinc ... do	33,824	7,779,520	24,614	6,005,816	31,212	7,553,304
Miscellaneous [8]	----	46,154,760	----	48,445,809	----	77,745,383
Total value, eliminating duplications	----	58,672,000	----	68,031,000	----	84,425,000

[1] Value included with "Miscellaneous."
[2] Value not included in total value for State.
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included with the metals.
[7] From copper smelting.
[8] Includes minerals indicated by "1" above.

Mineral products of the United States, 1945–47, by States—Continued

TEXAS

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Asphalt (native) short tons	(1)	(1)	(1)	(1)	(1)	(1)
Bromine pounds	(1)	(1)	(1)	(1)	(1)	(1)
Cement barrels	8,388,159	$14,790,545	10,996,478	$19,946,600	12,349,219	$24,111,833
Clay:						
Products, heavy clay (other than pottery and refractories)	----------	[2] 4,985,138	----------	[2] 7,019,000	----------	[2] 7,552,000
Raw short tons	[3] 846,000	[3] 1,443,704	[3] 1,369,003	[3] 1,714,403	[3] 1,385,878	[3] 1,739,141
Coal (lignite) do	79,949	68,000	55,978	46,454	60,000	(1)
Coke do	140,254	(1 4)	----------	----------	263,006	(1 4)
Copper pounds	110,000	14,850	6,000	972	12,000	2,520
Feldspar (crude) long tons	(1)	(1)	(1)	(1)	(1)	(1)
Fluorspar short tons	3,413	(1)	1,118	(1)	1,019	(1)
Fuller's earth do	103,076	931,878	110,693	1,157,892	102,901	1,199,726
Gem stones	----------	(5)	----------	(5)	----------	(5)
Gold troy ounces	----------	----------	9	315	45	1,575
Graphite, crystalline pounds	(1)	(1)	(1)	(1)	(1)	(1)
Gypsum (crude) short tons	407,640	511,869	771,633	1,630,929	831,633	2,000,341
Helium cubic feet	[6] 69,808,454	[6] 460,015	[6] 60,493,365	[6] 440,912	[6] 63,198,650	[6] 541,307
Iron:						
Ore long tons	217,237	705,736	21,458	(1)	289,273	(1)
Pig short tons	147,247	(1 4)	----------	----------	(1 4)	(1 4)
Lead do	----------	----------	47	10,246	78	22,464
Lime do	105,277	807,332	121,841	1,053,493	134,530	1,274,095
Magnesite do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium do	(1)	(1)	8,498	3,484,000	5,264	(1)
Magnesium compounds (from sea water) do	85,968	2,818,408	(1)	(1)	(1)	(1)
Mercury flasks (76 pounds)	(1)	(1)	----------	----------	----------	----------
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) M cubic feet	1,711,401,000	44,839,000	1,776,148,000	53,640,000	1,932,857,000	71,129,000
Natural gasoline and allied products:						
Natural gasoline and cycle products gallons	1,467,138,000	65,923,000	1,598,520,000	66,783,000	1,646,227,000	104,007,000
Liquefied petroleum gases do	721,167,000	20,067,000	684,459,000	15,587,000	973,703,000	33,133,000
Ores (crude), etc.:						
Copper short tons	1,600	(7)	80	(7)	68	(7)
Dry and siliceous (gold and silver) do	1,093	(7)	2,054	(7)	962	(7)
Lead do	----------	----------	221	(7)	772	(7)
Zinc do	----------	----------	4,350	(7)	----------	----------
Zinc-lead do	----------	----------	----------	----------	2,750	(7)
Peat do	(1)	(1)	(1)	(1)	(1)	(1)
Pebbles for grinding do	(1)	(1)	177	1,770	(1)	(1)
Petroleum barrels	754,710,000	914,410,000	760,215,000	1,070,400,000	819,427,000	1,577,028,000
Pumice short tons	584	11,680	805	13,054	(1)	(1)
Salt (sodium chloride) do	1,100,791	1,336,162	1,098,589	1,356,676	1,191,621	2,090,098
Sand and gravel do	11,038,244	7,595,904	11,188,849	8,086,097	13,198,728	10,540,980
Silver troy ounces	23,265	16,544	42,922	34,681	20,547	18,595

Soapstone ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sodium sulfate (natural) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Stone ... do	2,798,580	2,726,659	3,285,220	3,611,118	3,786,040	4,277,404
Strontium minerals ... do	(1)	(1)	------	------	------	------
Sulfur ... long tons	3,069,815	49,117,040	3,188,086	51,009,372	3,965,825	70,514,144
Sulfuric acid (60° B.) [8] ... short tons	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Sulfur ore ... long tons	1,300	6,500	5,100	71,400	2,675	37,450
Tungsten concentrates ... short tons (60-percent WO_3 basis)	------	------	1	(1)	------	------
Vermiculite ... short tons	------	------	(1)	(1)	------	------
Zinc ... do	------	------	44	10,736	22	5,324
Miscellaneous [9]	------	22,443,374	------	7,591,305	------	24,974,744
Total value, eliminating duplications	------	1,150,597,000	------	1,313,003,000	------	1,926,699,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Figure covers fiscal year ended June 30 of year stated.
[7] Not valued as ore; value of recoverable metal content included with the metals.
[8] From zinc smelting.
[9] Includes minerals indicated by "1" above.

UTAH

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Arsenious oxide (white arsenic) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Asphalt (native) ... do	83,123	$1,414,422	96,974	$1,615,368	99,192	$1,987,049
Bismuth ... pounds	(2)	(2)	(2)	(2)	(2)	(2)
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	------	(1 3)	------	(1 3)	------	[3] 1,210,000
Raw ... short tons	[4] 55,395	[4] 90,295	[4] 105,621	[4] 199,775	[4] 181,876	[4] 297,520
Coal ... do	6,679,063	22,798,321	5,994,013	21,448,859	7,330,000	28,880,000
Coke ... do	735,511	(1 5)	492,367	(1 5)	1,043,465	(1 5)
Copper ... pounds	452,752,000	61,121,520	228,568,000	37,028,016	533,066,000	111,943,860
Fluorspar ... short tons	2,973	(1)	2,370	(1)	1,730	(1)
Fuller's earth ... do	(1)	(1)	(1)	(1)	(1)	(1)
Gem stones	------	(6)	------	(6)	------	(6)
Gold ... troy ounces	279,979	9,799,265	178,533	6,248,655	421,662	14,758,170
Gypsum (crude) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)

See footnotes at end of table.

Mineral products of the United States, 1945–47, by States—Continued

UTAH—Continued

Product	1945 Quantity	1945 Value	1946 Quantity	1946 Value	1947 Quantity	1947 Value
Iron:						
Ore ... long tons	1,925,572	$2,170,334	1,321,334	$1,372,109	2,821,293	$2,860,739
Pig ... short tons	(1 5)	(1 5)	(1 5)	(1 5)	(1 5)	(1 5)
Lead ... do	40,817	7,020,524	30,711	6,694,998	49,698	14,313,024
Lime ... do	47,484	353,671	29,057	271,526	47,096	366,127
Manganiferous ore ... do	5,001	(1)	7,903	(1)	7,198	(1)
Molybdenum ... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Natural gas (estimated value at wells) ... M cubic feet	6,562,000	332,000	4,252,000	213,000	5,927,000	318,000
Natural gasoline ... gallons	867,000	52,000	578,000	35,000	696,000	51,000
Ores (crude), etc.:						
Copper ... short tons	23,978,159	(7)	12,471,208	(7)	29,021,293	(7)
Dry and siliceous (gold and silver) ... do	147,691	(7)	79,875	(7)	171,741	(7)
Lead ... do	24,305	(7)	11,700	(7)	27,194	(7)
Lead-copper ... do	-----	-----	1,236	(7)	-----	-----
Zinc ... do	104,499	(7)	105,222	(7)	94,685	(7)
Zinc-lead ... do	468,530	(7)	576,450	(7)	1,066,614	(7)
Zinc-lead-copper ... do	-----	-----	-----	-----	1,587	(7)
Phosphate rock ... long tons	-----	-----	(1)	(1)	(1)	(1)
Potassium salts ... short tons (K_2O equivalent)	(1)	(1)	(1)	(1)	(1)	(1)
Pumice ... short tons	-----	-----	-----	-----	7,500	30,000
Radium (refined) ... milligrams	[8] 10	[8] 185	[8] 10	[8] 185	1,000	18,500
Salt (sodium chloride) ... short tons	122,997	363,997	121,669	339,505	113,285	340,028
Sand and gravel ... do	2,147,910	1,280,578	1,653,010	992,083	2,945,943	1,612,354
Silver ... troy ounces	6,106,545	4,342,432	4,118,453	3,327,710	7,780,032	7,040,929
Stone ... short tons	[9] 215,400	[9] 318,254	404,370	591,940	[9] 178,680	[9] 368,255
Sulfuric acid (60° B.)[10] ... do	(1 5)	(1 5)	(1 5)	(1 5)	(1 5)	(1 5)
Tungsten concentrates ... short tons (60-percent WO_3 basis)	5	7,048	27	(1)	1	(1)
Vanadium ... pounds	97,572	58,154	63,188	37,370	48,949	(1)
Zinc ... short tons	33,630	7,734,900	28,292	6,903,248	43,673	10,568,866
Miscellaneous[11]	-----	28,357,793	-----	24,794,199	-----	49,288,945
Total value, eliminating duplications	-----	127,961,000	-----	95,506,000	-----	206,639,000

[1] Value included with "Miscellaneous."
[2] Figure not available.
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is 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 with the metals.
[8] Estimated.
[9] Exclusive of sandstone, value for which is included with "Miscellaneous."
[10] From copper smelting.
[11] Includes minerals indicated by "1" and "9" above.

VERMONT

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Arsenious oxide .... short tons	(1)	(1)	----	----	----	----
Asbestos .... do	(2)	(2)	(2)	(2)	(2)	(2)
Clay:						
Products, heavy clay (other than pottery and refractories)	----	(2 3)	----	(2 3)	----	(2 3)
Raw .... short tons	(2 4)	(2 4)	(2 4)	(2 4)	(2 4)	(2 4)
Copper .... pounds	(2)	(2)	(2)	(2)	(2)	(2)
Gold .... troy ounces	104	$3,640	165	$5,775	100	$3,500
Lime .... short tons	38,096	267,478	(2)	(2)	(2)	(2)
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Ores (crude), etc.: Copper .... short tons	82,943	(6)	126,782	(6)	145,661	(6)
Sand and gravel .... do	134,977	61,172	383,576	241,289	780,192	561,862
Silver .... troy ounces	20,586	14,639	35,275	28,502	21,469	19,429
Slate	----	1,691,825	----	(2)	----	(2)
Stone .... short tons	173,120	4,538,557	230,400	6,740,160	392,420	7,652,139
Talc .... do	63,574	752,583	75,144	843,247	77,327	999,704
Miscellaneous [7]	----	923,082	----	4,243,652	----	5,587,308
Total value, eliminating duplications	----	8,249,000	----	12,096,000	----	14,818,000

[1] Figure not available.
[2] Value included with "Miscellaneous."
[3] Figure obtained through cooperation with Bureau of the Census.
[4] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included with the metals.
[7] Includes minerals indicated by "2" above.

VIRGINIA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Aplite (crude) .... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Bauxite .... long tons (dried equivalent)	(1)	(1)	(1)	(1)	----	----
Cement .... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	----	[2] $1,254,665	----	[2] $2,914,000	----	[2] $3,936,000
Raw .... short tons	(1 3)	(1 3)	[3] 325,901	[3] 328,724	[3] 443,371	[3] 400,315
Coal .... do	17,234,993	59,071,606	15,526,895	59,570,583	19,406,000	92,179,000
Coke .... do	191,032	[4] 1,541,650	171,242	[4] 1,619,144	211,876	[4] 2,508,223
Copper .... pounds	140,000	18,900	----	----	10,000	2,100
Feldspar (crude) .... long tons	29,089	178,664	32,960	204,588	41,820	261,741
Ferro-alloys .... short tons	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Gem stones	----	(5)	----	(5)	----	(5)
Gold .... troy ounces	12	420	----	----	----	----

See footnotes at end of table.

Mineral products of the United States, 1945–47, by States—Continued

VIRGINIA—Continued

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Gypsum (crude) short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron:						
Ore long tons	(1)	(1)	(1)	(1)	6,782	(1)
Pig short tons	(1 4)	(1 4)	2	(1 4)	(1 4)	(1 4)
Kyanite do	(1)	(1)	(1)	(1)	(1)	(1)
Lead do	4,243	$729,796	4,381	$955,058	3,803	$1,095,264
Lime do	118,707	835,575	181,282	1,365,931	260,663	2,138,707
Manganese ore do	8,566	307,976	1,280	(1)	----	----
Manganiferous ore do	392	(1)	87	(1)	6,208	(1)
Marl, calcareous do	88,936	122,135	137,122	175,389	98,970	120,995
Mica:						
Scrap do	376	7,720	286	6,697	(1)	(1)
Sheet pounds	2,983	2,395	----	----	----	----
Millstones	----	(1)	----	(1)	----	(1)
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) M cubic feet	56,000	6,000	57,000	5,000	64,000	6,000
Ores (crude), etc.:						
Copper short tons	1,047	(6)	----	----	----	----
Zinc-lead do	449,290	(6)	490,278	(6)	505,759	(6)
Petroleum barrels	4,000	(1)	23,000	(1)	61,000	(1)
Phosphate rock long tons	(1)	(1)	(1)	(1)	(1)	(1)
Pyrites do	(1)	(1)	(1)	(1)	(1)	(1)
Salt short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel do	2,965,270	2,721,351	5,340,372	4,319,125	4,570,620	3,852,669
Sand and sandstone (ground) do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz) do	(1)	(1)	----	----	----	----
Silver troy ounces	1,300	924	----	----	----	----
Slate	----	(1)	----	(1)	----	(1)
Stone [7] short tons	5,445,900	6,689,809	7,873,020	9,754,482	8,359,420	12,377,061
Talc and ground soapstone [7] do	(1)	(1)	(1)	(1)	(1)	(1)
Titanium concentrates:						
Ilmenite do	(1)	(1)	(1)	(1)	(1)	(1)
Rutile do	(1)	(1)	(1)	(1)	(1)	(1)
Zinc do	16,075	3,697,250	16,905	4,124,820	16,788	4,062,696
Miscellaneous [8]	----	11,186,298	----	11,606,349	----	14,539,013
Total value, eliminating duplications	----	81,965,000	----	90,823,000	----	128,700,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is 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 with the metals.
[7] Soapstone used as dimension stone included in figures for stone.
[8] Includes minerals indicated by "1" above.

WASHINGTON

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Aluminum ... short tons	(1 2)	(1 2)	2 137,688	2 $38,872,100	2 191,330	2 $53,671,777
Antimony ore (concentrates) ... do	----	----	205	10,040	335	26,091
Arsenious oxide ... do	(3)	(3)	(3)	(3)	----	----
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	----	4 $1,336,877	----	4 2,216,000	----	4 2,112,000
Raw ... short tons	5 183,009	5 204,837	5 235,361	5 227,594	5 242,174	5 241,328
Coal ... do	1,357,244	6,947,404	991,127	5,417,620	1,138,000	(1)
Copper ... pounds	11,642,000	1,571,670	9,054,000	1,466,748	4,480,000	940,800
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)	38	(1)	----	----
Gem stones	----	(6)	----	(6)	----	(6)
Gold ... troy ounces	57,860	2,025,100	51,168	1,790,880	34,965	1,223,775
Iron ore ... long tons	----	----	----	----	2,268	(1)
Lead ... short tons	3,802	653,944	2,987	651,166	5,359	1,543,392
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesite ... do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore ... do	6,994	(1)	1,424	(1)	----	----
Mineral waters	(6)	(6)	(6)	(6)	(6)	(6)
Olivine ... short tons	----	----	1,400	(1)	2,900	(1)
Ores (crude), etc.:						
Copper ... do	38	(7)	43	(7)	83	(7)
Dry and siliceous (gold and silver) ... do	53,174	(7)	51,622	(7)	63,995	(7)
Lead ... do	1,800	(7)	6,920	(7)	7,946	(7)
Lead-copper ... do	----	----	----	----	3	(7)
Zinc ... do	29,607	(7)	39,634	(7)	25,357	(7)
Zinc-copper ... do	617,120	(7)	491,402	(7)	232,158	(7)
Zinc-lead ... do	266,507	(7)	268,402	(7)	346,634	(7)
Peat ... do	824	903	(1)	(1)	2,425	10,125
Pebbles for grinding ... do	(1)	(1)	21	210	(1)	(1)
Pulpstones ... do	----	----	72	3,880	76	4,976
Pumice ... do	4,414	36,045	14,585	56,008	26,497	74,173
Sand and gravel ... do	6,949,809	3,872,633	7,557,707	4,608,392	8,380,571	5,700,960
Sand and sandstone (ground) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Silver ... troy ounces	281,444	200,138	264,453	213,678	293,736	265,831
Stone ... short tons	8 3,741,250	8 3,773,096	8 3,149,900	8 3,232,805	3,865,110	4,550,275
Talc ... do	2,804	33,458	5,084	38,051	(1)	(1)
Tungsten concentrates ... short tons (60-percent WO_3 basis)	2	(1)	1	(1)	----	----
Zinc ... short tons	11,693	2,689,390	11,329	2,764,276	13,800	3,339,600
Miscellaneous 9	----	59,736,000	----	11,812,187	----	21,789,629
Total value, eliminating duplications	----	31,301,000	----	33,029,000	----	40,027,000

1 Value included with "Miscellaneous."
2 Value not included in total value for State.
3 Figure not available.
4 Figure obtained through cooperation with Bureau of the Census.
5 Sold or used; value of clay used in cement and heavy clay products is included here, but is not included in total value for State.
6 No canvass.
7 Not valued as ore; value of recoverable metal content included with the metals.
8 Exclusive of marble in 1945 and sandstone in 1946, values for which are included with "Miscellaneous."
9 Includes minerals indicated by "1" and "8" above.

Mineral products of the United States, 1945–47, by States—Continued

WEST VIRGINIA

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Bromine ... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Calcium chloride ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)		[2] $1,141,517		[2] $4,428,000		[2] $5,529,000
Raw ... short tons	[3] 348,080	[3] 1,003,868	[3] 469,024	[3] 992,673	[3] 590,680	[3] 1,117,155
Coal ... do	152,034,732	486,183,764	144,020,092	526,151,730	173,740,000	781,830,000
Coke ... do	2,750,331	[4] 14,167,585	2,383,050	[4] 14,104,420	3,200,206	[4] 28,292,720
Ferro-alloys ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Grindstones and pulpstones ... do	(1)	(1)	751	23,422	(1)	(1)
Iron, pig ... do	1,265,346	(1 4)	1,011,753	(1 4)	(1 4)	(1 4)
Lime ... do	511,509	3,620,401	409,952	3,103,183	471,914	4,050,950
Marl, calcareous ... do	(1)	(1)	(1)	(1)	(1)	(1)
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas (estimated value at wells) ... M cubic feet	160,225,000	21,887,000	178,958,000	26,736,000	182,072,000	28,076,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	53,242,000	2,766,000	60,854,000	2,496,000	55,454,000	3,549,000
Liquefied petroleum gases ... do	34,367,000	1,173,000	59,590,000	1,653,000	91,384,000	3,290,000
Petroleum ... barrels	2,879,000	9,620,000	2,929,000	9,960,000	2,617,000	10,418,000
Salt ... short tons	370,260	903,759	272,841	896,894	279,300	1,161,429
Sand and gravel ... do	2,501,773	3,323,289	3,457,372	4,518,325	3,796,253	5,782,988
Sand and sandstone (ground) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Stone ... do	3,670,700	3,989,534	[6] 4,131,540	[6] 4,464,048	4,888,860	6,033,930
Sulfuric acid (60° B.)[7] ... do	(1 4)	(1 4)				
Miscellaneous[8]		48,370,142		55,432,224		68,207,347
Total value, eliminating duplications		537.212.000		588,925,000		855,150,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here, but is not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of dimension sandstone, value for which is included with "Miscellaneous."
[7] From zinc smelting.
[8] Includes minerals indicated by "1" and "6" above.

WISCONSIN

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)		[2] $172,132		[2] $408,000		[2] $515,000
Raw ... short tons	[3] 61,071	[3] 46,734	[3] 154,913	[3] 135,207	[3] 111,450	[3] 81,200
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	1,295,647	3,575,133	1,097,471	(1)	1,543,099	(1)
Lead ... short tons	1,776	305,472	1,588	346,184	1,166	335,808
Lime ... do	124,560	988,422	74,686	760,432	70,233	805,000
Marl, calcareous ... do	811	801	883	750	(1)	(1)
Mineral waters	(5)	(5)	(5)	(5)	(5)	(5)
Ores (crude), etc.:						
Zinc ... short tons	703,415	(6)	670,210	(6)	313,111	(6)
Zinc-lead ... do	254,262	(6)	196,574	(6)	184,899	(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	8,384,279	4,111,282	14,828,713	6,802,828	16,335,238	9,938,778
Sand and sandstone (ground) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Stone ... do	4,764,180	8,442,921	6,193,400	11,473,119	[7] 5,897,960	[7] 11,669,611
Zinc ... do	15,561	3,579,030	14,276	3,483,344	12,224	2,958,208
Miscellaneous [8]		7,249,262		12,263,081		17,019,765
Total value, eliminating duplications		22,217,000		28,596,000		34,942,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is 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 with the metals.
[7] Exclusive of basalt, value for which is included with "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral products of the United States, 1945–47, by States—Continued

WYOMING

Product	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products, heavy clay (other than pottery and refractories)	----------	(1 2)	----------	[2] $268,000	----------	[2] $269,000
Raw short tons	[3] 206,535	[3] $1,694,154	[3] 232,835	[3] 2,003,537	[3] 274,498	[3] 2,593,782
Coal do	9,847,575	27,840,341	7,634,484	22,895,612	7,863,000	26,970,000
Copper pounds	----------	----------	2,000	324	----------	----------
Feldspar (crude) long tons	17,021	62,614	20,345	83,496	18,801	90,258
Gem stones	----------	(4)	----------	(4)	----------	(4)
Gold troy ounces	2	70	105	3,675	1,486	52,010
Gypsum (crude) short tons	(1)	(1)	(1)	(1)	22,643	112,238
Iron ore long tons	606,005	(1)	619,317	(1)	651,471	(1)
Lead short tons	3	516	----------	----------	----------	----------
Mica:						
Scrap do	(1)	(1)				
Sheet pounds	(1)	(1)	----------	----------	----------	----------
Mineral waters	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas (estimated value at wells) M cubic feet	35,282,000	1,415,000	33,266,000	1,264,000	40,083,000	2,000,000
Natural gasoline and allied products:						
Natural gasoline gallons	34,355,000	2,079,000	35,787,000	2,153,000	35,127,000	2,564,000
Liquefied petroleum gases do	17,269,000	802,000	7,719,000	323,000	15,987,000	703,000
Ores (crude), etc.:						
Copper short tons	----------	----------	19	(5)	----------	----------
Dry and siliceous (gold and silver) do	37	(5)	42	(5)	6,059	(5)
Lead do	15	(5)	----------	----------	----------	----------
Petroleum barrels	36,219,000	36,610,000	38,977,000	44,430,000	44,238,000	76,672,000
Phosphate rock long tons	----------	----------	----------	----------	51,845	290,484
Sand and gravel short tons	1,541,369	693,239	2,005,951	1,129,598	2,268,381	1,490,702
Silver troy ounces	31	22	26	21	95	86
Sodium sulfate (natural) short tons	(1)	(1)	(1)	(1)	(1)	(1)
Stone do	1,551,220	1,321,415	1,204,570	1,203,636	1,393,070	1,497,034
Vermiculite do	(1)	(1)	(1)	(1)	(1)	(1)
Miscellaneous [6]	----------	2,126,625	----------	3,001,393	----------	3,127,596
Total value, eliminating duplications	----------	74,620,000	----------	78,745,000	----------	118,422,000

[1] Value included with "Miscellaneous."
[2] Figure obtained through cooperation with Bureau of the Census.
[3] Sold or used; value of clay used in cement and heavy clay products is included here but is not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included with the metals.
[6] Includes minerals indicated by "1" above.

Employment and Injuries

in the Mineral Industries

By FORREST T. MOYER AND JOSEPH H. SCHUSTER

GENERAL SUMMARY

EMPLOYMENT in the mineral industries advanced in 1947 owing to the high level of industrial activity in the country. There was an average of 705,900 men at work daily, or 5 percent more than in 1946. In addition to the enlarged working force, the mines, quarries, and other mineral plants were operated an average of 259 days during the year to meet the demand for mineral raw materials and fuels. This was 15 days more than the 1946 average. As a result, man-hours worked in 1947 gained 9 percent over 1946 to a total of nearly 1½ billion. In contrast with the preceding year, labor-management relations during 1947 in the mineral industries were relatively undisturbed. All disputes were settled by negotiation between management and labor. Bituminous-coal mines, which had been under Federal Government control for more than a year, were returned to the operators after an industry-union contract was obtained in midyear.

Salient statistics of employment and injury experience in the mineral industries in the United States, 1943–47, by industry groups

	1943	1944	1945	1946 [1]	1947 [2]
Average number of men working daily: [3]					
Coal mines	486,516	453,937	[4] 437,000	457,500	469,100
Metal mines	87,880	70,413	61,294	65,910	71,700
Nonmetal mines	12,713	11,261	10,371	12,000	12,300
Quarries	69,877	58,476	58,180	70,265	80,300
Coke plants	25,765	24,766	22,987	21,410	23,700
Metallurgical plants	64,735	58,085	46,467	44,772	48,800
Total	747,486	676,938	636,299	671,857	705,900
Average number of active mine-days: [5]					
Coal mines	264	281	[4] 262	230	244
Metal mines	293	289	288	247	278
Nonmetal mines	269	282	291	287	291
Quarries	274	268	264	274	265
Coke plants	347	351	344	337	349
Metallurgical plants	336	329	329	286	312
Total	277	287	273	244	259

See footnotes at end of table.

Salient statistics of employment and injury experience in the mineral industries in the United States, 1943–47, by industry groups—Continued

	1943	1944	1945	1946[1]	1947[2]
Man-days worked, in thousands:[6]					
Coal mines	128,297	127,510	[4] 114,500	105,100	114,285
Metal mines	25,790	20,349	17,673	16,286	19,912
Nonmetal mines	3,426	3,171	3,016	3,441	3,580
Quarries	19,136	15,691	15,376	19,262	21,293
Coke plants	8,947	8,687	7,915	7,205	8,268
Metallurgical plants	21,755	19,113	15,268	12,816	15,246
Total	207,351	194,521	173,748	164,110	182,584
Man-hours worked, in thousands:[6]					
Coal mines[7]	1,034,507	1,078,474	[4] 984,000	884,000	933,190
Metal mines	206,242	163,027	141,295	131,142	159,590
Nonmetal mines	27,999	25,760	24,613	27,480	29,280
Quarries	155,280	129,302	127,168	158,528	174,890
Coke plants	70,679	69,590	64,375	57,710	66,770
Metallurgical plants	173,633	152,326	121,491	101,579	122,010
Total[7]	1,668,340	1,618,479	1,462,942	1,360,439	1,485,730
Number of injuries:					
Fatal:					
Coal mines	1,451	1,298	[4] 1,079	974	1,165
Metal mines	195	130	96	86	124
Nonmetal mines	25	17	16	24	12
Quarries	80	73	53	55	69
Coke plants	17	15	18	8	14
Metallurgical plants	31	38	19	20	22
Total	1,799	1,571	1,281	1,167	1,406
Nonfatal:					
Coal mines	64,594	63,691	[4] 59,350	56,800	58,200
Metal mines	11,533	8,894	6,922	7,425	8,480
Nonmetal mines	1,471	1,283	1,145	1,390	1,335
Quarries	5,199	4,437	4,121	5,137	5,885
Coke plants	986	988	835	810	915
Metallurgical plants	4,666	4,158	3,271	2,837	3,120
Total	88,449	83,451	75,644	74,399	77,935
Injury rates per million man-hours:					
Fatal:					
Coal mines	1.40	1.20	[4] 1.10	1.10	1.25
Metal mines	.95	.80	.68	.66	.78
Nonmetal mines	.89	.66	.65	.87	.41
Quarries	.52	.56	.42	.35	.39
Coke plants	.24	.22	.28	.14	.21
Metallurgical plants	.18	.25	.16	.20	.18
Total	1.08	.97	.88	.86	.95
Nonfatal:					
Coal mines	62.44	59.06	[4] 60.32	64.25	62.37
Metal mines	55.92	54.56	48.99	56.62	53.14
Nonmetal mines	52.54	49.81	46.52	50.58	45.59
Quarries	33.48	34.32	32.41	32.40	33.65
Coke plants	13.95	14.20	12.97	14.04	13.70
Metallurgical plants	26.87	27.30	26.92	27.93	25.57
Total	53.02	51.56	51.71	54.69	52.46

[1] Data on coal, metal, and nonmetal mines and metallurgical plants are preliminary, based on an average of 83 percent coverage. Data on quarries and coke plants are final.
[2] Preliminary figures based on an average of 81 percent coverage.
[3] Average number of men at work each day mine was active. Because absenteeism and labor turn-over are taken into consideration, this number is lower than number of men available for work as measured by a count of names on pay roll.
[4] Preliminary figure based upon 75-percent coverage of the industry.
[5] Average in which operating time of each mine is weighted by average number of workers in mine.
[6] Totals of man-days and man-hours are additions of the rounded subtotals and may differ slightly from totals obtained before rounding.
[7] Data included for bituminous-coal mines are on portal-to-portal basis.

The safety record of the extractive industries was improved in 1947, and the over-all frequency of injuries fell to 53.40 per million man-hours. The improvement resulted entirely from more favorable nonfatal-injury experience. Although there were approximately 3,500 nonfatal injuries more than in 1946, the total of 77,935 nonfatalities occurred at a frequency of 52.46 per million man-hours, an appreciably better rate than in the preceding year. However, the fatality record receded in 1947, and both the total of 1,406 fatalities and the occurrence rate of 0.95 per million man-hours were less favorable than in 1946.

Although 2,561,380 man-days of work were lost in the mineral industries through work stoppages in 1947, labor-management relations were relatively peaceful. Approximately half of the lost work-time resulted from stoppages called in protest of the passage of the Taft-Hartley Labor Management Relations Act on June 23, 1947. All told there were 483 work stoppages in the mineral industries, according to the United States Department of Labor. Of these, 415 strikes causing a loss of 2,190,000 man-days were at bituminous-coal mines, 28 with a loss of 159,000 man-days were at anthracite mines, and 2 with a loss of 117,000 man-days were at cement plants. Time lost through stoppages was not significant in other mineral industries.

The first major strike (one involving more than 10,000 men) during the year was in bituminous-coal mines in southwestern Pennsylvania and Indiana, where brief, sporadic stoppages of about 3 days' duration were called in protest against the pending Taft-Hartley bill. This strike involved approximately 18,000 men. The second major strike, also in bituminous-coal mines, involved two separate issues and extended across the scheduled vacation period of June 28–July 7. This stoppage started on June 23 in protest against passage of the Labor Management Relations Act (the Taft-Hartley bill). Between June 23 and 27, about 200,000 miners had stopped work. The soft-coal mines, which had been operated by the Federal Government since May 1946, were returned to the private companies on June 30, 1947. An industry-union wage agreement had not been negotiated by the end of the vacation period on July 7. Hence, approximately 343,000 miners remained away from work during July 8–11 until the contract was signed and ratified by the operators. In this latter period, the principal issues being arbitrated were wages, hours, welfare benefits, and mine safety. The approved agreement changed the portal-to-portal shift from 9 to 8 hours, for which the miners received a cost-of-living increase of $1.20 per day over that received for the longer shift. A United Mine Workers of America Welfare and Retirement Fund was established and financed by an assessment of 10 cents per short ton of coal produced for use or for sale. The new fund was to provide health and welfare benefits, including pensions, for employees. The accumulated moneys of the Medical and Hospital Fund, established in the Government-union agreement of May 29, 1946, were transferred to the new fund. The Federal Mine Safety

Code, also in effect under the Government-union contract of 1946, was continued in the new agreement.

In addition to the aforementioned strike, a major period of idleness in bituminous-coal mines was called on April 1, 1947, as a mourning period for the 111 men killed in the Centralia, Ill., mine disaster. This mourning period, which was popularly called a "safety strike" by the press, ended April 7. No data on this period of idleness are included in the Department of Labor figures. However, it is estimated that about 345,000 wage earners were affected and that approximately 1,725,000 man-days of work were lost at soft-coal mines.

Employment and injury experience of the mineral industries of the United States, 1931–47

Year	Men working daily	Average active days	Man-days worked	Man-hours worked [1]	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
1931	784,347	188	147,602,799	1,288,135,808	1,707	94,021	1.33	72.99
1932	671,343	165	110,655,616	962,924,915	1,368	66,028	1.42	68.57
1933	677,722	181	122,787,658	1,058,245,650	1,242	70,158	1.17	66.30
1934	739,817	195	144,566,133	1,167,723,543	1,429	79,211	1.22	67.83
1935	783,139	195	152,354,170	1,215,316,764	1,495	80,070	1.23	65.88
1936	824,514	216	177,920,334	1,426,233,543	1,686	90,608	1.18	63.53
1937	859,951	217	186,790,283	1,482,241,908	1,759	94,466	1.19	63.73
1938	774,894	187	145,056,875	1,144,137,296	1,369	69,940	1.20	61.13
1939	788,925	202	159,388,490	1,251,169,210	1,334	73,253	1.07	58.55
1940	801,926	219	175,663,792	1,385,128,234	1,716	80,856	1.24	58.37
1941	835,095	234	195,425,228	1,541,335,277	1,621	87,911	1.05	57.04
1942	802,640	260	208,739,906	1,653,284,620	1,862	91,675	1.13	55.45
1943	747,486	277	207,350,643	1,668,340,394	1,799	88,449	1.08	53.02
1944	676,938	287	194,521,159	1,618,479,042	1,571	83,451	.97	51.56
1945 [2]	636,299	273	173,748,657	1,462,942,363	1,281	75,644	.88	51.71
1946 [2]	671,857	244	164,109,621	1,360,439,931	1,167	74,399	.86	54.69
1947 [3]	705,900	259	182,584,000	1,485,730,000	1,406	77,935	.95	52.46

[1] Data for 1931–43 are revised by including estimated time required for travel and lunch in bituminous-coal mines. This places man-hours of bituminous-coal mines on a portal-to-portal basis.
[2] Preliminary in part.
[3] Preliminary.

The tragic disaster at the Centralia No. 5 coal mine, Centralia, Ill., on March 25 focused public attention on the problem of coal-mine safety. This mine explosion, which killed 111 men, caused a greater loss of life than any other mineral-industry disaster since the explosion of the Mather No. 1 mine in Pennsylvania on May 19, 1928. In the Mather disaster 195 men were killed. The Centralia explosion occurred while the soft-coal mines were under Federal Government control. On April 3, during the "memorial period," the Coal Mines Administrator ordered 518 mines not to resume production on or after April 7 unless certain hazardous conditions were corrected. After April 7, the Coal Mines Administrator closed 36 more mines; and, between April 24 and June 30, Federal mine inspectors closed

79 mines for safety reasons. Most of the mines were reopened within a few days because the hazardous conditions had been corrected promptly. By the close of June, 575 mines had been inspected and approved for operation, 23 had been inspected but not approved, 11 were abandoned, and the remaining 18 were idle for various reasons.

Besides the Centralia mine explosion, there were five other major disasters (a single accident in which five or more men are killed) in the mineral industries. All were coal-mine explosions. On April 30 the Spring Hill mine in Indiana exploded, killing 8 men, and on July 24 an explosion in the Old Ben No. 8 mine in Illinois caused a loss of 27 lives. The remaining three disasters were in Pennsylvania anthracite mines. On January 15, an explosion in the Nottingham mine killed 15 men, on April 10 another explosion in the Schooley mine killed 10 men, and 8 men lost their lives in the Franklin mine on December 11. The disaster record in 1947 contrasts sharply with 1946, when 2 mine explosions caused a loss of 27 lives.

The number of fatal injuries increased in 1947 in each of the major branches of the mineral industries except in nonmetal mines. The total of 1,406 fatalities in 1947 was 239 more than in the preceding year. However, the 1946 total of 1,167 was lower than in any year since fatality statistics on the mineral industries first were compiled in 1911. The frequency rate of fatalities was higher than in 1946 in all branches of the mineral industry except in nonmetal mines and at metallurgical plants. In nonmetal mines the rate improved sharply and was less than half that of 1946.

In contrast with the fatality experience, the record of nonfatal injuries was improved in 1947 in all branches of the mineral industry except quarries. In quarries the frequency rate of nonfatalities was slightly less favorable than in 1946. Owing to the longer worktime, the improved rates in 1947 were attained despite the increase in number of nonfatal injuries. The number of nonfatal injuries was higher in each major branch except nonmetal mines.

SPECIAL INJURY STUDY

Detailed individual reports on 7,500 coal-mine injuries in 1947 were classified by part of body injured and length of time lost from work. The number of reports was selected by States in proportion to the tonnages of coal produced.

It is significant that a larger proportion of the anthracite injuries fall in less severe groups of disability than the bituminous-coal injuries. It is notable also that finger and hand injuries and trunk injuries each were approximately one-fourth of the total injuries in the sample in both hard and soft coal mines. Another feature is that injuries to the upper parts of the body are in greater proportions in anthracite than bituminous-coal mines. However, leg, toe, and foot injuries have larger percentages of occurrence in soft- than in hard-coal mines.

Percentage distribution of injuries in bituminous-coal and anthracite mines in the United States by part of body, 1944 and 1947, and by length and degree of disability, 1947 [1]

Part of body injured	1947							1944
	Length of disability and degree of injury						Total	Total
	Temporary total				Permanent partial [2]	Fatal		
	1-7 days	8-14 days	15-30 days	Over 30 days				
Bituminous-coal mines:								
Eye	5.1	1.7	1.0	0.5	0.1		8.4	8.2
Head (except eye)	2.1	1.0	.9	.7		0.4	5.1	5.3
Trunk	7.2	4.2	5.1	6.5	.1	.5	23.6	25.3
Finger and hand	8.2	4.8	6.1	4.8	1.7		25.6	23.3
Arm, including wrist	2.2	1.0	1.0	1.5	.1		5.8	5.3
Toe and foot	4.8	2.1	2.6	3.9	.1		13.5	14.8
Leg, including ankle	5.2	3.7	4.5	4.4	.1	.1	18.0	17.8
Total	34.8	18.5	21.2	22.3	2.2	1.0	100.0	100.0
Anthracite mines:								
Eye	8.2	1.4	0.5	0.4			10.5	10.6
Head (except eye)	4.9	1.4	1.2	.5		0.2	8.2	7.4
Trunk	9.4	5.3	4.6	5.6		.2	25.1	25.2
Finger and hand	10.7	5.1	4.0	3.6	0.8		24.2	21.7
Arm, including wrist	2.8	1.8	1.1	.8			6.5	6.6
Toe and foot	5.6	2.8	2.1	1.5			12.0	12.5
Leg, including ankle	5.1	3.7	2.0	2.7			13.5	16.0
Total	46.7	21.5	15.5	15.1	.8	.4	100.0	100.0
Total coal mines:								
Eye	5.6	1.7	0.9	0.6	0.1		8.9	8.7
Head (except eye)	2.6	1.0	.9	.7		0.4	5.6	5.7
Trunk	7.5	4.3	5.0	6.3	.1	.4	23.6	25.3
Finger and hand	8.6	4.9	5.7	4.6	1.5		25.3	23.0
Arm, including wrist	2.3	1.2	1.1	1.3	.1		6.0	5.5
Toe and foot	5.0	2.2	2.5	3.5	.1		13.3	14.3
Leg, including ankle	5.2	3.7	4.1	4.1	.1	.1	17.3	17.5
Total	36.8	19.0	20.2	21.1	2.0	.9	100.0	100.0

[1] Based upon studies of 6,196 injuries in bituminous-coal mines and 1,304 injuries in anthracite mines, or a total of 7,500 coal-mine injuries in 1947; and 46,288 injuries in bituminous-coal mines and 11,303 injuries in anthracite mines, or a total of 57,591 coal-mine injuries in 1944.
[2] No permanent total injuries were found in the sample of 7,500 reports.

Comparison of the part of body injured in 1944 and 1947 shows a possibly significant decrease in the percentages of trunk, toe, and foot injuries and an increase in the percentage of finger and hand injuries in bituminous-coal mines.

COAL MINES

Fatality experience in coal mines in 1947 compares unfavorably with that in 1946. However, the 1946 record was the best in the statistical history of the industry. The total of 1,165 deaths was 191 higher than the total of 974 for 1946, which was the lowest for any year since 1910, when complete fatality statistics were first compiled. The unfavorable disaster record in 1947 explains, to a great extent, the increase in the number of deaths in coal mines. Six major disasters during the year resulted in the death of 179 men, while 2 such disasters killed 27 men in 1946. Hence, the fatality rates of 1.25 per million man-hours and 1.69 per million tons are less favorable than in 1946. The total of 58,200 nonfatal injuries was 1,400 higher than in 1946, but the rates of 62.37 per million man-hours and 84.62

per million tons are significant improvements over the corresponding rates of 64.25 and 95.55 for the preceding year.

Activity in coal mines was appreciably greater in 1947 than in 1946, when the total man-days lost through work stoppages was unusually large. Employment increased for the second consecutive year to an average of 469,100 men working daily. The total man-hours of work-time for the year were appreciably higher than in 1946.

BITUMINOUS COAL

Employment.—The average number of men working daily in bituminous-coal mines increased to 390,600 in 1947, a 3-percent gain over 1946. The working force was rather stable in the first half and increased to a slightly higher level of employment in the second half of the year after the shorter work shift became effective. The total man-hours of worktime rose to 781,190,000, or 7 percent more than in the preceding year. Owing to the shorter shift after midyear, the average miner worked a shift of 8.35 hours, compared with 8.70 hours in 1946. Each miner had a total workyear of 2,000 man-hours, or only 79 hours more than in 1946.

Employment and injury experience at coal mines in the United States, 1943–47 [1]

	Men working daily	Average active mine-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Bituminous-coal mines: [2]								
1943	407,135	263	106,911,764	883,675,272	1,225	51,067	1.39	57.79
1944	376,203	278	104,705,401	914,925,290	1,124	51,253	1.23	56.02
1945	363,000	261	94,750,000	841,000,000	936	47,750	1.11	56.78
1946	380,000	221	83,900,000	730,000,000	800	44,000	1.10	60.27
1947	390,600	239	93,510,000	781,190,000	990	45,700	1.27	58.50
Pennsylvania anthracite mines:								
1943	79,381	269	21,384,900	150,832,008	226	13,527	1.50	89.68
1944	77,734	293	22,804,917	163,549,087	174	12,438	1.06	76.05
1945	74,000	267	19,750,000	143,000,000	143	11,600	1.00	81.12
1946	77,500	274	21,200,000	154,000,000	174	12,800	1.13	83.12
1947	78,500	265	20,775,000	152,000,000	175	12,500	1.15	82.24
Total coal mines:								
1943	486,516	264	128,296,664	1,034,507,280	1,451	64,594	1.40	62.44
1944	453,937	281	127,510,318	1,078,474,377	1,298	63,691	1.20	59.06
1945	437,000	262	114,500,000	984,000,000	1,079	59,350	1.10	60.32
1946	457,500	230	105,100,000	884,000,000	974	56,800	1.10	64.25
1947	469,100	244	114,285,000	933,190,000	1,165	58,200	1.25	62.37

[1] Data for 1945–47 are preliminary.
[2] Includes lignite.

Injuries.—Fatality experience in bituminous-coal mines in 1947 was less favorable than in 1946, when these mines achieved the best record in the statistical history of the industry. In all, 990 men were killed in bituminous-coal mines in 1947, compared with 800 deaths the year before. The 1947 fatalities occurred at rates of 1.27 per million man-hours and 1.57 per million tons of coal mined, both of which were slightly higher than the corresponding rates in 1946. However, the 1947 rates were the second lowest on a tonnage basis and the fourth lowest on a man-hour basis since complete statistics were begun in 1910.

Nonfatal-injury experience was appreciably better in 1947 than in 1946. Although the total of 45,700 nonfatal injuries for the year was 1,700 more than in the previous year, the increases in man-hours of exposure and coal mined more than compensated for the greater number of injuries. The nonfatal-injury frequency rates of 58.50 per million man-hours and 72.47 per million tons were improvements over the corresponding rates of 60.27 and 82.41 for 1946.

ANTHRACITE

Employment.—Employment at anthracite operations advanced slightly to an average of 78,500 men working, an increase of 1,000 over 1946. However, total man-hours of worktime declined slightly to 152,000,000 man-hours. Production from underground mines, strippings, culm banks, and dredges fell to 57,190,000 tons, or 5 percent less than in 1946. The average employee in 1947 worked a 7.32-hour shift and performed 1,936 hours of work, or 51 hours less than in 1946.

Injuries.—Fatality experience at anthracite operations was less favorable in 1947. The number of fatalities increased to 175, compared with 174 in 1946, while both man-hours of worktime and tonnage declined. As a result, the fatal rates of 1.15 per million man-hours and 3.06 per million tons are higher than the respective rates of 1.13 and 2.88 for 1946. However, the total of 12,500 nonfatal injuries was 300 less than in 1946. The nonfatal frequency of 82.24 per million man-hours is an improvement over 1946, but the occurrence of 218.57 nonfatals per million tons is less favorable than in the previous year.

The disaster-free record of the anthracite industry in the 3 previous years was broken in 1947. Three major disasters occurred during the year, whereas only one had occurred in the previous 8½ years. In 1947 three explosions, killing a total of 33 men, occurred in anthracite mines in Luzerne County, Pa.

METAL MINES

Injury experience in metal mines in 1947 compares favorably with the preceding year. The total injury-frequency rate of 53.91 injuries (fatal and nonfatal) per million man-hours was much lower than the comparable rate of 57.27 for 1946. However, this improvement was due entirely to a lower nonfatal rate, for fatality experience in metal mines in 1947 was appreciably worse than in the previous year. Each of the six metal-mining groups had a higher fatality rate than in 1946. Employment rose to a total of 71,700 workers; and these men worked a total of 159,590,000 hours, or 22 percent more than in 1946.

IRON

Employment.—The average number of men at work daily in iron mines increased to a total of 26,400 in 1947. The mines were worked an average of 278 days, compared with 226 days in 1946, when extensive work stoppages occurred in the Lake Superior district. Each worker averaged 2,231 man-hours, compared with 1,812 hours in 1946. Total man-hours rose to 58,890,000, an increase of 33 percent over 1946.

Employment and injury experience at metal mines in the United States, 1945–47, by industry groups

	Men working daily	Average active mine-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Iron mines:								
1945	23,443	286	6,696,157	53,781,487	36	1,326	0.67	24.66
1946 [1]	24,500	226	5,540,000	44,390,000	25	1,200	.56	27.03
1947 [1]	26,400	278	7,342,000	58,890,000	36	1,405	.61	23.86
Copper mines:								
1945	14,542	305	4,434,654	35,474,475	23	1,531	.65	43.16
1946 [1]	13,600	275	3,739,000	29,910,000	23	1,565	.77	52.32
1947 [1]	16,100	307	4,938,000	39,510,000	32	1,735	.81	43.91
Lead-zinc mines:								
1945	14,645	292	4,273,405	34,161,578	29	2,976	.85	87.12
1946 [1]	16,200	257	4,167,000	33,780,000	29	2,830	.86	83.78
1947 [1]	16,800	265	4,446,000	35,540,000	33	3,200	.93	90.04
Gold-silver mines:								
1945	3,816	289	1,104,543	8,407,743	4	533	.48	63.39
1946	5,152	253	1,305,504	10,203,525	8	1,000	.78	98.01
1947 [1]	5,600	266	1,490,000	11,570,000	14	1,240	1.21	107.17
Gold placers:								
1945	1,819	175	318,102	2,683,598	--------	64	--------	23.85
1946	3,458	212	732,683	6,438,965	1	220	.16	34.17
1947 [1]	3,600	223	804,000	6,930,000	2	230	.29	33.19
Miscellaneous: [2]								
1945	3,029	279	845,950	6,786,457	4	492	.59	72.50
1946 [1]	3,000	267	802,000	6,420,000	--------	610	--------	95.02
1947 [1]	3,200	279	892,000	7,150,000	7	670	.98	93.71

[1] Data are preliminary.
[2] Includes antimony, bauxite, chromite, cobalt, manganese, mercury, molybdenum, pyrite, titanium, tungsten, and vanadium-uranium mines.

Injuries.—The number of fatal and nonfatal injuries increased to 36 and 1,405, respectively, from 25 and 1,200 in 1946. The fatal frequency rate of 0.61 per million man-hours was less favorable than the rate of 0.56 for 1946. However, the nonfatal-injury frequency rate of 23.86 was an improvement over the 1946 rate of 27.03.

COPPER

Employment.—Employment at copper mines gained 18 percent over 1946 to a total of 16,100 men working daily in 1947. Total man-hours at all copper mines were 32 percent greater than in 1946. In 1947 the average shift was 8.00 hours and the average workyear per man was 2,454 hours.

Injuries.—Fatality experience in copper mines in 1947 was less favorable than in 1946, but nonfatal experience improved considerably. The fatality rate of 0.81 for the year was higher than the rate of 0.77 for 1946. Although the number of nonfatal injuries increased to 1,735 in 1947, the nonfatal rate of 43.91 per million man-hours was a sharp improvement over 1946.

LEAD-ZINC

Employment.—Available reports indicate that employment in lead-zinc mines increased slightly to a total of 16,800 in 1947. Similarly, total man-hours worked in these mines were higher for the year. The average of 265 days worked during the year was an increase of 8 days over the preceding year.

Injuries.—The safety record of lead-zinc mines in 1947 was less favorable than in 1946. The 33 fatal injuries in 1947 (4 more than in 1946) occurred at a rate of 0.93 per million man-hours. Nonfatal injuries totaled 3,200 for the year and had a frequency rate of 90.04, or considerably higher than the rate of 83.78 in 1946.

GOLD-SILVER MINES

Employment.—The average number of men at work in gold and silver lode mines totaled 5,600, a gain of 9 percent over 1946. The average length of shift declined slightly, but total worktime for all mines in this group rose 13 percent in 1947.

Injuries.—The injury experience in gold and silver lode mines in 1947 was considerably worse than in 1946, when the safety record of these mines was not at all satisfactory. The 14 fatalities for 1947, compared with 8 in 1946, resulted in a fatality rate of 1.21 per million man-hours. Nonfatal injuries totaled 1,240, an increase of 240 over 1946 and occurred at a rate of 107.17 per million man-hours which was the highest in the mineral industries in 1947.

GOLD PLACER

Employment.—Employment at gold placers was about the same in both 1946 and 1947. Total man-hours of worktime gained 8 percent in 1947, owing to an increase of 11 in active mine days.

Injuries.—Fatality experience at gold placers was less favorable than in 1946. The 2 deaths during the year occurred at the rate of 0.29 per million man-hours. However, nonfatal injury experience improved in 1947 to a rate of 33.19 nonfatals per million man-hours.

MISCELLANEOUS METAL

Employment.—The labor force of 3,200 in 1947 was slightly larger than in 1946 in the mines of this group, which includes antimony, bauxite, chromite, cobalt, manganese, mercury, molybdenum, pyrite, titanium, tungsten, and vanadium-uranium operations. Total worktime in these mines increased 11 percent to 7,150,000 man-hours in 1947.

Injuries.—Fatality experience in miscellaneous metal mines was considerably worse in 1947 than in 1946. There were no fatalities in this group in 1946; but in 1947, 7 deaths occurred at a rate of 0.98 per million man-hours. On the other hand, the nonfatal rate improved slightly to 93.71 for the year.

NONMETAL MINES

Employment.—The average of 12,300 men at work daily is slightly higher than the total for 1946 in this group of mines, which comprises barite, feldspar, fluorspar, gypsum, magnesite, mica, phosphate rock, rock salt, sulfur, and miscellaneous nonmetallic-mineral operations. These mines worked an average of 291 days and total worktime increased 7 percent in 1947.

Injuries.—The safety record of nonmetal mines improved appreciably in 1947. Despite increased man-hours of exposure, both fatal and nonfatal injuries were reduced in number. The 12 fatalities are a 50-percent reduction from 24 in 1946. The fatal rate of 0.41 is less than half the frequency rate of 0.87 for 1946. The 1,335 nonfatal injuries in 1947 occurred at the rate of 45.59 per million man-hours.

QUARRIES

Injury experience in the quarry industries in 1947 was less favorable and the rates of occurrence of both fatal and nonfatal injuries increased over 1946. The combined rate of 34.04 injuries (fatal and nonfatal) per million man-hours is higher than the corresponding rate of 32.75 for the preceding year. Operating activity in each of the quarry industries increased, and man-hours of worktime rose 10 percent over 1946. Employment increased from 70,265 to 80,300, or 14 percent. The average length of shift of 8.21 and the average number of 2,178 hours worked per man during the year were slightly lower than in 1946.

CEMENT

Employment.—Employment in cement quarries and mills during the year registered a slight increase over 1946. Although 2 work stoppages caused a loss of 117,000 man-days, the 28,500 men working in 1947 had an average of 317 days active. As a result, man-hours of worktime were 11 percent higher for the year.

Employment and injury experience at nonmetal mines and quarries in the United States, 1945–47, by industry groups [1]

	Men working daily	Average active mine-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Nonmetal mines: [2]								
1945	10,371	291	3,015,980	24,612,921	16	1,145	0.65	46.52
1946 [3]	12,000	287	3,441,000	27,480,000	24	1,390	.87	50.58
1947	12,300	291	3,580,000	29,280,000	12	1,335	.41	45.59
Quarries:								
Cement: [4]								
1945	20,858	285	5,944,040	48,078,750	9	600	.19	12.48
1946	25,901	311	8,063,361	64,185,021	12	834	.19	12.99
1947	28,500	317	9,026,000	71,240,000	22	800	.31	11.23
Limestone:								
1945	17,704	234	4,150,750	35,182,061	24	1,381	.68	39.25
1946	20,850	234	4,870,876	41,864,367	26	1,878	.62	44.86
1947	25,600	204	5,228,000	44,560,000	27	1,960	.61	43.99
Lime: [4]								
1945	8,162	297	2,420,409	19,615,613	8	961	.41	48.99
1946	8,741	296	2,591,301	20,657,787	4	1,011	.19	48.94
1947	9,400	296	2,785,000	22,680,000	6	1,230	.26	54.23
Marble:								
1945	1,748	256	446,645	3,792,968	2	164	.53	43.24
1946	2,370	260	616,200	5,292,992		173		32.68
1947	2,900	266	771,000	6,420,000	2	165	.31	25.70
Granite:								
1945	4,067	249	1,014,288	8,615,078	7	396	.81	45.97
1946	5,176	249	1,288,468	10,930,012	5	493	.46	45.11
1947	5,700	250	1,423,000	12,280,000	2	765	.16	62.30
Traprock:								
1945	2,079	235	487,940	4,135,498		195		47.15
1946	2,493	244	607,405	5,125,217	3	221	.59	43.12
1947	2,600	241	626,000	5,290,000	1	270	.19	51.04
Slate:								
1945	988	259	256,235	2,301,264		115		49.97
1946	1,323	274	361,855	3,330,047	2	181	.60	54.35
1947	1,700	263	447,000	4,510,000	3	240	.67	53.22
Sandstone:								
1945	2,574	255	655,920	5,447,089	3	309	.55	56.73
1946	3,411	253	862,381	7,142,732	3	346	.42	48.44
1947	3,900	253	987,000	7,910,000	6	455	.76	57.52

[1] Data for 1947 are preliminary.
[2] Includes barite, feldspar, fluorspar, gypsum, magnesite, mica, phosphate rock, rock salt, sulfur, and miscellaneous nonmetallic-mineral mines.
[3] Preliminary.
[4] Includes burning or calcining and other mill operations.

Injuries.—The 22 fatalities that occurred in cement quarries and mills represented a sharp increase over the 12 deaths in 1946. The fatality rate of 0.31 per million man-hours was well above the corresponding rate of 0.19 for the preceding year. On the other hand, despite the increase in man-hours of exposure, the number of nonfatal injuries declined to 800 in 1947, and the nonfatal injury-frequency rate fell to 11.23.

LIMESTONE

Employment.—The average number of men working in limestone operations rose 23 percent to 25,600 in 1947. The significant increase in employment more than offset the drop in days active, and total man-hours of worktime increased 6 percent to 44,560,000 man-hours.

Injuries.—Although the 27 fatal and 1,960 nonfatal injuries were higher than in 1946, the 6-percent increase in man-hours more than compensated for the increased number of injuries. Thus, the fatality rate of 0.61 and the nonfatal rate of 43.99 per million man-hours were improvements over 1946.

LIME

Employment.—The number of workers employed at lime plants and associated quarries increased to 9,400 in 1947. This increased employment, together with a longer workyear for each employee, resulted in a higher total man-hours of worktime for the industry.

Injuries.—Injury experience during the year was less favorable than in 1946. The 6 fatalities and 1,230 nonfatal injuries occurred at rates of 0.26 and 54.23, respectively, which were higher than the corresponding rates of 0.19 and 48.94 for 1946.

MARBLE

Employment.—The total of 2,900 men working daily in marble operations was a sharp gain over 1946. As a result, the total man-hours of worktime in the industry rose 21 percent in 1947.

Injuries.—Although no fatalities occurred in marble operations in 1946, there were 2 deaths in 1947, resulting in a fatality rate of 0.31 per million man-hours. The nonfatal record of the industry, however, was considerably improved, and the rate fell to 25.70 nonfatals per million man-hours.

GRANITE

Employment.—Preliminary figures for granite operations in 1947 indicated that 5,700 men were employed for an average of 250 days. The average worker had a shift of 8.63 hours and a workyear of 2,154 man-hours. Total man-hours of worktime in the industry increased 12 percent.

Injuries.—As the granite industry had 2 fatalities during the year, compared with 5 in 1946, the fatality rate fell to 0.16 per million man-hours. However, nonfatal-injury experience was unfavorable in 1947, and the rate increased to 62.30.

TRAPROCK

Employment.—There was little change in employment figures for traprock quarries during the year. Estimates for 1947 showed a slight increase in the number of men and in the total worktime.

Injuries.—Fatalities in traprock quarries were reduced from 3 in 1946 to 1 for 1947; the fatality rate per million man-hours fell correspondingly to 0.19. However, the number of nonfatals rose to 270 in 1947, and the frequency rate increased to 51.04 nonfatals per million man-hours.

SLATE

Employment.—An average of 1,700 men was employed in slate quarries in 1947, a significant gain over 1946. These quarries worked 263 days during the year and reported an average length of shift of 10.09 hours. The total worktime was 35 percent higher than in 1946.

Injuries.—The fatality rate for the year for slate quarries—0.67—was higher than the rate of 0.60 for 1946. However, the nonfatal frequency rate of 53.22 was an improvement over 1946.

SANDSTONE

Employment.—Employment at sandstone quarries rose from 3,411 in 1946 to 3,900 in the current year. Total man-hours of worktime, because of increased employment, increased 11 percent to 7,910,000 man-hours in 1947.

Injuries.—Injury experience in sandstone quarries was less favorable in 1947. Fatal injuries increased from 3 to 6, and nonfatal injuries rose from 346 to 455. The rates of 0.76 deaths and 57.52 nonfatal injuries per million man-hours were considerably higher than in 1946.

COKE PLANTS

The fatality experience of coke plants in 1947 was less favorable than in the preceding year. The 14 deaths were a marked increase over the 8 chargeable to 1946, and the fatality rate rose to 0.21 per million man-hours. Although the 915 nonfatal injuries in 1947 exceeded the total in 1946, the rate of 13.70 nonfatal injuries per million man-hours was more favorable than in 1946, owing to the 16-percent gain in worktime.

BYPRODUCT COKE

Employment.—The average number of men working in byproduct-coke plants increased from 18,906 in 1946 to 20,800 in the current year. The number of days worked and the length of shift likewise increased. The total man-hours of worktime increased 14 percent to 60,780,000 in 1947.

Injuries.—There were 10 fatalities during the year, or 2 more than in 1946. The fatality rate of 0.16 per million man-hours is slightly higher than in 1946. Although the number of nonfatal injuries increased from 648 in 1946 to 695 in 1947, the nonfatal rate of 11.43 was more favorable than in 1946.

Employment and injury experience at coke plants in the United States, 1945–47 [1]

	Men working daily	Average active plant-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Byproduct ovens:								
1945	20,454	356	7,290,410	59,292,507	17	647	0.29	10.91
1946	18,906	354	6,693,947	53,547,047	8	648	.15	12.10
1947	20,800	360	7,480,000	60,780,000	10	695	.16	11.43
Beehive ovens:								
1945	2,533	247	625,031	5,082,575	1	188	.20	36.99
1946	2,504	204	510,740	4,163,075		162		38.91
1947	2,900	272	788,000	5,990,000	4	220	.67	36.73

[1] Data for 1947 are preliminary.

BEEHIVE COKE

Employment.—The industrial activity at beehive coke ovens during the year was much greater than in 1946, when strikes in coal and steel adversely affected the industry. Total worktime in 1947 increased 44 percent, and employment rose to 2,900 men working daily. In addition, the average number of days worked by the industry increased from 204 to 272.

Injuries.—The fatality experience in the industry was much worse in 1947. There were no fatalities in 1946; but in 1947 there were 4 deaths, making the fatal rate 0.67 per million man-hours. However, the nonfatal rate was improved to 36.73 per million man-hours.

METALLURGICAL PLANTS

The safety record of metallurgical plants in 1947 was better than in 1946. Although the number of both fatal and nonfatal injuries was higher in 1947, the increased worktime in the industry more than compensated for the higher number of injuries. Employment rose to 48,800, and total worktime was 20 percent greater than in 1946.

ORE-DRESSING PLANTS AND AUXILIARY WORKS

Employment.—The average number of men working in all metal mills was slightly higher in 1947, and total worktime increased 14 percent. The average employee worked an 8.07-hour shift for 285 days in 1947.

Employment and injury experience at metal mills in the United States, 1945–47, by metals [1]

	Men working daily	Average active mill-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Copper:								
1945	5,891	327	1,923,926	15,439,427	2	322	0.13	20.86
1946 [2]	5,700	284	1,619,000	12,600,000	1	385	.08	30.56
1947 [2]	5,900	325	1,917,000	15,330,000	2	300	.13	19.57
Iron:								
1945	3,283	261	855,859	6,946,659	1	134	.14	19.29
1946 [2]	3,100	200	620,000	5,060,000	1	65	.20	12.85
1947 [2]	3,300	248	819,000	6,680,000	2	90	.30	13.47
Gold-silver:								
1945	600	294	176,380	1,383,341	--------	48	--------	34.70
1946	1,015	263	267,053	2,077,925	1	89	.48	42.83
1947 [2]	1,000	283	283,000	2,330,000	2	115	.86	49.36
Lead-zinc:								
1945	4,368	304	1,329,693	10,650,753	5	400	.47	37.56
1946 [2]	4,200	276	1,159,000	9,290,000	6	285	.65	30.68
1947 [2]	4,300	266	1,144,000	9,270,000	2	270	.22	29.13
Miscellaneous metals: [3]								
1945	1,650	292	482,379	3,885,264	1	128	.26	32.94
1946 [2]	1,400	265	371,000	2,960,000	1	85	.34	28.72
1947 [2]	1,300	266	346,000	2,770,000	--------	100	--------	36.10
Total:								
1945	15,792	302	4,768,237	38,305,444	9	1,032	.23	26.94
1946 [2]	15,415	262	4,036,053	31,987,925	10	909	.31	28.42
1947 [2]	15,800	285	4,509,000	36,380,000	8	875	.22	24.05

[1] Includes crushers, grinders, washers, ore concentration, sintering, cyaniding, leaching, and all other metallic ore-dressing plants and auxiliary works.
[2] Preliminary.
[3] Includes aluminum, antimony, chromium, manganese, mercury, molybdenum, tungsten, vanadium, and other metals.

Injuries.—Despite the 14-percent increase in the number of man-hours of exposure, both fatalities and nonfatal injuries were reduced in metal mills in 1947. The fatality experience of lead-zinc mills is noteworthy, for in these mills the number of deaths was lowered from 6 in 1946 to 2 in the current year. The 8 fatalities in metal mills occurred at the rate of 0.22 per million man-hours. The nonfatal injury-frequency rate also was improved to 24.05 per million man-hours.

SMELTERS, REFINERIES, REDUCTION PLANTS, AND AUXILIARY WORKS

Plants in this classification are engaged in the primary extraction of nonferrous metals from ores and concentrates. Iron and steel plants are excluded.

Employment.—The number of men working in each group of plants was higher in 1947 and total employment increased 12 percent above 1946. Total man-hours of work rose 23 percent. This gain was due, in part, to the increased average number of days active.

Employment and injury experience at primary nonferrous smelters, refineries, and reduction plants in the United States, 1945–47, by metals [1]

	Men working daily	Average active smelter-days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Copper:								
1945	10,420	347	3,612,376	28,947,308	4	541	0.14	18.69
1946	10,187	289	2,946,354	23,572,764	6	503	.25	21.34
1947	12,400	322	3,992,000	31,940,000	7	700	.22	21.92
Lead, silver-lead:								
1945	3,698	323	1,193,484	9,538,276	2	177	.21	18.56
1946	3,848	255	980,243	7,844,293	--------	160	--------	20.40
1947	4,000	339	1,356,000	10,840,000	4	190	.37	17.53
Zinc:								
1945	9,944	350	3,482,249	27,701,226	1	857	.04	30.94
1946	9,917	338	3,356,262	26,199,631	4	915	.15	34.92
1947	10,500	344	3,616,000	28,670,000	1	995	.03	34.71
Miscellaneous metals: [2]								
1945	6,613	334	2,211,852	16,998,447	3	664	.18	39.06
1946	5,405	277	1,496,988	11,974,531	--------	350	--------	29.23
1947	6,100	291	1,773,000	14,180,000	2	360	.14	25.39
Total:								
1945	30,675	342	10,499,961	83,185,257	10	2,239	.12	26.92
1946	29,357	299	8,779,847	69,591,219	10	1,928	.14	27.70
1947	33,000	325	10,737,000	85,630,000	14	2,245	.16	26.22

[1] Includes smelters, refineries, and reduction, roasting, electrolytic, retort, and all other nonferrous metal reduction plants. Data for 1947 are preliminary.
[2] Includes antimony, magnesium, mercury, and tin plants.

Injuries.—The increase to a total of 14 fatal injuries in 1947 resulted in a fatality rate of 0.16 per million man-hours. Although lead, silver-lead, and miscellaneous metal smelters had no fatalities in 1946, these groups had 6 fatal injuries in 1947. On the other hand, nonfatal-injury experience improved over the previous year to a rate of 26.22 per million man-hours.

PART II. COMMODITY REVIEWS

Abrasive Materials

By ROBERT W. METCALF

GENERAL SUMMARY

OWING to the high level of construction and industrial production in 1947, the markets for most abrasive materials increased substantially. New sales records were established for ground sand and sandstone, pumice and pumicite, and metallic abrasives. The demand for pumice and pumicite for use as aggregate in construction materials in Western States was especially noteworthy, as was the increased output of steel shot and grit (metallic abrasives).

Sales of ground sand and sandstone in 1947 increased 13 percent to over 650,000 short tons valued at more than five million dollars. Pumice and pumicite sold or used, largely for use as aggregate or for abrasive purposes, rose 38 percent. Tripoli shipments were the largest since 1937, and garnet production was the largest since 1923, the peak year. Sales of diatomite and quartz continued heavy. Marketed output of emery and grindstones was less in 1947 than in 1946.

With respect to artificial abrasives, output of silicon carbide remained at virtually the same level as in 1946. Production of aluminum oxide, however, rose sharply, and shipments of metallic abrasives for the first time surpassed 150,000 tons.

The value of imports for consumption in the United States of natural abrasive products in 1947 declined 8 percent compared with 1946. An 11-percent drop in value of imports of diamond bort contributed largely to this decrease. Imports of corundum ore and garnet also were substantially less than in 1946. Receipts of emery ore, pumice, "flint, flints, flintstones, unground" (last class includes grinding pebbles), were 21 percent, 43 percent, and 64 percent, higher, respectively, than in 1946. The total value of exports of natural abrasive products in 1947 increased 38 percent compared with 1946.

Salient statistics of the abrasives industries in the United States, 1946–47

	1946		1947		Percent of change in 1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Natural abrasives (domestic) sold or used by producers:						
Diatomite	(1)	(1)	(1)	(1)		
Tripoli	28,955	$549,099	34,578	$751,422	+19	+37
Quartz	73,179	293,852	73,347	368,977	(2)	+26
Ground sand and sandstone	575,888	4,125,398	651,120	5,181,113	+13	+26
Grindstones	11,605	501,444	10,620	476,811	−8	−5
Pulpstones	72	3,880	76	4,976	+6	+28
Oilstones and related products	(3)	(3)	(3)	(3)		
Millstones	(4)	14,780	(4)	23,189		+57
Tube-mill liners	2,375	44,247	1,496	40,303	−37	−9
Grinding pebbles	4,652	102,043	5,860	122,883	+26	+20
Pumice and pumicite	319,883	1,585,753	442,552	2,021,880	+38	+28
Garnet	7,743	570,186	8,722	614,071	+13	+8
Emery	6,188	62,099	5,798	66,927	−6	+8
Artificial abrasives (production):						
Silicon carbide [5]	63,849	5,457,903	63,724	5,633,811	(6)	+3
Aluminum oxide [5]	132,084	8,367,158	160,022	10,158,432	+21	+21
Metallic abrasives (steel shot and grit)—shipments	111,512	6,387,819	154,191	12,449,855	+38	+95
Foreign trade:						
Imports	(7)	15,320,284	(7)	14,054,978		−8
Exports	(7)	2,426,853	(7)	3,351,546		+38

[1] Average annual figure for 1945–47 was 213,588 short tons valued at $4,307,088; not at liberty to publish annual data separately.
[2] Increase of less than 0.5 percent.
[3] Bureau of Mines not at liberty to publish.
[4] Tonnage of millstones not recorded.
[5] Includes Canadian production.
[6] Decrease of less than 0.5 percent.
[7] Weight cannot be recorded because of varying units.

This chapter includes data for most materials used chiefly as abrasives, although certain carbides, clays, oxides, and other substances mentioned later under Miscellaneous Mineral Abrasive Materials are not included in the statistics presented herein. On the other hand, as indicated later, certain abrasive products for which figures are shown also have important nonabrasive uses.

NATURAL SILICA ABRASIVES

Diatomite.—Annual statistics of diatomite have not been published by the Bureau of Mines since 1926, as to do so would reveal individual producers' figures. Total output (sales) for 3-year periods, however, may be shown, as indicated by the annual averages: 1939–41, 120,167 short tons valued at $1,915,405; 1942–44, 174,957 tons valued at $3,298,178; and 1945–47, 213,588 tons valued at $4,307,088. The production in 1945–47 thus indicated growing demand for this material.

Producing States in 1947 were California, Oregon, Nevada, and Washington. No production was reported from Arizona and New

York. California had by far the largest output. Exact data with respect to the uses of diatomite cannot be indicated. Approximate distribution, however, may be shown: Filtration, somewhat above one-half of the total shipments; fillers, about one-fourth of sales; and insulation, about one-eighth. Other uses, including small quantities for fine abrasive, comprised the remainder.

Quotations on diatomite in 1947, as reported in E&MJ Metal and Mineral Markets, were unchanged from those in 1946: Per ton f. o. b. mill, Nevada, crude, in bulk, dried, nominal: 98- to 100-mesh, $25; low-temperature insulation, $25; high-temperature insulation, $40; fine abrasive, 2 to 3 cents per pound (bags are extra). California filtration grades were quoted at $20 to $50 per ton f. o. b. mill.

The LaSalle Canyon diatomite plant near Lompoc, Calif., formerly operated by Lompoc Diatomite Co., San Francisco, was leased to Alexander M. Grant. Buildings and equipment were being repaired, and a new fabrication plant is planned.[1] A new operation, Cro-Diatomite, Inc., near Modesto, Stanislaus County, Calif., was placed in production in early 1948 to market diatomaceous earth, principally as a soil conditioner for use in fertilizers. The General Diatomite Co., Fallon, Nev., commenced production near Fernley during 1947. Another new operation near Fernley, Nev., is Chiturk Dry Mining Co., which is developing the use of diatomite as an oil absorbent. The Eagle-Picher Lead Co., Cincinnati, Ohio, which had been mining diatomaceous earth near Reno, Nev., completed construction of a new grinding, classifying, and calcining plant at Clark, Nev. The product, trade-marked "Celatom," may be blended into any desired size combination by the air classification system installed in the mill. Ground material ranging in size from 10-mesh to air float minus 325-mesh is prepared for a wide variety of markets.[2]

Tripoli.—Production of tripoli, amorphous silica, and rottenstone in 1947 totaled 34,578 short tons valued at $751,422, an increase of 19 percent in quantity and 37 percent in value over 1946. The tonnage in 1947 almost matched the 1937 figure (34,936 tons), while the value was 32 percent greater than in the next highest recorded year (1920). Output in Missouri increased by nearly 60 percent over 1946. Illinois production declined somewhat. Sales of Pennsylvania rottenstone,

Tripoli [1] sold or used by producers in the United States, 1943–47, by States

Year	Illinois		Missouri		Pennsylvania		Other States [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1943	10,203	$168,758	(3)	(3)	(3)	(3)	4,709	$75,607	14,912	$244,365
1944	12,031	205,732	(3)	(3)	(3)	(3)	6,394	96,131	18,425	301,863
1945	11,144	184,189	6,542	$114,188	561	$8,452			18,247	306,829
1946	15,631	321,600	12,180	211,244	1,144	16,255			28,955	549,099
1947	14,687	271,115	19,375	469,927	516	10,380			34,578	751,422

[1] Including Pennsylvania rottenstone.
[2] 1943: Arkansas, Missouri, Oklahoma, and Pennsylvania. 1944: Arkansas, Missouri, and Pennsylvania.
[3] Included with "Other States."

[1] Engineering and Mining Journal, vol. 148, No. 7, July 1947, p. 134.
[2] Chemical Industries, vol. 62, No. 1, Jan. 1948, p. 74; Chemical and Engineering News, vol. 25, No. 48, Dec. 1, 1947, p. 3576; Engineering & Mining Journal, vol. 148, No. 5, May 1947, p. 108.

although quarried on a small scale, decreased substantially from the 1946 level.

The chief outlets for tripoli and amorphous silica are as abrasives, principally as a component of polishing and buffing compounds and as filler in a wide variety of products. Sales for abrasive use in 1947 were 41 percent higher than in 1946. Tonnages reported for filler and for "other uses" declined sharply.

Tripoli [1] sold or used by producers in the United States, 1945–47, by uses

Use	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Abrasives	11,113	$188,262	21,206	$406,620	29,866	$654,232
Concrete admixture	1	18				
Filler	3,969	65,569	4,450	89,721	2,573	47,640
Other uses [2]	3,164	52,980	3,299	52,758	2,139	49,550
	18,247	306,829	28,955	549,099	34,578	751,422

[1] Including Pennsylvania rottenstone.
[2] Foundry facing, drilling mud, and unspecified.

Quotations on tripoli in 1947, given in E&MJ Metal and Mineral Markets, remained the same as those reported for 1944–46 (per short ton, f. o. b. Missouri, in paper-lined burlap bags, minimum carlot 30 tons): once ground, through 40-mesh, rose or cream, $14.50; double-ground, through 110-mesh, rose or cream, $16; air-floated, through 200-mesh, $26. As reported in Oil, Paint and Drug Reporter, quotations on rottenstone, which had remained unchanged during 1944–46 at $25.50 per short ton, for carlots, in bags, at mines and $37.50 for less than carlots, were raised in the middle of April 1947 to $36 per ton for carlots and $43 for less than carlots. This price was maintained throughout the rest of the year.

Firms producing tripoli, amorphous silica and rottenstone in 1947 were: Illinois (amorphous silica)—Olive Branch Minerals Co., Olive Branch, Ill. (formerly operated by Tamms Silica Co., Chicago, Ill.) and Ozark Minerals Co., Cairo; Oklahoma (mine) and Missouri (mill)—American Tripoli Corp., Seneca, Mo. (formerly Barnsdall Tripoli Corp.); 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 1947 increased slightly in tonnage and 26 percent in value over 1946. The quantity of crude quartz sold dropped sharply. Crushed quartz and especially ground quartz, however, increased substantially. The average value per ton of all quartz sold in 1947 rose to $5.03 compared with $4.02 in 1946 and $4.10 in 1945.

Quartz (crude, crushed, and ground)[1] sold or used by producers in the United States, 1943–47

Year	Crude		Crushed		Ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	38,587	107,069	29,228	109,437	5,364	77,346	73,179	293,852
1947	21,940	118,231	34,199	114,706	17,208	136,040	73,347	368,977

[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.

Quartz (crude, crushed, and ground)[1] sold or used by producers in the United States, 1945–47, by States

State	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Arizona, California, Washington	36,044	$99,113				
Arizona, California, Washington, Oregon			41,844	$160,266	54,137	$255,044
Oregon	1,462	16,260				
Maine	4	10	---	---	---	---
Massachusetts	696	6,349	829	7,715	1,019	9,185
Other States[2]	19,558	115,071	30,506	125,871	18,191	104,748
	57,764	236,803	73,179	293,852	73,347	368,977

[1] To avoid duplication, the ground material shown here is only that ground by the original producers of the crude quartz or by grinders whose purchase from small miners not reporting their production.
[2] Maryland, North Carolina, South Dakota, Wisconsin; and New Jersey and Virginia in 1945, and Tennessee in 1946–47.

Quartz production for 1947 in the Far Western States of Arizona, California, Oregon, and Washington combined, probably largely for use in the manufacture of ferrosilicon, rose nearly 30 percent over 1946. Output in Massachusetts, although much smaller, also showed a large gain compared with 1946. Quotations on ground "hard-quartz" silica in Oil, Paint and Drug Reporter during 1945–46 and up to September 15, 1947, were as follows: 325-mesh (99½-percent grade) carlots in bags, $15.50 per short ton, and less than carlots, $18.50; 140-mesh (99½-percent grade), carlots in bags, $11 per ton, and less than carlots, $16. After September 15, 1947, and during the rest of the year, quotations were: $20 per ton for 325-mesh material in carlots and $25 in less than carlots; and $15 for 140-mesh in carlots, and $20 in less than carlots.

Ground Sand and Sandstone.—Sales of ground sand and sandstone again rose to a new record in both quantity and value in 1947, totaling 651,120 short tons valued at $5,181,113. This represented a 13-percent increase in tonnage and a 26-percent increase in value over 1946, the previous high year. Average value per ton in 1947 was $7.96 compared with $7.16 in 1946. Sales in Illinois were 37 percent greater than in 1946, while sales from Georgia, though much smaller, more than doubled. Outputs in New Jersey and Ohio-Virgina-West Virginia in 1947 indicated moderate gains over 1946 levels. The principal producing States, other than Illinois and New Jersey, were Ohio and Pennsylvania.

Ground sand and sandstone sold or used by producers in the United States, 1943–47

Year	Short tons	Value	Year	Short tons	Value
1943	541, 350	$3, 937, 452	1946	575, 888	$4, 125, 398
1944	558, 606	3, 989, 981	1947	651, 120	5, 181, 113
1945	533, 656	3, 709, 597			

Ground sand and sandstone sold or used by producers in the United States, 1945–47, by States

State	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Arizona California	20, 610	$225, 450	-----------	-----------	-----------	-----------
California Washington	(1)	(1)	39, 401	$215, 889	(1)	(1)
Georgia	7, 190	27, 858	4, 406	25, 993	11, 031	$57, 820
Illinois	144, 212	1, 003, 273	144, 753	1, 061, 046	198, 500	1, 614, 173
Massachusetts	2, 350	11, 600	2, 000	10, 000	1, 944	11, 628
New Jersey Pennsylvania	181, 076	1, 084, 284	105, 985 (1)	649, 828 (1)	118, 446 (1)	772, 213 (1)
Ohio, Virginia, and West Virginia	142, 002	1, 102, 135	169, 710	1, 396, 151	177, 048	1, 568, 756
Other States [2]	36, 216	254, 997	109, 633	766, 491	144, 151	1, 156, 523
	533, 656	3, 709, 597	575, 888	4, 125, 398	651, 120	5, 181, 113

[1] Included with "Other States."
[2] Includes Missouri, Wisconsin, and States indicated by footnote 1.

Firms producing 92 percent of the total sales of ground sand and sandstone in 1947 reported distribution of sales by uses. The principal users of these products were the pottery, tile, and porcelain industries (38 percent of the tonnage for which uses were reported), manufacturers of cleaning and scouring compounds and other abrasive products (23 percent), foundries (15 percent), and glassmakers (8 percent), followed closely by enamel manufacturers (7 percent). Filler and miscellaneous uses comprise the rest of the tonnage for which data were given.

Ground sand and sandstone sold or used by producers in the United States in 1947, by uses [1]

Use	Short tons	Value	
		Total	Average per ton
Abrasive:			
Cleansing and scouring compound	133, 638	$938, 562	$7. 02
Other	6, 849	29, 890	4. 36
Enamel	39, 320	321, 639	8. 18
Filler	12, 164	99, 099	8. 15
Foundry	89, 729	705, 069	7. 86
Glass	49, 736	346, 580	6. 97
Pottery, porcelain, and tile	226, 206	2, 033, 388	8. 99
Other uses	41, 768	282, 864	6. 77
Total reported by uses	599, 410	4, 757, 091	7. 94

[1] Data represent 92 percent of the industry.

Abrasive Sands.—Natural sands with a high silica content may be used for coating sandpaper, glass grinding, stone polishing, sandblasting, or other abrasive purposes. Sales of such grinding and polishing sand in 1947 reached 1.099,253 short tons valued at $1,801,989, an increase in quantity and value, respectively, of 21 and 31 percent over 1946. Included in the 1947 statistics were 308,128 tons of blast sand valued at $958,023. Information with respect to tonnages produced in each State, where these figures may be published, appears in the Sand and Gravel chapter of this volume.

SPECIAL SILICA-STONE PRODUCTS

Grindstones and Pulpstones.—Sales of grindstones in 1947 decreased somewhat to about the same level as in 1943 and totaled 10,620 short tons valued at $476,811. Pulpstones were reported from Washington and grindstones from Ohio and West Virginia.

Grindstones and pulpstones sold by producers in the United States, 1943–47

Year	Grindstones		Pulpstones		
			Quantity		
	Short tons	Value	Pieces	Equivalent short tons	Value
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)
1946	11,605	501,444	22	72	3,880
1947	10,620	476,811	24	76	4,976

1 Bureau of Mines not at liberty to publish figure.

Oilstones and Related Products.—Sales of natural sharpening stones, including oilstones, whetstones, scythestones, and rubbing stones, in 1947 were smaller than in 1946; the Bureau of Mines is not at liberty to publish the figures. Producing States in 1947 and the type of abrasive stone reported from each, were: Arkansas—oilstones and whetstones; Indiana—whetstones and rubbing stones; New Hampshire—scythestones; and Ohio—scythestones, whetstones, and rubbing stones (holystones).

Millstones.—The value of sales of millstones and chasers in 1947 increased sharply to the highest recorded value since 1929 ($31,407). Marketed production of millstones and chasers was reported in Ulster County, N. Y., Rowan County, N. C., and in Montgomery County, Va.

Value of millstones and chasers sold by producers in the United States, 1943–47 [1]

Year	Number of producers	Value	Year	Number of producers	Value
1943	4	$9,240	1946	4	$14,780
1944	3	9,700	1947	4	23,189
1945	4	15,018			

1 Produced in Minnesota (1945 only), New York, North Carolina, and Virginia.

Grinding Pebbles and Tube-Mill Liners.—Production for sale of grinding pebbles in 1947 increased 26 percent in quantity and 20 percent in value compared with 1946. The tonnage and value of tube-mill liners were less than in 1946. Grinding pebbles and tube-mill liners in 1947 were produced in the same States as in 1946: Grinding pebbles in California, Minnesota, North Carolina, Texas, Washington, and Wisconsin; and tube-mill liners in Minnesota, North Carolina, and Wisconsin.

Grinding pebbles and tube-mill liners sold or used by producers in the United States, 1943–47

Year	Grinding pebbles		Tube-mill liners		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	4,652	102,043	2,375	44,247	7,027	146,290
1947	5,860	122,883	1,496	40,303	7,356	163,186

NATURAL SILICATE ABRASIVES

Pumice and Pumicite.—Sales of pumice and pumicite in 1947 were the highest on record, totaling 442,552 short tons valued at $2,021,880, 38 percent higher in tonnage and 28 percent higher in value than in 1946, the previous peak year. The continued demand for pumice in building operations in the Western States where lumber and other construction materials were in tight supply was the chief factor in the growth of this industry.

Production of pumice and pumicite in 1947 was reported from 12 States—3 more than in 1946. The additional States were Montana, Oklahoma, and Utah. In 1947 California was the largest producer. The second-highest output came from Idaho, followed closely by New Mexico. Oregon and Washington were next in order of tonnage sold. Nebraska and Idaho both showed small losses in 1947 compared with 1946. Other States for which data are given, however, reported large gains in 1947 over 1946. These gains were due largely to the increased consumption in 1947 as aggregate.

Pumice and pumicite sold for concrete admixture and concrete aggregate in 1947 was 60 percent greater than in 1946. Pumice and pumicite used in acoustic plaster and miscellaneous abrasive uses also was considerably higher in 1947. Other uses in 1947 included insulation, paint filler, insecticides, and absorbents. Trends in sales of pumice and pumicite in recent years, separated according to chief uses, are indicated in figure 1.

Pumice and pumicite sold or used by producers in the United States, 1943–47

Year	Short tons	Value	Year	Short tons	Value
1943	85,150	$611,495	1946	319,883	$1,585,753
1944	88,757	704,110	1947	442,552	2,021,880
1945	157,011	1,051,037			

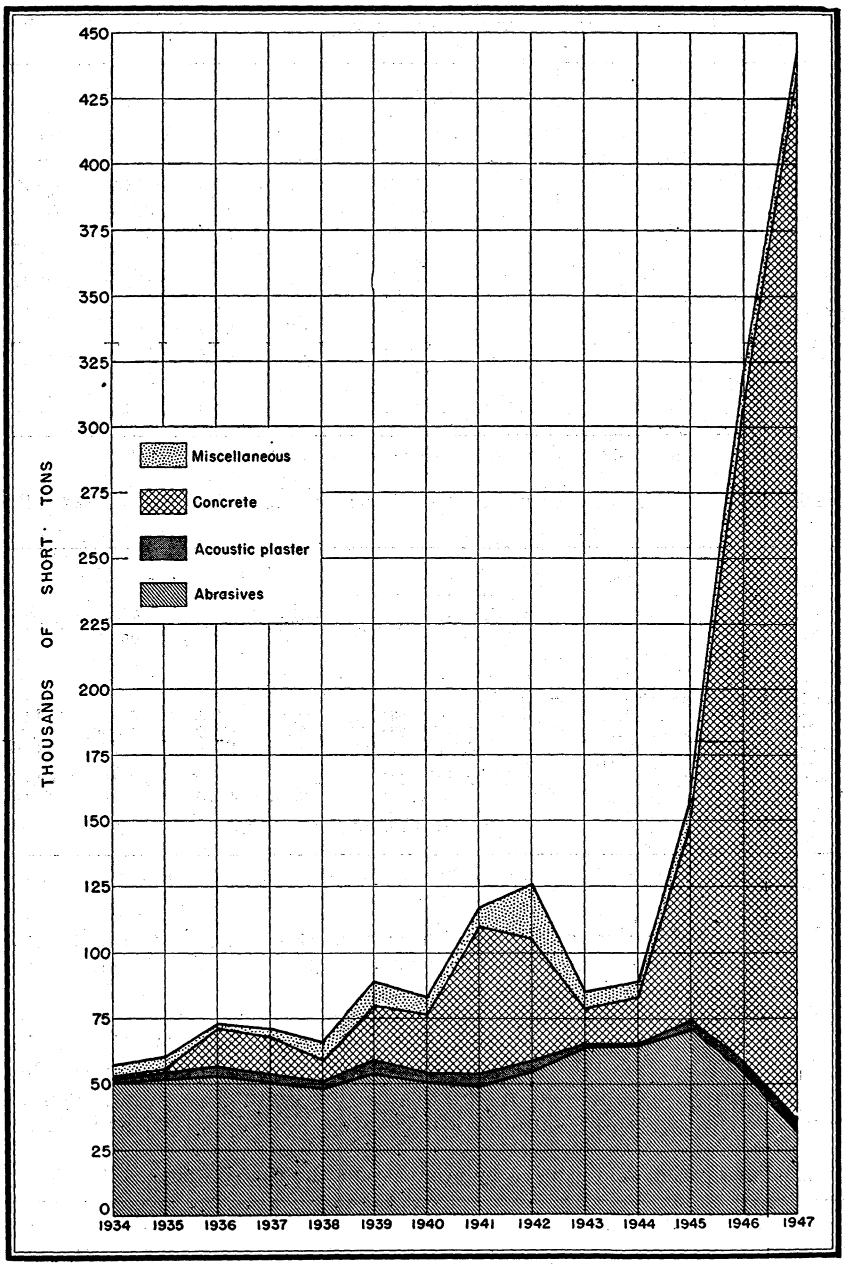

FIGURE 1.—Trends, by uses, of pumice and pumicite sold or used in the United States, 1934–47.

Pumice and pumicite sold or used by producers in the United States, 1945–47, by States

State	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
California	75,238	$481,664	89,181	$755,570	169,037	$1,026,275
Colorado	—	—	600	1,200	(1)	(1)
Idaho	(1)	(1)	108,847	163,515	98,618	119,882
Kansas	47,484	187,651	35,466	105,084	(1)	(1)
Montana	—	—	—	—	2,035	9,476
Nebraska	6,764	59,735	4,772	45,900	4,546	43,760
New Mexico	(1)	(1)	62,623	432,890	85,639	512,176
Oklahoma	—	—	—	—	(1)	(1)
Oregon	(1)	(1)	3,004	12,532	33,240	111,380
Texas	584	11,680	805	13,054	(1)	(1)
Utah	—	—	—	—	7,500	30,000
Washington	4,414	36,045	14,585	56,008	26,497	74,173
Undistributed [1]	22,527	274,262	—	—	15,440	94,758
	157,011	1,051,037	319,883	1,585,753	442,552	2,021,880

[1] Figures that may not be shown separately are combined as "Undistributed."

Pumice and pumicite sold or used by producers in the United States, 1945–47, by uses

Use	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Abrasive:						
Cleansing and scouring compounds and hand soaps	63,704	$434,928	52,085	$386,593	25,266	$323,885
Other abrasive uses	7,307	229,212	2,369	112,694	5,800	326,348
Acoustic plaster	3,693	78,278	4,342	139,871	5,427	163,360
Concrete admixture and concrete aggregate	72,901	176,920	248,247	607,695	397,223	1,083,630
Other uses [1]	9,406	131,699	12,840	338,900	8,836	124,657
Total	157,011	1,051,037	319,883	1,585,753	442,552	2,021,880

[1] Insecticide, insulation, brick manufacture, filtration, solvents, plastics, paint filler, absorbents, and unspecified.

Garnet.—Sales of garnet in 1947 increased 13 percent in quantity and 8 percent in value over 1946, and represented the highest sales and value respectively since 1923 and 1925, the peak years in each category. The trend in output (sales) of garnet since 1920 is shown in figure 2. As in 1946, garnet was produced for sale in 1947 in Idaho and New York. Northern Minerals, Inc., Essex, N. Y., has succeeded to the garnet operations of the Estate of John Burnham, also of Essex. Otherwise, the same producers were active in 1947 as in 1946.

Abrasive garnet sold or used by producers in the United States, 1943–47

Year	Short tons	Value	Year	Short tons	Value
1943	5,935	$429,120	1946	7,743	$570,186
1944	(1)	(1)	1947	8.722	614,071
1945	6,306	375,198			

[1] Bureau of Mines not at liberty to publish figure.

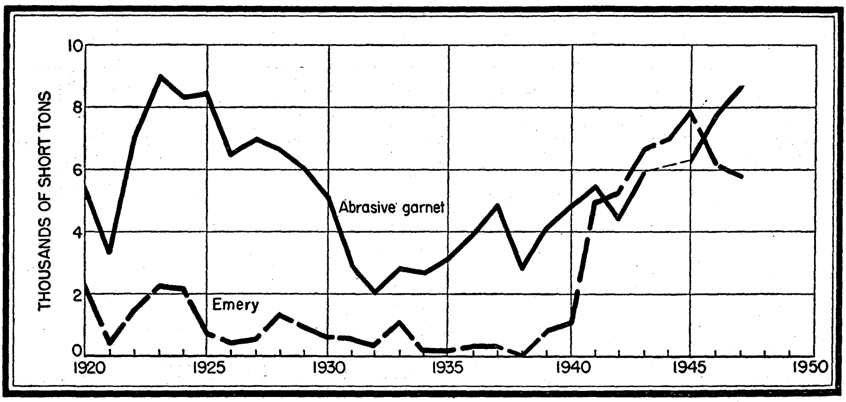

FIGURE 2.—Marketed production in the United States of abrasive garnet and domestic emery, 1920–47.

NATURAL ALUMINA ABRASIVES

Corundum.—The demand for corundum, a natural alumina (Al_2O_3) abrasive, for use in snagging wheels and for polishing precision instruments and lenses continued in 1947. It has become, however, increasingly difficult to obtain sufficient supplies to satisfy industrial needs, not to mention building up a stock pile in this country. Efforts to stimulate the domestic exploitation of corundum largely have been unsuccessful. The record of exploration by the Bureau of Mines in Clay [3] and Macon [4] Counties, N. C., and in Madison [5] and Gallatin [6] Counties, Mont., was published. Another Bureau of Mines study describes in detail the methods of investigation and the results of metallurgical tests undertaken at Rolla, Mo., on corundum ore from Gallatin County, Mont.[7]

Corundum consumed in the United States in recent years has originated largely in the Union of South Africa, although at various times, principally during the war years, small shipments were received from other countries. Production in the Transvaal (Union of South Africa), which had dropped to 1,854 metric tons in 1946, rose to 2,313 tons in 1947, although imports into the United States again dropped sharply in 1947. Demand still remains high, however, and efforts to increase the available supply continued.[8]

World production of corundum in recent years, as far as statistics are available, appears in the accompanying table.

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[3] Ballard, T. J., Buck Creek Corundum, Clay County, N. C.: Bureau of Mines Rept. of Investigations 4052, 1947, 34 pp.

[4] Ballard, T. J., Corundum Hill Mine, Macon County, N. C.: Bureau of Mines Rept. of Investigations 4042, 1947, 10 pp.

[5] Hopkins, John B., and Taber, John, Bear Trap Corundum Deposit, Madison County, Mont.: Bureau of Mines Rept. of Investigations 4039, 1947, 6 pp.

[6] O'Brien, Robert D. and Taber, John, Bozeman Corundum Deposit, Gallatin County, Mont.: Bureau of Mines Rept. of Investigations 4050, 1947, 4 pp.

[7] Calhoun, W. A. and O'Meara, R. G., Mississippi Valley Experiment Station Laboratory and Pilot-Plant Concentration of Corundum from Gallatin Gateway, Mont., for World War II: Bureau of Mines Rept. of Investigations 4161, 1947, 27 pp.

[8] South African Mining and Engineering Journal, vol. 58, part II, No. 2860, Dec. 6, 1947, pp. 337, 339.

World production of corundum, 1937–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
Australia (New South Wales)									[2] 10	(3)	(3)
Belgian Congo								[4] 5			
Brazil								[5] 100	(3)	(3)	(3)
Canada [6]								157	1,195	1,080	
French Equatorial Africa								[5] 2	141	46	3
India		3	1	(7)	56	135	110	349	409	98	(3)
Madagascar	27	35	5				14	70	50	21	(3)
Nyasaland					(7)	81	180	305	328	379	(3)
Portuguese East Africa							834	1,108	152	(3)	(3)
Southern Rhodesia	(3)	102	69	90	32	74	44			13	
Swaziland						15	141				(3)
Tanganyika							7				(3)
Union of South Africa (sales)	2,237	1,397	1,381	3,820	6,119	6,724	4,270	3,531	4,379	1,854	2,313
United States (sales)							(8)	(8)			
Total [9]	2,300	1,537	2,456	3,910	6,207	7,029	5,600	5,650	6,800	3,850	3,100

[1] In addition to countries listed, corundum probably is produced in U. S. S. R., but data on production are not available.
[2] Reported as corundum and emery (believed to be largely emery).
[3] Data not available.
[4] Imports into United States.
[5] Estimate.
[6] Recovered from tailing dumps.
[7] Less than 1 ton.
[8] Bureau of Mines not at liberty to publish figure.
[9] Includes estimates by author for entries where footnote 3 indicates data not available, and includes United States production as measured by sales. Excludes estimates for U. S. S. R.

Emery.—Sales of domestic emery in 1947 were 6 percent less than in 1946, although the total realization increased 8 percent. Joe DeLuca and DiRubbo & Ellis, as in other recent years, were the only miners and operated near Peekskill, N. Y. The crude material is shipped to manufacturers of emery grain used in grinding wheels, polishing compositions, abrasive sticks, and other abrasive products. A large part of the total mined is used as a nonslip, wear-resistant agent in concrete floors and steps. The trend of production since 1920 is shown in figure 2.

Quotations in E&MJ Metal and Mineral Markets on crude domestic emery during 1945, 1946, and the first part of 1947 were:$10 per short ton for first-grade ore, f. o. b. New York. In May 1947, the quoted price rose to $12 per ton, where it remained the rest of the year. Grain emery at the beginning of 1947 was quoted by the same source as follows (per pound, in 350-pound kegs, f. o. b. Pennsylvania): Turkish and Naxos, 7 cents; and American, 5 cents. After the middle of September, the quotations rose to 10 cents per pound for Turkish and Naxos grain and to 6½ cents for American.

Emery sold or used by producers in the United States, 1943–47

Year	Short tons	Value	Year	Short tons	Value
1943	6,666	$63,195	1946	6,188	$62,099
1944	6,940	64,858	1947	5,798	66,927
1945	7,856	75,977			

NATURAL CARBON ABRASIVES

Abrasive or Industrial Diamonds.—Although world output of industrial diamonds in 1947 was somewhat less than in 1946, the value of sales of industrials by Industrial Distributors (Sales), Ltd., increased nearly £1,000,000 to £4,377,000. Sales that were much larger in the latter half of the year were made chiefly for diamond drilling operations in the United States and Canada and for automobile and plane manufacturing. An active market demand for industrial grades was expected to continue through 1948.[10]

Imports of diamond bort (not manufactured) in 1947 decreased 16 percent in quantity and 11 percent in value compared with 1946. Receipts for consumption of carbonados and ballas and of diamond dust, on the other hand, increased sharply. Exports of diamond dust and diamond grinding wheels also were substantially greater in 1947 than in 1946.

A comprehensive paper by Grodzinski on diamond technology was published.[11] The current market situation and the many uses of the diamond are described in an authoritative article by Sydney Ball.[12]

ARTIFICIAL ABRASIVES

Shipments of metallic abrasives in 1947 surpassed all previous records, rising to 154,191 short tons valued at $12,449,855. Production of silicon carbide remained at virtually the same level as in 1946, although the output of aluminum oxide rose 21 percent in both quantity and value compared with 1946. Included in the total for aluminum oxide in 1947 were 16,711 short tons of "white high-purity or special" material valued at $1,755,450, which represented an increase of 30 percent in tonnage and 24 percent in value compared with 1946. Silicon carbide consumed in refractory or other nonabrasive uses in 1947 was estimated at 42 percent of the total output, and aluminum oxide used for similar purposes in 1947 was estimated at 4 percent.

Crude artificial abrasives produced in the United States and Canada, 1943–47

Year	Silicon carbide [1]		Aluminum oxide [1] (abrasive grade)		Metallic abrasives [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	63,849	5,457,903	132,084	8,367,158	111,512	6,387,819	307,445	20,212,880
1947	63,724	5,633,811	160,022	10,158,432	154,191	12,449,855	377,937	28,242,098

[1] Bureau of Mines not at liberty to publish data for United States separately. Figures include material used for refractories and other nonabrasive purposes.
[2] Shipments from United States plants only.

[9] See also the Gem Stones chapter of this volume.
[10] Wall Street Journal, Oppenheimer, De Beers Chairman, Sees Diamond Demand on a Firm Basis: Vol. 131, No. 144, June 19, 1948, p. 2.
[11] Grodzinski, P., Purpose and Aims of Diamond Technology: Industrial Diamond Rev., vol. 7, No. 77, April 1947, pp. 97–101.
[12] Ball, Sydney H., Industrial Diamonds: Mining Cong. Jour., vol. 34, No. 2, February 1948, pp. 107–108.

Ratio of production to capacity for silicon carbide was 88 percent in 1947; for aluminum oxide, 69 percent; and for metallic abrasives, 64 percent. Stocks of silicon carbide on hand at the end of 1947 dropped sharply, while stocks at the end of the year for aluminum oxide and metallic abrasives increased 22 and 53 percent, respectively, over stocks at the end of 1946. Total capacity of the silicon carbide and aluminum oxide plants remained virtually unchanged, although new firms and increased facilities at existing plants brought about 16 percent rise in total capacity of plants manufacturing steel shot and grit (metallic abrasives).

Production of silicon carbide and aluminum oxide for abrasives is concentrated largely in the Niagara Falls region of Canada and the United States; some aluminum oxide, however, is manufactured in Quebec, Canada, and in Alabama. No new firms came into operation during 1947. The Exolon Co., Buffalo, N. Y., suspended operations at its Blasdell, N. Y., plant. Manufacturing equipment is to be concentrated in the factory at Tonawanda, N. Y., and extensive modernization and improvements have been approved for its crude-abrasive-ore electric furnace plant at Thorold, Ontario, Canada.[13] It was announced toward the end of the year that Carborundum Co., Niagara Falls, N. Y., would purchase for a reported $1,000,000, a part of the Government-owned plant (Plancor 168) in Buffalo, N. Y., formerly operated by Bell Aircraft Corp. This property of about 65 acres was to house a new plant for the company Coated Products Division.[14] The same firm plans to build a $2,000,000 plant at Vancouver, Wash., for the manufacture of silicon carbide.[15] The Electro Refractories & Alloys Corp., Buffalo, N. Y., reported that it is establishing a $350,000 electric-furnace plant at Cap-de-la-Madeleine, Quebec, about 100 miles northeast of Montreal. This plant, to be operated by Electro Refractories & Alloys Canada, Ltd., will have an indicated annual capacity of 3,000 to 4,000 tons of silicon carbide.[16]

Stocks of crude artificial abrasives and capacity of manufacturing plants, as reported by producers in the United States and Canada, 1943–47, in short tons

Year	Silicon carbide		Aluminum oxide		Metallic abrasives [1]	
	Stocks, Dec. 31	Average annual capacity	Stocks, Dec. 31	Average annual capacity	Stocks, Dec. 31	Average annual capacity
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
1946	5,339	71,679	27,072	232,889	6,524	211,407
1947	3,524	72,350	32,977	233,500	9,987	245,479

[1] Figures pertain to United States plants only.

[13] Ceramic Age, vol. 50, No. 4, October 1947, p. 215.
[14] Chemical Engineering, vol. 54, No. 11, November 1947, p. 190; Ceramic Age, vol. 50, No. 4, October 1947, p. 214.
[15] Chemical & Engineering News, vol. 25, No. 42, Oct. 20, 1947, p. 3088; Bull. Am. Ceram. Soc., vol. 26 No. 10, Oct. 15, 1947, p. 364.
[16] Brick & Clay Record, vol. 113, No. 3, September 1948, pp. 72, 74.

Statistics for metallic abrasives cover steel shot and grit shipped from plants in the United States but not steel wool. The principal producing States in 1947, in order of volume of shipments, were Ohio, Michigan, and Pennsylvania. Other States from which shipments were made in 1947 were Illinois, Massachusetts, New Hampshire, and New York. Eighteen firms with 19 plants reported sales in 1947 compared with 16 companies and 17 plants in 1946. The two new concerns reporting output for the first time were Metal Blast, Inc., 871 East Sixty-seventh Street, Cleveland, Ohio, and Abrasive Metals Co., Twenty-sixth Street and B. & O. R. R., Pittsburgh 22, Pa. The firm that reported small experimental output in 1946, Abrasive Shot & Grit Co., 2007 West Eightieth Street, Los Angeles 44, Calif., was not in commercial production in 1947.

MISCELLANEOUS MINERAL ABRASIVE MATERIALS

In addition to the natural and manufactured abrasive substances for which data are included herein, many other mineral materials are used for abrasive purposes. A number of oxides, including tin oxides, magnesia, iron oxides (rouge and crocus), cerium oxide, chromium oxide, and manganese oxide, are employed as polishing agents. Certain carbides, such as boron carbide and the cemented carbides, which include tantalum carbide, titanium carbide and tungsten carbide, have been used for their abrasive properties or because of their extreme hardness or durability. Other substances with abrasive applications include finely ground and calcined clays (ball clays, china clays, fire clays), lime, talc, ground feldspar, river silt, slate flour, and whiting.

FOREIGN TRADE [17]

Imports.—The total value of imports for consumption of natural abrasive products in 1947 declined 8 percent compared with 1946. Imports of diamond bort (comprising largely the so-called industrial grades) were 16 percent smaller in quantity and 11 percent less in value. Receipts of diamond dust and carbonado and ballas, however, were larger than in 1946 Imports of corundum ore and garnet showed large decreases compared with 1946. Receipts of emery ore, "crude or unmanufactured" pumice, and "flints, and flintstones, unground" (which includes grinding pebbles) were 21, 43, and 64 percent, respectively, higher in 1947 than in 1946.

Imports of emery ore in 1947 originated wholly in Turkey, while corundum ore came from Union of South Africa, with small amounts from Canada and British East Africa. Imports of industrial diamonds

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

(bort, not manufactured) in 1947 were received from 18 countries, but by far the most caratage came from Union of South Africa (71 percent) and Belgian Congo (23 percent). Brazil furnished virtually all of the carbonados and ballas imported.

Abrasive materials imported for consumption in the United States, 1945–47, by kinds

Kind	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Burrstones: Bound up into millstones short tons	22	$1,406	13	$1,099	27	$1,848
Grindstones, finished or unfinished do	250	8,893	232	12,077	251	17,255
Hones, oilstones, and whetstones do	12	11,864	12	26,595	20	59,315
Emery:						
Ore do	----------	----------	2,561	33,358	3,105	50,750
Grains, ground, pulverized, or refined pounds	(1)	(1)	(1)	(1)	(1)	(1)
Paper and cloth coated with emery or corundum reams	731	92,719	873	130,660	1,356	180,584
Wheels, files, and other manufactures of emery or corundum or garnet pounds	26,323	5,115	4,378	4,113	7,212	8,674
Corundum (see also "Emery"):						
Ore short tons	6,244	456,581	4,207	340,891	2,401	194,158
Grains, ground, pulverized, or refined pounds	[1] 74,811	[1] 4,077	[1] 117,368	[1] 7,011	[1] 114,493	[1] 4,516
Garnet in grains, ground, etc do	6,100	92	38,874	2,373	1,264	190
Tripoli and rottenstone short tons	37	1,170	93	3,095	83	2,951
Pumice:						
Crude or unmanufactured do	----------	----------	5,471	61,190	7,809	70,174
Wholly or partly manufactured do	----------	----------	984	25,204	795	17,028
Manufactures, n. s. p. f.	----------	10	----------	110	----------	148
Diamonds:						
Bort, manufactured carats	1,099	30,728	2,104	63,674	1,679	95,975
Bort (glaziers' and engravers' diamonds, unset, and miners') carats	10,729,914	12,770,003	4,609,146	14,012,604	3,892,778	12,525,230
Carbonado and ballas do	3,497	53,959	16,136	284,932	27,234	315,636
Dust do	62,317	47,213	77,732	129,272	116,391	230,139
Flint, flints, and flintstones, unground short tons	1,323	27,498	6,965	182,026	11,399	280,407
	----------	13,511,328	----------	15,320,284	----------	14,054,978

[1] Emery included with corundum; not separately classified.

Exports.—The value of all exports of natural abrasive products in 1947 totaled $3,351,546, or 38 percent more than in 1946. All classifications shown in 1947 registered small to substantial increases over 1946 in both quantity and value of product exported except grindstones, which were about one-quarter less than in 1946.

Abrasive materials exported from the United States, 1942–47, by kinds

Kind	Grindstones		Wheels of emery and corundum		Emery powder	
	Pounds	Value	Pounds	Value	Pounds	Value
1942	6, 294, 875	$224, 998	6, 387, 353	$3, 665, 386	906, 200	$84, 108
1943	4, 716, 588	213, 170	2, 318, 956	1, 295, 011	721, 533	75, 150
1944	3, 393, 763	155, 048	600, 682	342, 215	744, 076	74, 331
1945	4, 699, 860	252, 293	248, 118	144, 589	326, 758	34, 003
1946	6, 135, 719	285, 799	431, 434	218, 961	529, 362	60, 982
1947	4, 591, 080	217, 747	450, 834	256, 191	547, 264	66, 104

Kind	Diamond dust		Diamond grinding wheels		Other natural abrasives, hones, and whetstones		Total value
	Carats	Value	Pounds	Value	Pounds	Value	
1942	45, 448	$51, 498	2, 272	$54, 995	28, 230, 363	$2, 603, 367	$6, 684, 352
1943	116, 478	135, 282	2, 454	95, 195	34, 066, 371	1, 697, 361	3, 511, 169
1944	119, 458	133, 270	2, 897	104, 947	45, 494, 759	1, 281, 864	2, 091, 675
1945	92, 019	95, 761	3, 256	83, 626	54, 548, 442	1, 475, 874	2, 086, 146
1946	116, 650	146, 490	4, 398	95, 205	52, 881, 184	1, 619, 416	2, 426, 853
1947	122, 925	324, 572	13, 217	212, 074	69, 989, 036	2, 274, 858	3, 351, 546

Aluminum

By HERBERT L. CULLEN

GENERAL SUMMARY

THE aluminum industry in 1947 benefited materially from the price advantage over copper and other nonferrous metals, and the resulting output of 571,750 short tons of primary aluminum taxed the productive capacity of the industry. As aluminum was not only cheaper but more readily available, than some metals, it found increasing application in new fields of use, thereby creating a competitive market that should maintain it in its present position as one of the Nation's most important metals.

There was no change in the ownership of reduction facilities during the year, but after the heavy demand for aluminum developed in the fall, the need for more electric power was evident, promising an expanded industry upon the solution of the power problem. None of the six former producing plants remaining under Federal ownership was available for operation, lack of power being the principal factor contributing to their inactivity.

Production during the first 5 months exceeded a 600,000-ton annual rate and then declined to a lower level, first because of a slackened demand, and later because of reduced power supply. However, at the end of the year, available power was greater because of increased water flow in generating areas, and output in 1948 promised to exceed the 1947 peacetime record.

Salient statistics of the aluminum industry, 1943–47

	1943	1944	1945	1946	1947
Primary production.......short tons..	920,179	776,446	495,060	409,630	571,750
Value............................	$265,380,000	$222,416,000	$140,864,000	$115,812,000	$161,626,000
Quoted price per pound.........cents..	[1] 15.0	[1] 15.0	[1] 15.0	15.0	15.0
Secondary production.....short tons..	313,961	325,645	298,387	278,073	330,000
Imports..............................	$41,817,044	$30,322,653	$99,370,633	$12,463,960	$6,603,722
Exports..............................	$67,216,832	$89,800,122	$9,906,041	$20,284,053	$52,231,972
World production.........short tons..	2,152,000	1,842,000	944,000	866,000	1,183,000

[1] Ceiling price; control lifted Aug. 31, 1945.

Apparent consumption of virgin metal in 1947 was 13 percent greater than that in the preceding year. However, if the proper corrections are made to apparent consumption figures, to account for disposals from Government-owned stocks, it becomes evident that use of primary aluminum in 1947 was actually slightly lower than in 1946. Residual Government stocks were reduced to 18,700 short tons at the end of the year, and this tonnage was declared surplus and available to industry early in 1948. In addition to the continued high use of primary aluminum, enormous quantities of secondary aluminum were reclaimed from scrap during the year, the most important contributor being that metal recovered from aircraft scrap.

The price of standard 99.0–99.5 percent ingot remained at 15 cents a pound throughout the year, the level maintained since 1942. However, it was evident that the cost of semifinished aluminum to the consumer was increasing, because of readjustments resulting largely from higher labor costs. Prices of most grades of secondary ingot showed a general downward trend for the year, but rising demand in December promised increases in 1948.

World production increased from an estimated 786,000 metric tons in 1946 to 1,073,000 tons in 1947.

Aluminum ores, alumina, and aluminum salts are discussed in the Bauxite chapter of this volume.

PRODUCTION

Primary.—Domestic production of primary aluminum totaled 571,750 short tons in 1947, an increase of approximately 40 percent over the 409,630 tons produced in 1946 and the highest peacetime output in the history of the industry. As had been indicated in the 1946 readjustment period, aluminum in 1947 invaded markets formerly supplied by other metals (principally galvanized steel and copper) with notable success, and by the end of the year demand for the metal considerably exceeded supply. The rapid expansion of aluminum production is more strikingly shown by comparison with growth in over-all industrial production. The index of total production [1] increased from 170 in 1946 to 187 in 1947, a gain of 10 percent. However, the index for aluminum production, calculated on the same base period, advanced from 328 in 1946 to 457 in 1947, an increase of 40 percent, which shows that it expanded during 1947 at a rate four times that of industrial output as a whole.

Production of primary aluminum in the United States, 1941–47, by months, in short tons [1]

Month	1941	1942	1943	1944	1945	1946	1947
January	21,800	32,250	60,650	84,750	48,650	24,750	50,045
February	19,500	30,100	55,600	74,400	45,650	22,250	47,002
March	22,200	34,400	64,600	80,200	53,100	26,000	53,032
April	22,900	35,000	66,800	77,800	51,600	25,900	51,007
May	25,200	37,200	72,850	76,450	52,000	24,850	51,116
June	25,800	39,500	74,150	66,400	47,500	27,800	46,259
July	27,000	45,000	78,450	67,550	47,900	35,750	47,998
August	27,900	48,950	81,350	61,650	45,800	39,850	47,054
September	27,600	49,550	86,400	47,450	31,600	41,100	43,228
October	29,500	54,150	94,050	48,400	25,000	45,000	43,959
November	29,000	55,000	91,350	44,450	20,800	46,300	43,461
December	30,800	60,000	93,600	46,850	24,000	50,700	47,589
Total: Preliminary	309,200	521,100	919,850	776,350	493,600	410,250	571,750
Final	309,067	521,106	920,179	776,446	495,060	409,630	571,750

[1] Monthly data 1941–July 1946 from producers' reports to War Production Board and its successor, Civilian Production Administration. Monthly data thereafter and final annual figures 1941–47 from reports to Bureau of Mines.

[1] Federal Reserve Bank indexes of physical volume of industrial production, 1935–39=100, are used herein.

Production of virgin aluminum proceeded at a rate in excess of 600,000 tons annually during the first 5 months of the year, when high water at power developments permitted capacity operation. However, demand dropped off markedly in May, and in June the Reynolds Metals Co. closed its Longview, Wash., plant, giving up the power contract temporarily. Thereafter, disposals increased substantially, and by October aluminum was in strong demand. The Permanente Metals Corp. reported production from its Tacoma reduction works in November, as a result of the installation of the seventh generator at Grand Coulee Dam, but it was indicated that operation of the Longview plant would be delayed until completion of the eighth generator installation early in 1948.

Despite the growing requirements for aluminum in the United States, domestic production appeared to be limited to a peak rate of about 600,000 short tons annually by the availability of electric power. Toward the end of 1947 low water at several locations restricted primary aluminum output, and it was evident that some time must elapse before the growing demands for electrical energy throughout the country could be adequately satisfied. According to the Federal Power Commission, total power requirements in the fall of 1947 were 17 percent greater than in 1944, when war production was at a maximum, and the load in December was almost equivalent to the total national dependable capacity. Although increases in installed generator capacity are scheduled over the next few years, these are barely sufficient to cover existing commitments and do not allow for possible increase in the number of aluminum reduction units. Aluminum has made remarkable progress in new fields of use, but further gains evidently will be limited by the ability of the industry to expand.

During most of 1947 primary production was supplemented by a substantial flow of remelt ingot and choice scrap from Naval air stations and private contractors working on surplus Army planes, averaging almost 10,000 tons a month. In addition, all stocks of scrap held by the Office of Metals Reserve have been released. Actually, then, domestic consumption of aluminum has been much greater than primary production, and the end of the aircraft melting program in mid-1948 threatens a domestic shortage of aluminum of substantial proportions, unless consumption declines.

The reconstituted industry achieved a considerable degree of stability during the year in the production of primary metal, and the extraordinary quantity of secondary aluminum available to the three primary producers permitted an aggressive selling campaign that presumably accounted in large part for the increased demand for aluminum products. However, the matter of raw-material supplies presented a definite problem. Alcoa remained in the most favorable position with regard to bauxite production and furnished virtually all of Permanente's bauxite requirements for the Baton Rouge, La., alumina plant, as well as a small quantity of alumina. Reynolds held a purchase lien on the huge War Assets Administration stock pile of high-silica bauxite near the Hurricane Creek, Ark., plant and was therefore in a comfortable position for a while, but both Reynolds and Permanente were actively engaged in the development of alternate sources of supply.

The postwar readjustment of the aluminum industry was essentially completed during 1946 and was fully reviewed in this chapter of the 1946 volume. The industry operated during 1947 along the competitive lines achieved at that time, Alcoa operating approximately 330,000 tons or 51 percent of the total 649,000 tons operable rated annual reduction capacity, Reynolds, 190,000 tons or 29 percent, and Permanente, 129,000 tons or 20 percent. In addition, six units were held by the War Assets Administration for which power was not available; most of these had been high-cost producers during the war.

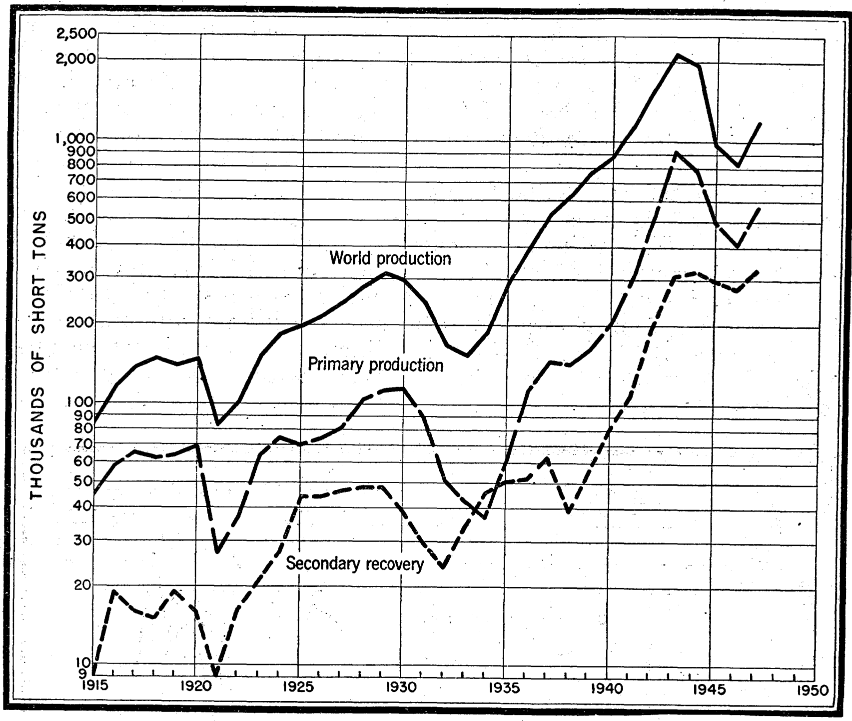

FIGURE 1.—Trends in world and domestic primary production and domestic secondary recovery of aluminum, 1915–47.

Secondary.—The recovery of secondary aluminum from scrap increased markedly in 1947, as melting operations on aircraft scrap reached a peak. In addition to the production of remelt ingot at Naval air stations, output was recorded in 1947 from five Army airfields, where large quantities of planes had been sold to private contractors for remelting. This intensification of effort in converting war scrap to usable metal resulted in an appreciable increase in the quantity of metal available for wrought products, as most of the remelt aircraft ingot was absorbed by the primary aluminum producers and incorporated into their product. The increase was only partly offset by slight declines in the recovery of secondary aluminum by custom smelters and by primary producers (directly from scrap and in addition to the use of remelt ingot mentioned above).

Detailed information regarding secondary aluminum in 1947 is given in the Secondary Metals—Nonferrous chapter of this volume.

CONSUMPTION AND USES

The apparent consumption of primary aluminum totaled 524,200 tons in 1947, as computed by the usual method of adding production and net imports and adjusting for producers' stock changes. This total was 13 percent greater than the 461,877 tons used in 1946, according to this method of calculating use. However, as pointed out in the 1946 chapter of this series, the large importation and subsequent holding by the Office of Metals Reserve of Canadian aluminum during the war years greatly distorted the apparent consumption, and for the purpose of presenting a truer picture of domestic aluminum consumption a modified set of figures was evolved, based on releases of Canadian aluminum from Reconstruction Finance Corporation inventories. These stocks, which at the end of 1946 were 71,760 tons, were reduced to 18,700 tons on December 31, 1947, and it was expected that this remaining tonnage would be released to industry during 1948. The adjusted apparent consumption figures for the years 1944 through 1947 are 671,072, 696,750, 575,687, and 571,760 tons, respectively. When this information is considered together with the absorption of large quantities of secondary aluminum during the years 1946 and 1947, it is evident that aluminum accomplished the transition to peacetime economy with little diminution of actual consumption.

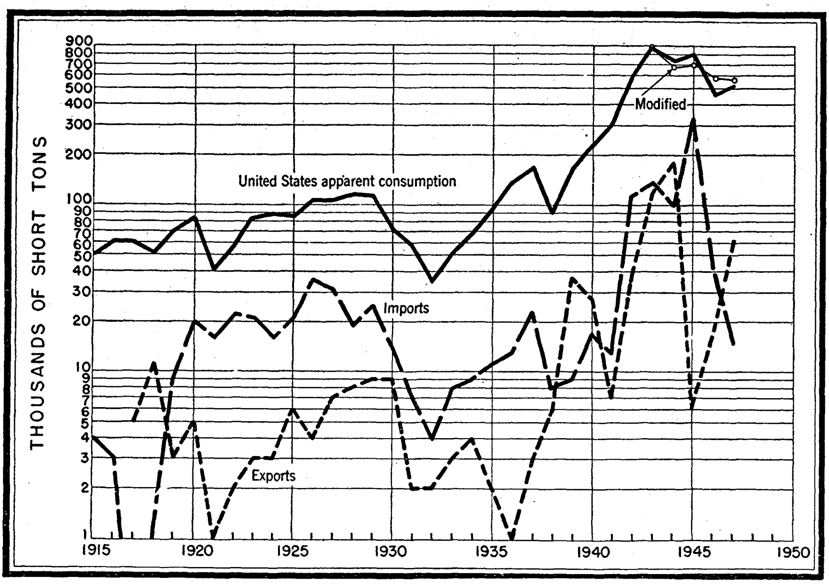

FIGURE 2.—Trends in imports, exports, and apparent consumption of aluminum, 1915–47.

If the modified figures for apparent consumption of primary aluminum are added to the figures for secondary recovery from old scrap only, the following total consumption figures are obtained (quantities in short tons):

Year	Apparent consumption of primary aluminum	Secondary aluminum recovered from old scrap	Total consumption
1939	167,646	37,763	205,409
1943	877,349	33,094	910,443
1944	[1] 671,072	22,899	693,971
1945	[1] 696,750	27,311	724,061
1946	[1] 575,687	90,535	666,222
1947	[1] 571,760	[2] 100,000	671,760

[1] Modified. [2] Estimated

It should be noted that the above figures do not include the huge quantity of new scrap and working stock aluminum that was absorbed by the industry after the close of the war, most of it during 1946. However, the most striking fact gained from the above summation is not that aluminum did not lose ground after the war but that total annual consumption over the past 4 years has been approximately 700,000 tons, or 3½ times the 1939 rate, and 100,000 tons more than the present annual operating capacity for primary aluminum!

Production, imports, exports, and apparent consumption of primary aluminum and production of secondary aluminum in the United States, 1943–47

Year	Primary aluminum					Secondary aluminum	
	Production		Imports (short tons)	Exports (short tons)	Apparent consumption [1] (short tons)	Short tons	Value [2]
	Short tons	Value					
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	325,645	93,264,728
1945	495,060	140,864,000	334,117	5,901	797,052	298,387	85,297,005
1946	409,630	115,812,000	42,607	16,694	461,877	278,073	78,639,044
1947	571,750	161,626,000	15,610	62,333	524,200	330,000	94,000,000

[1] Data not available on fluctuations in consumers' stocks. Withdrawals from producers' stock totaled 55,320 tons in 1944 and 26,334 in 1946; additions to producers' stocks totaled 60,787 tons in 1943, 26,224 in 1945, and 827 in 1947. Figures not adjusted for changes in Government stocks.
[2] Based upon average price of primary aluminum as reported to Bureau of Mines.

Aluminum made significant progress during 1947 in its invasion of fields of use formerly supplied by other metals, notably steel and copper. Information compiled by the Aluminum Co. of America indicated that, although the total quantity of aluminum consumed increased substantially during the year, the percentages that went into building products, transportation, household appliances, and power transmission also increased, so the progress made in those applications was doubly effective. The building trade was the best customer of the aluminum industry for the second successive year, as utility-grade sheet roofing and siding marketed by all three major producers prepared the way for industrial sheet, window frames, heating and ventilating ducts, nails, screens, thresholds, venetian blinds, awnings, etc., made of aluminum. Much of the progress made in sheet applications was due to the extreme shortage of galvanized steel sheet, but aluminum undoubtedly will retain a large share of the market thus gained (even after galvanized sheet becomes readily available) because of its durability.

Because aluminum is relatively lightweight, its use in transportation media increases payload and profit by reducing dead-weight tonnage hauled. This has accounted for a phenomenal increase in the use of the metal in trucks, trailers, and buses. Use in passenger cars also has exhibited a rising trend because of the shortage of steel and merchant pig iron. Consumption for aircraft production, although not great in 1947, should increase steadily in the immediate future as a result of expansion of the Air Force. In addition, larger quantities of aluminum are finding application in the textile and petroleum industries; in packing in the form of foil, collapsible tubes, cans, and closures; and in hardware, tools, and instruments.

STOCKS

In the monthly survey on primary aluminum production, it is necessary to measure output at the pot lines to make sure that no secondary aluminum is included. As a consequence, the stock figures reported cover only the inventories of pig aluminum at the reduction plants, and no measurement is taken at the ingot stage or other advanced stages. Stocks of pig aluminum at reduction plants at the end of 1947 were 15,549 short tons, compared with 14,722 tons at the beginning of the year. However, it should be noted that these inventories reached a peak of 78,054 tons on July 31, during the period of slack demand. Government stocks available for allocation dropped from 71,760 tons to 18,700 tons during the year.

PRICES

The base price of 99.0-99.5 percent primary ingot remained unchanged throughout 1947 at 15 cents a pound, having been at that level since the latter part of 1941. The price for primary pig was also unchanged at 14 cents a pound. Aluminum in ingot form thus maintained its price advantage over copper, which had been raised to a peak of 24 cents by at least one producer during May, and was stable at 21.5 cents during most of the year. This price disparity between the two metals was a significant factor in the increasing acceptance of aluminum for uses formerly supplied by copper.

Although the price of ingot as stabilized at 15 cents, it became evident in the latter part of the year that readjustments in pricing of semifabricated shapes were gradually raising the price of delivered aluminum to the eventual consumer. This increase, of course, was due principally to higher labor costs and affected nearly all forms in which the metal was marketed. As the increases continued into 1948, it appeared possible that the price advantage over copper would be neutralized. Despite these developments, demand for aluminum was becoming stronger at the close of the year, and the industry in 1948 faced the prospect of informal rationing of the product to customers.

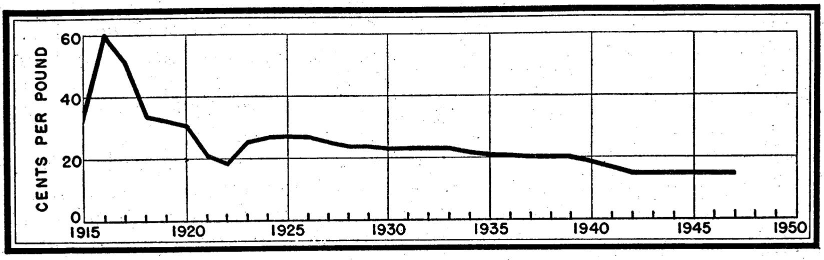

FIGURE 3.—Trend in average quoted prices of aluminum, 1915–47. Price is for No. 1 virgin metal 98–99 percent at New York through 1929; thereafter for 99-percent-plus virgin ingot, as reported by American Metal Market.

FOREIGN TRADE [2]

During 1947 foreign trade in aluminum experienced a reversal in export-import relationship, and the United States became a net exporter of aluminum for the first time since 1944. Imports of crude and semicrude metal (excluding scrap) totaled 15,610 tons, the smallest quantity since 1941. By far the greater part of this tonnage was received from Canada. By contrast, imports of aluminum scrap (much of it wrecked aircraft) reached a new high of 15,719 tons and were the largest since separate reporting of scrap was begun in 1939. Approximately three-fourths of the scrap received was from Canada, the remainder coming from 11 other countries.

Exports of crude and semicrude aluminum (excluding scrap) were nearly four times as great as in 1946 but were only one-third the

Aluminum imported for consumption in the United States, 1945–47, by classes

Class	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Crude and semicrude:						
Metal and alloys, crude	332,437	$96,932,769	41,487	$9,986,327	15,579	$3,723,514
Scrap	5,168	511,824	14,493	1,766,298	15,719	2,550,627
Plates, sheet, bars, etc	1,680	840,571	1,120	483,474	31	25,621
	339,285	98,285,164	57,100	12,236,099	31,329	6,299,762
Manufactures:						
Bronze powder and powdered foil	1,932	766,817	5	5,289	(1)	45
Foil less than 0.006 inch thick	100	92,661	57	61,287	41	70,058
Folding rules					(2)	11
Leaf (5½ by 5½ inches)			(3)	39,504	(3)	50,608
Table, kitchen, hospital utensils, etc	6	13,906	14	47,334	38	103,607
Other manufactures	(4)	212,085	(4)	74,447	(4)	79,631
	(4)	1,085,469	(4)	227,861	(4)	303,960
Grand total	(4)	99,370,633	(4)	12,463,960	(4)	6,603,722

1 Less than 1 ton.
2 Number: 26; equivalent weight not recorded.
3 Leaves: 1946, 6,710,636; 1947, 7,566,959; equivalent weight not recorded.
4 Quantity not recorded.

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.

record tonnage exported in 1944. Shipments of ingots and slabs during 1947, however, were still less than one-tenth the record 1944 exports, whereas shipments of plates, sheets, bars, etc., were only slightly lower than in 1944. Of the 1947 exports of ingots and slabs, 4,934 tons went to Argentina, 3,856 to Germany, 1,378 to Italy, 627 to Poland, and 512 to France. The remainder was distributed among 20 other countries. Of the 788 tons of scrap exported, the greater share, 547 tons, went to France. Semifinished shapes (sheets, plates, strip, rods, and bars) were exported to 84 countries, but 80 percent of the total was shipped to 16 countries, as follows: Philippine Republic, 12,373 tons; Union of South Africa, 4,294 tons; Venezuela, 3,390; Argentina, 3,247; Canada, 3,225; Mexico, 2,068; India, 2,012; Cuba, 1,743; Southern Rhodesia, 1,302; Sweden, 1,157; Brazil, 1,020; Belgian Congo, 1,016; Chile, 990; British East Africa, 805; British Malaya, 795; and Colombia, 757.

Aluminum exported from the United States, 1945–47, by classes

Class	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Crude and semicrude:						
Ingots, slabs, and crude	2, 269	$629, 599	1, 107	$305, 072	12, 098	$3, 578, 029
Scrap	802	102, 657	640	120, 522	788	181, 211
Plates, sheets, bars, etc	3, 632	2, 384, 131	15, 587	9, 706, 350	50, 235	29, 428, 940
	6, 703	3, 116, 387	17, 334	10, 131, 944	63, 121	33, 188, 180
Manufactures:						
Tubes, moldings, or other shapes	815	640, 352	1, 338	1, 130, 786	1, 983	2, 488, 997
Table, kitchen, and hospital utensils	177	313, 225	1, 860	3, 419, 792	2, 624	4, 469, 291
Foil and leaf	1, 306	1, 512, 419	1, 794	1, 570, 334	4, 860	4, 611, 598
Powders and pastes (aluminum and aluminum bronze) (aluminum content)	4, 214	2, 065, 398	435	473, 770	737	709, 446
Other manufactures	(1)	2, 258, 260	(1)	3, 557, 427	(1)	6, 764, 460
	(1)	6, 789, 654	(1)	10, 152, 109	(1)	19, 043, 792
Grand total	(1)	9, 906, 041	(1)	20, 284, 053	(1)	52, 231, 972

1 Quantity not recorded.

TECHNOLOGY

The year 1947 witnessed continued effort toward the expansion of technical knowledge furthering the applications of aluminum and toward furnishing new techniques and materials, which have broadened the field of use of the metal considerably in the past few years.

A new heavy-duty sheet was developed for industrial roofing and siding that was readily accepted for use on factories, warehouses, and similar structures. Improvement in welding technique facilitated a 400-percent increase in the production of aluminum window frames for homes and buildings, and specially developed alloy wire contributed to the steady gain in output of aluminum nails, a necessity in installing aluminum roofing and siding.

In the field of transportation a forward step was the production of forged-spoke and disk-type wheels for trucks and buses instead of the old cast wheels. In addition, aluminum's lightweight and chemical properties were responsible for increased application in railroad tank and hopper cars. In aviation, the new high-strength alloys such as 75S were replacing the older alloys in airframes (24S was most commonly used during the war).

Work in France on the development of light anti-friction alloys [3] was accelerated by the shortage of copper, lead, and tin. Two successful alloys resulted from the experimental work, one of them a lining metal containing small percentages of tin, lead, and antimony and the other a bearing metal containing tin, copper, magnesium, and manganese. General conclusions drawn from a series of tests were that light alloy bearings required greater clearance and more lubrication.

The successful production of aluminum-coated sheet steel [4] offers designers and engineers a new material of many desirable properties in that it combines the surface characteristics of aluminum with the mechanical and physical properties of steel. The weight of aluminum applied to both sides of the sheet is about 0.50 ounce per square foot, or a coating of approximately 0.001 inch on each side. The material possesses superior properties of corrosion resistance, heat reflectivity, and resistance to elevated temperatures and holds promise for such uses as warm-air heating-furnace combustion chambers and heat deflectors and oven liners in kitchen ranges.

WORLD REVIEW [5]

World production of aluminum in 1947 totaled approximately 1,073,000 tons, or 37 percent more than in 1946. Most of this increase was due to gains in the United States and Canada, the two largest producing countries. The accompanying table, includes revised figures for production in Switzerland for the entire period 1940–47. It also includes revised figures for Austria, France, Italy, Norway, and the United Kingdom for some of the years listed.

Australia.—It was announced early in 1947 that the combined alumina and aluminum reduction plant to be erected by the Australian Aluminum Production Commission would be located about 2 miles south of Launceston, Tasmania. In view of the necessity for power, the Tasmanian Parliament was to be asked for credit to build a dam in the area of the Tamar and South Esk Rivers. Bauxite would be supplied from deposits in Tasmania and on the Australian mainland. Supplies of aluminum ingot for Australian requirements continued to be met by distribution of wartime stocks of Canadian aluminum and by current imports from Canada. Shipments of ingot from Canada to Australia in 1947 totaled 3,650 tons.

Austria.—At the end of the war the three operable Austrian aluminum plants were in the occupation zone controlled by the Western Powers, and the partly completed plant at Engerau was in the Russian zone. The smaller plants at Lend and Steeg were idle throughout 1946 and 1947, but the Ranshofen plant achieved some production during a few months of 1947, working on residual stocks

[3] Metal Industry (London), Aluminum Bearings: Vol. 72, No. 3, Jan. 16, 1948, p. 47.
[4] Steel, Aluminum Coated Steel: Vol. 120, No. 13, Mar. 31, 1947, pp. 80, 81, 102, 104.
[5] Unless otherwise noted, metric tons used throughout this section.

World production of aluminum, 1940–47, by countries, in metric tons

[Compiled by B. B. Mitchell]

	1940	1941	1942	1943	1944	1945	1946	1947
Austria	6,675	21,415	35,071	44,201	40,097	5,250	1,039	3,595
Brazil	------	------	------	------	------	480	------	------
Canada	99,013	194,021	308,982	449,734	419,176	195,691	175,449	269,432
China:								
Formosa [1]	8,762	12,547	13,498	14,498	9,201	(2)	------	(2)
Manchuria	[1] 5,026	[1] 8,031	[1] 7,437	8,557	[3] 8,000	[3] 1,500	(2)	(2)
France	61,740	63,915	45,224	46,462	26,154	37,225	47,579	53,225
Germany	204,783	212,266	227,131	203,068	191,000	[3] 20,000	------	(2)
Hungary	3,190	4,980	5,960	9,460	[4] 13,190	[5] 2,300	[6] 687	1,970
India	------	------	------	1,292	1,751	[3] 1,500	[3] 2,000	[3] 2,400
Italy	38,790	48,195	45,430	46,200	15,241	2,584	10,629	23,341
Japan [1 3 7]	30,620	56,080	85,211	114,057	88,254	[8] 5,404	------	[9] 600
Korea	1,481	3,120	4,366	12,529	12,943	[8] 1,243	[3] 5,000	[3] 5,000
Norway	27,780	17,528	20,498	23,514	20,035	4,608	16,692	(2)
Rumania	------	------	------	------	------	(2)	(2)	(2)
Spain	1,295	1,120	742	797	206	592	1,007	(2)
Sweden (includes alloys)	1,563	1,094	1,294	3,572	3,723	3,236	3,566	(2)
Switzerland	28,300	25,588	23,665	18,526	9,686	5,029	13,083	18,458
U. S. S. R.	59,940	66,400	[3] 55,000	62,340	[3] 71,000	86,310	[3] 105,000	[3] 120,000
United Kingdom	19,264	23,030	47,528	56,557	36,038	32,432	32,067	29,384
United States	187,100	280,383	472,737	834,768	704,376	449,109	371,608	518,680
Yugoslavia (estimated)	2,000	2,000	2,000	2,000	1,000	(2)	(2)	(2)
Total [7]	787,000	1,042,000	1,402,000	1,952,000	1,671,000	856,000	786,000	1,073,000

[1] Fiscal year ended March 31 of year following that stated.
[2] Data not available; estimate by author of chapter included in the total.
[3] Estimated.
[4] January to June, inclusive.
[5] June to December, inclusive.
[6] January to May, inclusive.
[7] Preliminary; subject to revision.
[8] April to June, inclusive.
[9] Estimated primary portion of total production.

of bauxite. Production was halted in August 1947 because of the shortage of electricity, but the plant was expected to reopen in 1948. An agreement has been signed with France to exchange aluminum for bauxite in order that the output will be large enough to permit some supply for Austrian industry.

Canada.—Production of aluminum in Canada resulted from the growth of the industry in the United States. The Pittsburgh Reduction Co. (later to become the Aluminum Co. of America) established the Northern Aluminum Co. in 1899 and undertook the construction of a plant at Shawinigan Falls, Quebec. The first ingot was produced in 1901, and growth of the industry proceeded as world demand increased. The present huge plant at Arvida resulted from the purchase in 1925 by Alcoa of extensive water-power sites on the Saguenay River from the Duke group, which had been planning to found an aluminum enterprise in the area. These properties, which were transferred to Aluminum, Ltd., in 1928, were the nucleus of the expansion of the Canadian aluminum capacity at the beginning of World War II. As the area is accessible to ocean shipping and has vast electric power potential, the plants reputedly have achieved the world's lowest-cost aluminum reduction operation.

Canadian output in 1947 was 269,432 metric tons, of which the major portion was exported. This production came from the Arvida and Isle Maline plants, the other reduction plants at LaTuque, Beauharnois, and Shawinigan Falls having been closed since 1945. However, it was understood the Shawinigan Falls plant would resume operation at half capacity in 1948. These operations would consume almost all of the electric power currently available to the industry, and further expansion would depend on the diversion of power from other industries.

Canada exported 197,380 metric tons of aluminum to 46 countries during the year, the major recipient being the United Kingdom (98,925 tons). Of the total exported, 193,855 tons were in the form of ingots, bars, and blooms, and 3,525 tons were shipped as sheet, rod, and circles.

Of considerable importance to the Canadian industry was the United States tariff reduction on aluminum, which was announced in November and became effective January 1, 1948. The reduction from 3 cents to 2 cents a pound, coupled with the devaluation of the Canadian dollar, put the Aluminum Co. of Canada, Ltd., (Alcan) in position to compete in the United States market, even though the price of ingot was raised from 14 to 15 cents, Canadian. Alcoa was reported to have contracted for delivery of substantial tonnages of ingot in 1948 and 1949, and additional quantities may be made available to other firms in this country.

China.—There is no known instance of the commercial production of aluminum ingot in China proper, largely because hydroelectric power is not available although experimental ingot was produced at Kunming in 1943. Ingot production of significant proportions, however, was apparently obtained by the Japanese from plants at Takao (Kaohsiung) and Karenko on the island of Formosa. The Karenko plant was so badly damaged by bombing that it is not proposed to rehabilitate it, although the Taiwan Aluminum Co. is salvaging some equipment from it for use in rebuilding the Takao plant. Part of this latter plant was placed in operation toward the end of 1947, but actual tonnage of ingot produced was reportedly very small. Production by the end of February 1948 was expected to be at a rate of 4,000 tons annually, and complete rehabilitation of the two-pot-line plant should bring it to an annual capacity of 23,000 tons.

France.—Production of primary aluminum in France totaled a little more than half of theoretical capacity in 1947, being hampered by limited availability of power. With a production potential of 95,000 tons, the output of little more than 53,000 tons was insufficient to meet domestic demand. Additional ingot was imported from Canada and the United States, and the plant at Rheinfelden, in the French zone of Germany, was operated for a while, despite an Anglo-American protest of this breach of the Four-Power Agreement on German industry.

Domestic output of primary aluminum increased from 2,456 tons in January to a peak of 6,322 tons in July and then declined for the remainder of the year. However, primary production was supplemented by the recovery of approximately 22,000 tons of secondary aluminum from scrap during the year. Late in the summer the Government granted producers an increase in the price of ingot, to 82,000 francs per ton, but it was stated that the price was still uneconomic.

Germany.—Under the terms of the original Four-Power Agreement for the demilitarization of Germany, none of the eight primary aluminum plants that had been in operation in the country before and during the war was to be permitted to produce virgin aluminum, but those of the primary plants and the various secondary plants that were adaptable and operable were to be allowed to produce secondary ingot from aircraft scrap. By midyear 1947 even this production was being hampered by the lack of high-grade virgin metal, needed for bringing the secondary metal to specification. Partly to meet this requirement and partly to fill their own needs, the French permitted the operation for a short time of the plant at Rheinfelden, near the Swiss border and in the French zone. This operation was not long continued, because of Anglo-American objections. Of more assistance in filling the requirement for virgin ingot were imports from the United States and Canada. Exports from the United States to Germany were 3,856 short tons during the year and from Canada, 2,220 tons.

A special discussion of German aluminum plants and production was included in the 1946 chapter of this series.

Hungary.—Under the 3-year plan for industrial expansion in Hungary a goal of annual exports of aluminum has been set at 100 million dollars and will augment considerably the country's aluminum production capacity. Hungary has been an important source of bauxite for many years, but most of the material was processed in Germany, Austria, and Poland. The current situation presents an opportunity for Hungary to capture aluminum markets formerly supplied by those plants. In implementation of the 3-year plan the Council of Ministers adopted a bill late in the year to nationalize the bauxite, alumina, and aluminum industries.

In addition, it is reported that Hungary and Yugoslavia signed an agreement earlier in the year under which a joint effort is to be made to develop the aluminum industry in both countries. Details of the agreement are not available, but it is believed to involve integration of the two industries, with the help of Yugoslav electricity and caustic soda.

India.—Owing to the increased demand for aluminum in India, plans furthering the expansion of the industry continued to develop. The reduction works of the Indian Aluminum Co. in Travancore was reported to have reached a rate of about 5,000 tons; in addition, the Government of the Central Provinces was planning an installation of approximately 3,000 tons annual capacity.

Italy.—Although Italy lost approximately half its bauxite resources in the cession of the Istrian peninsula to Yugoslavia, the alumina and aluminum plants suffered relatively little damage during the war. The aluminum plant at Porto Marghera, which was damaged to some extent in pot-line and transformer installations, was sufficiently repaired by mid-1947 to resume operations, and the plants at Mori, Bolzano, and Borgofranco were already in production.

Output in 1947 totaled 23,341 tons, but the industry was believed to be operating at an annual rate of about 40,000 tons by the end of the year, or three-fourths of the rated capacity. The price of 99–99.5 percent aluminum ingot was quoted on the Milan nonferrous metal market in August at 200 lire per kilogram, but in September it was announced that the Italian Ministry for Commerce and Industry had fixed the price at 300 lire.

Japan.[6]—Commercial production of aluminum in Japan was begun

[6] Most of the data contained herein were derived from "Aluminum Metallurgy in Japan," Report No. 87, Natural Reserve Section, General Headquarters, Supreme Commander for the Allied Powers—republished as Special Supplement No. 19 to "Mineral Trade Notes," October 1947.

in 1934, but the country never became an important exporter of the metal, because the nation's economy was on a war basis during the entire period through 1945, when production was suspended. The industry was based on the ample supply of low-cost power in the home islands. The first successful alumina plants operated on bauxite from Bintan, Malaya, and Palau, but earlier plants had tried, unsuccessfully, to treat Korean alunite. Later plants were built both in Japan proper and in Korea and Manchuria to process aluminous shale from North China.

The growth of the industry under the existing military economy was phenomenal, the production of approximately 114,000 metric tons of aluminum in 1943 placing Japan in fourth place in world production for that year. Output declined rapidly thereafter under the pressure of the American attack and was discontinued entirely at the end of the war, to be resumed on a restricted basis in 1947.

Five companies operating eight reduction plants produced all of the primary aluminum in Japan proper. From the standpoint of annual productive capacity, the Showa Denko Co. and Nippon Keikinzoku Co. were the largest. All of the aluminum-metal producers except one also operated alumina plants. Nine other companies also operated alumina plants in Japan to supply reduction plants in Japan, Korea, Formosa, and Manchuria.

The metallurgy of aluminum in Japan followed closely the conventional methods developed in the United States and Europe, as about 95 percent of the total tonnage up to 1945 was produced by the standard Bayer and Hall-Heroult processes. However, in the development of lower-grade materials, about 20,000 tons of alumina were produced from aluminous shale by direct fusion in the electric furnace, approximately 16,000 tons from the same material, by the lime-soda-sinter process, and about 4,000 tons from alunite, clay, and aluminum phosphate, by alkaline and acid solvents.

During 1947 four of the reduction plants were operating, although the greater part of their production was from alumina produced by the caustic digestion of scrap. Showa Denko's Kitakata plant was operating on alumina produced partly from scrap and partly from bauxite. The Niigata plant of Nippon Keikinzoku produced a crude aluminum ingot from scrap and dross; the Kambara plant of the same company operated on alumina produced from scrap at the Shimizu works. At Niihama the Sumitomo company produced high-grade aluminum by refining duralumin scrap, as well as pig aluminum from alumina (the source of the alumina not being reported). It is estimated that primary aluminum produced from the Kitakata and Niihama operations totaled about 600 tons in 1947, the remainder of the 1947 output being secondary aluminum. Other operable plants of the aluminum industry were converted during the year to the production of salt, other chemicals, ferrosilicon, etc.

Norway.—Construction of the first half of the new aluminum plant at Aardal was completed during the year, and production began about the first of January 1948. Output was scheduled at an annual rate of 12,000 tons; completion of the second half of the plant would bring total capacity to 24,000 tons. This addition will place Norway's productive potential at approximately 50,000 tons a year.

At the time of the German invasion in 1940 Norway had six small aluminum plants with a total capacity of 35,800 tons. To this nucleus the Germans planned to add another six plants with an annual production capacity of 176,000 tons. All of the projects were begun at about the same time, and construction proceeded simultaneously, with the result that none of the plants was completed. After the war the Norwegian Government decided to complete only the Aardal plant, which seemed to have the best location and possibility of economical operation.

As Norway's home consumption of aluminum totals only about 4,000 tons annually, the completion of the Aardal works will add greatly to the country's export potential, and thus furnish an increased foreign exchange.

Switzerland.—Production in Switzerland sank to a low of 5,029 tons in 1945, owing to damage to alumina plants in combatant countries and wartime difficulties of transportation, power, exchange, etc., but has been rising since. Statistics on output during the past few years recently became avaliable and have been incorporated in the accompanying world production table.

U. S. S. R.—Reports received from several sources regarding the progress achieved in expanding the aluminum industry in the Urals are conflicting in detail, but the consensus is that the rate exceeds that called for by the current 5-year plan. It seems probable that the Volkhov plant (annual capacity, 10,000 tons) has been back in operation since 1946. At Kamenske the present capacity should be about 75,000 tons annually and at Stalinsk, an additional 10,000 tons. About 60,000 tons of the capacity planned at Bogoslovsk was probably in operation in 1947, as well as some capacity at the Dneiper plant; there is also the German Lautawerke plant, which was moved to Russia from Saxony in 1945 and was either re-erected as en entity or the equipment used in reconstructing other plants. It is possible that the capacity called for by 1950 in the current 5-year plan has already been exceeded, but it is doubtful whether the shortage of power, combined with other difficulties, has permitted capacity production. Capacity by the end of 1948 may exceed 200,000 tons, and plans are already developing for further power projects.

In view of the total lack of authenticated information, 1947 production is estimated at about 120,000 metric tons.

United Kingdom.—Consumption of aluminum in Britain continued at a high level in 1947, fostered largely by the Government's housebuilding program. Much of the aluminum consumed in housing was of secondary origin, and the aircraft-scrap melting program conducted by the Government contributed approximately one-third of the total supply of secondary aluminum.

The Government remained the sole purchaser and distributor of aluminum, and the prices set for standard 99-percent-plus ingot, governed by contract prices for Canadian aluminum, were the occasion of considerable comment in British metal journals. The price of £72¾ a long ton, which had prevailed since September 1946, was raised to £80 in March 1947, owing to efforts of the Ministry of Supply to average the cost of metal purchased at home and abroad. It was believed that the new price was still considerably lower than domestic production costs. Export control of aluminum was reimposed on September 15 in an effort to balance domestic material requirements against the ever-present need for increasing exports.

Antimony

By SAMUEL A. GUSTAVSON

GENERAL SUMMARY

SUBSTANTIAL gains in production of primary antimony, both from domestic and foreign ores, were reported in 1947. Domestic production from secondary sources also increased. The chief factors effecting these gains were record high peacetime prices and improving labor, supply, and transportation conditions. Industrial consumption of primary antimony decreased 5 percent from 1946. Industrial stocks, as of December 31, 1947, showed considerable decrease from those of a year earlier, whereas Government stocks increased.

Production of recoverable antimony from domestic antimony ores and concentrates in 1947 was estimated at 4,891 short tons (92 percent of 5,316 tons) and more than doubled the 1946 output. Imports for consumption were 8,539 short tons of recoverable antimony in ores (92 percent of 9,282 tons), 12 tons in needle antimony, and 5,879 tons as metal—a total of 14,430 tons. The total new supply of antimony available for consumption in the United States in 1947 from domestic antimony ores and imports, in terms of recoverable metal, was 19,321 short tons, about 50 percent of the estimated world production (exclusive of U. S. S. R.) of 38,400 short tons.

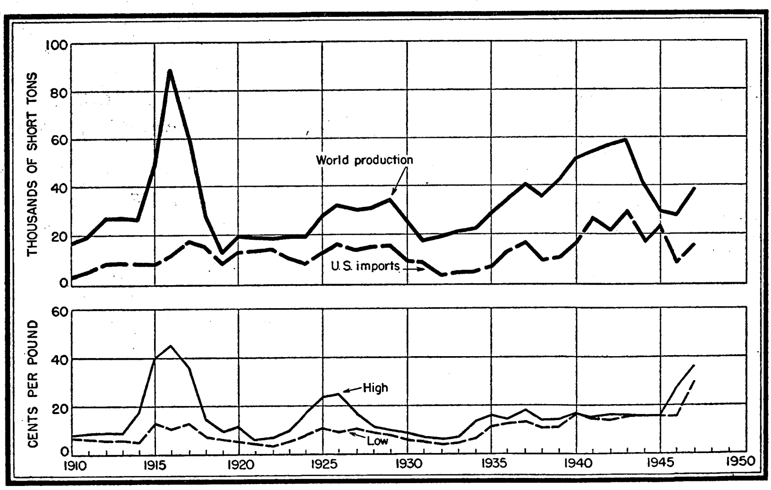

FIGURE 1.—Trends in world production, United States imports and New York price of antimony, 1910–47

Salient statistics for antimony in the United States, 1943–47

	1943	1944	1945	1946	1947
Production of primary antimony:					
Mine (antimony content) short tons	5,556	4,735	1,930	2,505	5,316
Smelter (antimony content) do	20,624	20,000	21,000	[1] 12,422	13,782
Production of secondary antimony do	15,483	15,886	17,148	19,115	22,984
Imports for consumption:					
Antimony in ore do	28,755	17,080	22,643	5,903	9,282
Needle or liquated antimony do	1				17
Metal do	932	293	627	2,593	5,879
Exports of antimony ore and metal [2] do	291	745	333	462	808
Consumption of primary antimony do	19,508	23,756	25,761	17,515	16,647
Average price of antimony at New York: [3]					
Chinese (nominal) cents per pound	16.50	16.50	16.50	16.50	(4)
American do	15.92	15.84	15.84	17.31	33.45
World production (estimated) short tons	58,500	40,100	29,400	28,000	38,400

[1] Revised figure.
[2] In addition, antimony compounds were exported as follows: 1943, 203 tons; 1944, 574 tons; 1945, 404 tons; 1946–47, not separately recorded.
[3] American Metal Market.
[4] Not quoted.

The average market price per pound for domestic brands of antimony metal at New York in 1947 was 33.45 cents, a 93-percent increase over the 1946 average of 17.31 cents.

Antimony remained under Government allocation as provided in War Production Board General Preference Order M–112 throughout 1947. The order was modified, effective September 3, 1947, so that an application was no longer required tor permission to ship antimony including exports, nor was it necessary for a purchaser to name his supplier. Other restrictions were retained. OMD continued to be the Government agency administering the order.

Exports to any country except Canada were subject to export license requirements, against an over-all export quota, of the Office of International Trade, United States Department of Commerce. Authorizations to receive antimony from the United States by companies or individuals in Canada are issued by OMD.

DOMESTIC PRODUCTION

MINE RPODUCTION

In 1947 only six mines—one each in Alaska, Arkansas, Idaho, Nevada, Oregon, and Washington—are reported to have produced ore, concentrates, or both for the antimony contained, compared with six in 1946 and eight in 1945.

Antimony-bearing ores and concentrates produced in the United States, 1943–47, in short tons

Year	Gross weight	Antimony content		Year	Gross weight	Antimony content	
		Quantity	Average percent			Quantity	Average percent
1943	16,785	5,556	33.1	1946	13,962	2,505	17.9
1944	13,501	4,735	35.1	1947	20,020	5,316	26.6
1945	14,966	1,930	12.9				

Alaska.—The Stampede Mines, Inc., was organized in 1947 to operate the Stampede mine in the Kantishna district. The company took possession of the mine September 6 and began operations in November.

Arkansas.—A small shipment of antimony ore was made from the Poor-Boy mine in Sevier County.

Idaho.—The Bradley Mining Co., the only producer in Idaho, supplied 97 percent of the antimony produced in the United States and Alaska in 1947. The company is now producing more than 5,000 tons of antimony metal a year. During the first part of the year the company produced only two concentrates—high-grade antimony low in gold and silver and low-grade antimony high in gold and silver. In the latter part of the year three concentrates were made—high antimony, medium antimony, and gold concentrate with as little antimony as possible.

Nevada.—Bratton & Blair is reported to have shipped antimony ore in 1947. Antimony properties of Tony Romano at Big Creek have been incorporated as the Big Creek Mining & Milling Co., and a new concentrating mill is being built. The mill will have a capacity of 50 tons in two shifts.

Oregon.—Anthony Brandenthaler operated the Gray Eagle mine in Baker County.

Washington.—Zenith Mines, Inc., operated the Zenith mine in Stevens County.

SMELTER PRODUCTION

Primary.—Primary antimony smelters produced 13,782 tons of antimony as metal, oxide, or sulfide during 1947—an increase of 11 percent over the 1946 output of 12,422 tons.

Antimony metal, alloys, and compounds produced in the United States, 1943–47, in short tons

Year	Primary metal, oxide, and sulfide (antimony content)	Antimonial lead produced at primary lead refineries						Alloys (antimony content) produced at secondary smelters and by remelters
		Gross weight	Antimony content					
			From domestic ores [1]	From foreign ores [2]	From scrap	Total		
						Quantity	Percent	
1943	20,624	63,515	1,591	494	1,286	3,371	5.3	15,483
1944	20,000	57,902	2,015	842	1,813	4,670	8.1	15,886
1945	21,000	56,495	1,749	243	2,156	4,148	7.3	17,148
1946	[3] 12,422	50,480	1,231	226	1,828	3,285	6.5	19,115
1947	13,782	86,075	1,460	571	2,902	4,933	5.7	22,984

[1] Includes primary residues and small quantity of antimony ore.
[2] Includes foreign base bullion and small quantity of foreign antimony ore.
[3] Revised figure.

Producers of refined products, including antimony metal from ores and concentrates in 1947, included the Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho; Foote Mineral Co., Philadelphia, Pa.; Harshaw Chemical Co., El Segundo, Calif.; McGean Chemical Co., Cleveland, Ohio; Metal & Thermit Corp., Carteret, N. J.; National Lead Co., Laredo, Tex. (plant purchased from the

Texas Mining & Smelting Co., December 31, 1946); and the Wah-Chang Trading Corp., Glen Cove, Long Island, N. Y.

A total of 86,075 tons of antimonial lead was produced by domestic primary lead refineries in 1947—an increase of 71 percent over 1946. This antimonial lead contained 4,933 tons (5.7 percent) of antimony—1,460 tons from domestic ores, 571 tons from foreign ores, and 2,902 tons from scrap. This antimony produced as a byproduct from domestic and foreign ores is in addition to domestic mine production and imports of antimony ores, concentrates, and metal. A detailed discussion of antimonial lead production is contained in the Lead chapter of this volume.

Secondary.—Recovery of antimony in antimonial lead, other alloys, and other products from scrap at primary smelters and secondary smelters, and by remelters totaled 22,984 short tons in 1947—an increase of 20 percent over 1946. Plates, grids, and sludge from discarded storage batteries continued to be the main source of scrap material. A detailed review is contained in the Secondary Metals—Nonferrous chapter of this volume.

CONSUMPTION AND USES

Primary antimony consumed in finished products, in 1947, not including antimony recovered in antimonial lead at lead refineries, was 16,647 short tons compared with 17,515 tons in 1946, according to OMD.

Industrial consumption of primary antimony, 1944–47, in short tons [1]

Product	1944	1945	1946	1947
Metal products:				
Ammunition	93	107	30	24
Antimonial lead [2]	5,287	5,920	4,827	6,172
Battery metal	2,341	1,273	1,084	
Bearing metal and bearings	2,637	2,825	2,886	2,056
Cable covering	422	275	79	61
Castings	115	267	233	129
Collapsible tubes and foil	114	203	121	77
Sheet and pipe	326	368	218	225
Solder	71	125	281	132
Type metal	841	1,243	1,903	1,216
Total metal products	12,247	12,606	11,662	10,092
Nonmetal products:				
Ammunition primers	43	66	15	16
Antimony trichloride	289	207	106	(3)
Flameproofed textiles	7,063	7,675	97	205
Frits and ceramic enamels	501	936	1,814	1,754
Glass and pottery	411	304	351	421
Matches	10	18	25	23
Paints and lacquers	2,490	3,062	1,662	1,324
Plastics	(3)	(3)	(3)	[4] 156
Rubber	(3)	(3)	(3)	39
Sodium antimonate	369	512	1,358	(3)
Other	333	375	425	2,617
Total nonmetal products	11,509	13,155	5,853	6,555
Grand total	23,756	25,761	17,515	16,647

1 Compiled from monthly applications filed with Office of Materials Distribution, U. S. Department of Commerce (formerly with War Production Board and Civilian Production Administration).
2 Includes miscellaneous metallic products.
3 Included with "Other." Bureau of Mines not at liberty to publish separate figures.
4 Consumption April through December; January through March included with "Other."

Processing losses of primary antimony at refineries, in addition to quantities consumed as shown in the accompanying table, were reported by OMD as 1,371 tons in 1944, 2,467 tons in 1945, 646 tons in 1946, and 2,049 tons in 1947. For this 4-year period processing losses averaged 7.2 percent.

STOCKS

Stocks of antimony raw materials—ores, concentrates, metal, oxide, and sulfides—held as mine, smelter, and consumers' stocks and by the Office of Metals Reserve (data on stocks in the National Strategic Stock Pile are not available) contained a total of 13,653 short tons of antimony, a 2-percent decline from 13,943 tons in 1946.

Stocks of antimony in the United States at year end, 1946–47, in short tons of contained antimony

[Office of Materials Distribution]

Raw materials	Dec. 31, 1946				Dec. 31, 1947			
	Industry		OMR	Total	Industry		OMR	Total
	Mine	Other			Mine	Other		
Ores and concentrates	146	5,139	1,703	6,988	95	3,047	260	3,402
Metallic antimony		1,975	2,929	4,904		1,563	6,546	8,109
Antimony oxide		1,967		1,967		2,015		2,015
Antimony sulfide (needle and precipitate)		84		84		127		127
	146	9,165	4,632	13,943	95	6,752	6,806	13,653

Antimony ores and concentrates stocked at smelters and manufacturers' plants at end of year, 1943–47, in short tons of contained antimony

[Office of Materials Distribution]

Ore and concentrates	1943	1944	1945	1946	1947
Chemical-grade sulfide ore	338	794	935	373	332
Metallurgical-grade sulfide ore	415	405	907	1,147	630
Mixed or oxide ore	920	990	500	407	789
Sulfide concentrates	1,484	855	1,904	3,212	1,296
	3,157	3,044	4,246	5,139	3,047

PRICES

The New York price of domestic brands of antimony in carlots, according to American Metal Market, averaged 33.45 cents a pound during 1947, compared with an average for less-than-carlots of 17.31 cents in 1946. The London price of metal, 99 percent minimum, which closed at £125 per long ton in 1946, opened in January 1947 at £150 and in the latter part of April rose to £180.

According to E&MJ Metal and Mineral Markets, opening and changes in nominal quotations for antimony ore, during 1947, per unit of antimony contained, were as follows:

	50-55 percent	58-60 percent	60-65 percent
Jan. 2	\$3.80-\$3.90	\$3.90-\$4.15	\$4.10-\$4.35
16	3.90- 3.95	4.00- 4.15	4.15- 4.35
Mar. 20	4.00- 4.10	4.10- 4.35	4.35- 4.55
June 12	4.25- 4.30	4.30- 4.40	4.40- 4.50
Aug. 7	4.40- 4.50	4.50- 4.60	4.60- 4.70
Sept 18	4.30- 4.40	4.40- 4.50	4.50- 4.60
Nov. 27	4.40- 4.45	4.50- 4.60	4.60- 4.70

The London price for 60- to 65-percent grades, per long-ton unit, opened in 1947 at 15s. to 17s. 6d., and recorded increases in January, February, May, June, and finally July, when it reached 23s. to 24s.

FOREIGN TRADE [1]

Imports.—General imports of antimony ore increased 45 percent in 1947. The average grade of ore was about 33 percent in 1947, compared with 30 percent in 1946. Antimony metal imports, the largest

Antimony imported into the United States, 1943–47, by countries [1]

[U. S. Department of Commerce]

Country	Antimony ore			Needle or liquated antimony		Antimony metal	
	Gross weight (short tons)	Antimony content					
		Short tons	Value	Short tons	Value	Short tons	Value
1943	63,435	28,854	\$5,360,057			932	\$267,916
1944	41,472	16,880	2,667,891			294	105,667
1945	49,543	22,736	4,641,036			627	181,557
1946							
Bolivia [2]	1,237	758	194,243				
Chile [2]	63	39	705				
China						1,720	587,401
Honduras	14	8	1,272				
Japan						873	237,297
Mexico	18,306	5,031	1,114,783				
Peru [2]	93	48	8,040				
Siam	31	21	5,074				
	19,744	5,905	1,324,117			2,593	824,698
1947							
Belgium and Luxembourg						56	35,280
Bolivia [2]	3,896	2,435	950,853			(3)	392
Canada	420	145	40,459				
Chile [2]	592	348	122,151				
China				17	\$7,914	5,815	3,446,422
Mexico	23,250	6,138	1,502,226				
Peru [2]	241	156	43,680				
Siam	25	12	3,747				
Turkey	112	53	15,414				
United Kingdom						28	17,853
	28,536	9,287	2,678,530	17	7,914	5,899	3,499,947

[1] Data include antimony imported for immediate consumption plus material entering the country under bond.
[2] Imports shown from Chile probably mined in Bolivia or Peru and shipped from a port in Chile.
[3] Less than 1 ton.

[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.

since 1941, were 127 percent greater than 1946. Needle or liquated antimony imports were resumed.

The estimated antimony content of type metal and antimonial lead imported for consumption was 187 short tons in 1947, compared with 246 tons in 1946 and 1,380 tons in 1945. For gross weight and value, see the Lead chapter of this volume.

Exports.—Domestic antimony exported in 1947 included 529 tons of ore and concentrates, and 279 tons of metal and alloys—a total of 808 tons, gross weight.

Reexports of foreign metal and alloys totaled 40 tons, gross weight. There were no reexports of foreign ores and concentrates.

Foreign antimony (regulus or metal) exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1943	(1)	$200	1946	139	$43,197
1944	18	5,445	1947	40	19,341
1945	463	141,301			

1 Less than 1 ton.

WORLD REVIEW

World production of antimony in recent years, insofar as data are available, is shown in the accompanying table.

Austria.—Austrian output in 1947 is reported at 2,683 metric tons of antimony ore, all from the Soviet Zone.

Bolivia.—See antimony review in The Mineral Industry of Middle and South America chapter of this volume.

Canada.—Mines in British Columbia supplied all the antimony produced in Canada during 1947. Production was 1,145,000 pounds valued at $382,430 (preliminary data). In 1946, production was 642,145 pounds valued at $96,322.

China.—Approximately 95 percent of the output of antimony comes from mines in Hunan Province, the remainder from Kweichow, Kwangsi, Kwangtung, and Yunnan. Most of the ores produced in China are high grade and are refined in China.

World production of antimony, 1939–47, by countries, in metric tons [1]

[Compiled by B. B. Mitchell]

Country	1939	1940	1941	1942	1943	1944	1945	1946	1947
North America:									
Canada	[2] 550	1,083	1,329	1,269	465	809	696	286	480
Honduras	--------	(3)	23	103	110	65	11	8	--------
Mexico [4]	7,243	11,286	10,241	10,759	12,585	10,056	8,053	6,046	6,371
United States	328	412	1,013	2,457	4,638	3,952	1,611	2,091	4,437
South America:									
Argentina	97	91	123	41	100	71	13	(3)	(3)
Bolivia (exports)	9,255	10,813	13,680	16,231	16,536	6,852	5,093	6,407	9,989
Peru	775	809	1,440	1,457	2,472	932	2,041	969	1,140
Europe:									
Austria	102	184	26	391	571	658	132	15	82
Czechoslovakia	[2] 1,012	[2] 1,104	1,645	[2] 3,130	(3)	(3)	1,115	2,156	1,434
France	--------	--------	--------	128	153	116	153	190	200
Greece	1	--------	--------	--------	--------	--------	--------	--------	--------
Hungary [2]	750	3,100	3,000	2,200	1,500	[5 6] 1,160	(6)	--------	--------
Italy	674	630	819	667	522	(3)	270	330	450
Portugal	174	247	46	(3)	[2] 115	[2] 39	6	5	(3)
Spain	22	3	101	210	176	128	108	96	84
Yugoslavia	3,759	5,791	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Asia:									
Borneo, British	14	41	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Burma [2]	163	305	(3)	843	843	843	(3)	(3)	(3)
China	[7] 12,017	[7] 8,469	[7] 7,989	[7] 3,510	[7] 505	[7] 203	--------	426	1,909
Indochina, French	22	10	4	1	11	25	(3)	--------	(3)
Iran [8]	(3)	1	19	(3)	18	2	--------	--------	(3)
Japan	125	180	250	350	600	450	210	49	100
Korea	26	21	(3)	(3)	(3)	(3)	--------	--------	--------
Siam [2]	(3)	(3)	--------	--------	22	54	41	(3)	104
Turkey (Asia Minor) [9]	460	240	80	40	8	58	33	36	103
Africa:									
Algeria	216	270	397	304	902	170	423	--------	110
Morocco:									
French	460	469	184	322	409	166	294	260	390
Spanish	54	67	85	144	153	72	52	103	128
Southern Rhodesia	50	101	83	169	164	116	29	15	38
Union of South Africa	6	126	445	990	1,560	2,570	2,250	2,330	3,020
Oceania:									
Australia	419	404	1,052	1,042	532	454	172	460	185
New Zealand	--------	1	8	(3)	--------	--------	--------	--------	--------
Total [10]	38,800	46,300	49,100	51,400	53,100	36,400	26,700	25,400	34,800

[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. U. S. S. R. produces antimony but data on production are not available.
[2] Estimate.
[3] Data not available; estimate included in total.
[4] Includes antimony content of antimonial lead.
[5] January to June, inclusive.
[6] Data represent Trianon Hungary subsequent to October 1944.
[7] Data represent area designated as Free China during the period of Japanese occupation.
[8] Fiscal year ended Mar. 20 of year following that stated.
[9] Revised data; previously shipments were listed in some cases in lieu of production data.
[10] Estimated by author of chapter. Excludes U. S. S. R.

Mexico.—See antimony review in The Mineral Industry of Middle and South America chapter of this volume.

United Kingdom.—British Empire production of ores has been unimportant, although meager quantities have been produced in Burma, Southern Rhodesia, and Sarawak. Great Britain's supplies of ore and metal came chiefly from Latin America and China.

Arsenic

By SAMUEL A. GUSTAVSON

GENERAL SUMMARY

PRODUCTION of white arsenic in the United States increased 84 percent in 1947 over that in 1946 and exceeded the 1935–39 average (17,091 short tons) by 10 percent. Imports for consumption in 1947 increased 1 percent over 1946. Producers' stocks of white arsenic increased from 471 tons on December 31, 1946, to 1,038 tons December 31, 1947.

Of the total white arsenic available for United States consumption in 1947, domestic production (from domestic and foreign ores) accounted for 57 percent and imports 43 percent. Apparent consumption of white arsenic during 1947 was about 1,700 tons less than new supply.

Although increased quantities of DDT (dichloro-diphenyl-trichloroethane) and other insecticides not containing arsenic were used in place of lead arsenate, calcium arsenate, and paris green in combating the cotton boll weevil, codling and gypsy moths, and other insects, the demand for arsenicals was strong throughout the year. The quotation for white arsenic was steady at 6 cents per pound.

Salient statistics for white arsenic in the United States, 1943–47

	1943	1944	1945	1946	1947
Production short tons	31,202	36,094	24,349	10,211	18,755
Imports for consumption do	16,112	9,965	13,149	13,822	13,940
Exports do	1,975	2,401	858	(1)	(1)
Consumption, apparent [2] do	48,235	40,025	38,100	27,000	31,000
Price per pound, end of year	$0.04	$0.04	$0.04	$0.06	$0.06

[1] Data not available.
[2] Producers' shipments, shipments to or from Government stocks, imports minus exports (exports estimated at 1,000 tons annually in 1946–47). Actual consumption was 51,083 short tons in 1943 and 43,500 tons in 1944 (differing from apparent consumption because of reductions in consumer stocks); actual consumption data for 1945–47 not available.

DOMESTIC PRODUCTION

Reports from producers indicate that the output of crude and refined white arsenic in the United States totaled 18,755 tons in 1947, an increase of 8,544 tons over 1946. This increase can, for the most part, be attributed to virtually uninterrupted production at all smelters producing arsenic in 1947.

Arsenic is produced in the United States chiefly as a byproduct of copper and lead smelting. Producers of arsenic included the American Smelting & Refining Co., at Tacoma, Wash., El Paso, Tex., and

Murray, Utah; Anaconda Copper Mining Co., at Anaconda, Mont.; and the United States Smelting, Refining & Mining Co., at Midvale, Utah. No white arsenic was produced by the Jardine Mining Co., Jardine, Mont., or Getchell Mine, Inc., Red House, Nev. Sodium arsenite solution for weed killer continued to be produced by the Shepherd Chemical Co., Cincinnati, Ohio.

White arsenic produced and shipped by producers in the United States, 1943–47

Year	Crude			Refined			Total		
	Production (short tons) [1]	Shipments		Production (short tons)	Shipments		Production (short tons)	Shipments	
		Short tons	Value [2]		Short tons	Value [2]		Short tons	Value [2]
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
1946	8,981	[3] 10,448	[3] 557,986	1,230	1,591	97,091	10,211	[3] 12,039	[3] 655,077
1947	17,636	17,119	1,424,316	1,119	1,069	109,440	18,755	18,188	1,533,756

[1] Excludes crude consumed in making refined. Includes crude white arsenic equivalent of compounds made directly from ores, flue dust, and speiss as follows: 1943, 172 tons; 1944, 443 tons; 1945, 112 tons; 1946, 180 tons; 1947, data not available for publication.
[2] Partly estimated.
[3] Revised to exclude 437 tons sold from Metals Reserve Company stocks which had previously been reported as sales to Metals Reserve Company.

As classified in the accompanying production table, crude white arsenic contains 95 to 98 percent As_2O_3 and refined white arsenic, 99 percent or more As_2O_3. Much of the crude arsenic is marketed without further refining. The arsenic reported as a refined product is not duplicated in crude arsenic statistics.

CONSUMPTION AND USES

Apparent consumption of white arsenic (domestic producers' sales plus imports minus estimated exports) was about 31,000 short tons in 1947 compared with 27,000 tons in 1946, an increase of about 15 percent. Domestic producers of white arsenic reported that production slightly exceeded their sales.

Data are not available on total domestic consumption of various arsenic insecticides and fungicides.

The major uses of arsenic and its compounds, in order of importance, are: As insecticides, weed killers, in the manufacture of glass, and as a wood preservative. Other uses include cattle dips, poison baits for rodents, in fire works, dyeing, printing, antiseptics, medicinals, as a reducing agent for silver, as an alloying element in the manufacture of antimonial lead and lead anodes, and as a flux or alloying element in the brass and white bearing metals with copper.

The principal arsenic insecticides are calcium arsenate ($Ca_3(AsO_4)_2$) lead arsenate ($Pb_3(AsO_4)_2$) and paris green (copper acetoarsenite). Sodium arsenite is used as a weed killer and a grasshopper bait. Wolman salts (25 percent sodium arsenate) and to a lesser extent zinc meta-arsenate are used as wood preservatives. Refined white arsenic (As_2O_3) is used in the glass industry.

In recent years non-arsenic-containing chemicals and compounds have competed with arsenic compounds with increasing success as insecticides, rodent controls, medicinals, and weed killers. DDT is rapidly replacing lead arsenate in controlling the codling moth. A dust containing DDT and benzene hexachloride is being increasingly used in place of calcium arsenate for control of the boll weevil. Sodium arsenate is being partly replaced as a weed killer by 2,4–D (dichlorophenoxyacetic acid) and modifications of this organic compound. Other replacements for arsenic compounds include thallium sulfate as a rodenticide (over 10 times as poisonous as arsenic compounds used for this purpose) and penicillin in place of arsenicals used in the treatment of venereal diseases.

Production of arsenical insecticides, consumption of arsenical wood preservatives, and production of arsenical drugs in the United States, 1943–47

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	
1943	[4] 36,978	[4] 37,427	1,944	769,316	53,516	83,026
1944	45,352	[4] 22,175	2,265	782,256	11,503	100,190
1945	[4] 35,261	[5] 12,889	(6)	732,154	17,980	[7] 36,759
1946	[4] 28,334	[4] 17,696	(6)	1,669,889	14,650	(6)
1947	15,094	23,594	(6)	1,149,224	(6)	(6)

1 Bureau of the Census, U. S. Department of Commerce.
2 Forest Service, U. S. Department of Agriculture.
3 War Production Board.
4 Revised figure.
5 January to November, inclusive.
6 Data not available.
7 January to June, inclusive.

STOCKS

Stocks of white arsenic held by producers on December 31, 1947, totaled 1,038 short tons, an increase of 567 tons over the 471 tons on hand December 31, 1946. Year-end stocks in 1946 were exceptionally low. Producers' and Government year-end stocks averaged 4,868 short tons from 1939 through 1945. Although data are not available it is believed that stocks of other arsenicals increased.

Producers and Government year-end stocks of arsenic compounds in the United States, 1943–47, in short tons

End of year	White arsenic			Calcium arsenate [1] (producers)	Lead arsenate [2] (producers)
	Producers	Government	Total		
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
1946	471	----------	471	(4)	(4)
1947	1,038	----------	1,038	(4)	(4)

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.
3 As of September 30; year-end data not available.
4 Data not available.

PRICES

White arsenic was quoted at 6 cents a pound (powdered, in barrels, carlots) throughout 1947, according to the Oil, Paint and Drug Reporter. Calcium arsenate was quoted at 9 cents per pound (in carlots at warehouse) until the latter part of March, when the price rose to 9.25 cents. Similarly lead arsenate was quoted at 20 cents per pound (in 6-pound bags) until March, then 21.25 cents per pound for the remainder of the year. The quotation for paris green (in kegs by carlot, freight allowed)—31 cents per pound—was unchanged during the year.

In 1947 London quotations for arsenic metal, 99 percent, was £400 per long ton until the middle of July, and then £400–£425 to the end of the year. Year-end quotations for white arsenic, ex store, were £38 5/16–£41 5/16 in 1946 and £41¾–£44¾ in 1947.

FOREIGN TRADE [1]

Imports.—Imports of white arsenic into the United States totaled 13,940 short tons in 1947, an increase of about 1 percent over 1946, when total imports were 13,822 short tons. As in the past, Mexico was the major source of imports, supplying 77 percent of the total; Russia supplied 10 percent, Sweden 9 percent, and Poland and Danzig, Peru, Canada, and others (three combined), 1 percent each.

Imports of white arsenic from Russia, first recorded in 1946, were about six times greater in 1947. Imports from Sweden were nearly twice that of 1946. Poland and Portugal appeared for the first time among countries shipping arsenic to the United States; France appeared for the first time since 1940.

Imports of metallic arsenic, virtually all from the United Kingdom declined from 92,064 pounds in 1946 to 18,928 pounds in 1947.

White arsenic (As_2O_3 content) imported for consumption in the United States, 1943–47, by countries

[U. S. Department of Commerce]

Country	1943		1944		1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Bolivia									11	$1,040
Canada	35	$2,349	5	$100	1	$73	275	$24,074	109	10,414
France									55	6,230
Mexico	15,974	870,380	7,654	424,911	9,665	533,305	10,309	571,483	10,710	773,133
Peru	103	3,945	2,306	120,344	3,483	154,595	2,345	100,693	150	16,394
Poland and Danzig									177	24,922
Portugal									55	8,207
Sweden							642	57,942	1,228	148,669
U. S. S. R							251	18,833	1,445	156,459
	16,112	876,674	9,965	545,355	13,149	687,973	13,822	773,025	13,940	1,145,468

Exports.—Exports of calcium arsenate in 1947 decreased 28 percent from those of 1946, whereas exports of lead arsenate increased 11 percent. Peru received 75 percent of the calcium arsenate exported in 1947, El Salvador 17 percent, Mexico 3 percent, and other countries

[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.

Arsenicals imported into and exported from the United States, 1943–47, by classes, in pounds

[U. S. Department of Commerce]

Class	1943	1944	1945	1946	1947
Imports for consumption:					
White arsenic (As_2O_3 content)	32, 224, 879	19, 929, 608	26, 297, 962	27, 641, 765	27, 879, 965
Metallic arsenic	6, 840	21, 395	51, 501	92, 064	18, 928
Sulfide	----	----	2, 226, 560	88, 184	44, 092
Calcium arsenate	514	----	----	----	----
Sheep dip	545	159, 867	197, 000	1, 460	83, 654
Sodium arsenate	133, 247	----	----	----	----
Lead arsenate	----	----	----	552	120, 000
Exports:					
White arsenic	3, 950, 657	4, 802, 932	1, 715, 855	(1)	(1)
Calcium arsenate	6, 384, 559	2, 411, 095	3, 499, 625	6, 877, 347	4, 967, 249
Lead arsenate	3, 054, 326	4, 265, 513	6, 339, 103	2, 795, 205	3, 103, 863
Paris green (cupric acetoarsenite)	1, 062, 640	1, 138, 435	456, 811	(1)	(1)

[1] Beginning Jan. 1, 1946, not separately classified.

the remaining 5 percent. Of the total lead arsenate exported in 1947, 29 percent was shipped to Argentina, 25 percent to Brazil, 10 percent to Cuba, 7 percent to China, and 29 percent to all other countries. Data concerning exports of white arsenic and paris green were not separately classified in 1946 or 1947.

WORLD REVIEW

The world production record of white arsenic in recent years, insofar as data are available, is shown in the following table.

World production of white arsenic, 1938–47, by countries, in metric tons [1]

[Compiled by B. B. Mitchell]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
Australia (Western Australia)	4, 063	1, 439	3, 385	3, 432	2, 771	2, 320	2, 341	2, 021	1, 651	1, 210
Austria [2]	(3)	(3)	(3)	(3)	36	310	(3)	(3)	(3)	(3)
Belgium - Luxembourg (exports)	2, 706	3, 332	(3)	722	299	15	----	----	(3)	(3)
Brazil	519	713	1, 088	1, 172	900	970	840	962	829	(3)
Canada	987	790	950	1, 605	3, 562	1, 430	1, 192	928	338	334
China	[4] 100	[4] 100	[4] 80	----	----	(3)	(3)	(3)	(3)	(3)
France	7, 578	5, 993	7, 034	4, 792	4, 882	4, 837	1, 704	1, 530	(3)	(3)
Germany	[5] 2,845	[2] 1,259	[2] 1,507	[2] 1,393	[2] 1,616	[5] 560	[5 6] 579	(3)	(3)	(3)
Greece	77	113	117	(3)	(3)	(3)	(3)	(3)	(3)	14
Italy	810	1, 151	1, 283	541	356	(3)	(3)	(3)	(3)	(3)
Japan	[7] 3,474	[7] 3,541	[7] 3,835	[7] 3,506	[7] 2,093	[8] 2,284	[8] 1,415	(3)	767	1, 302
Korea	132	(3)	(3)	(3)	(3)	(3)	(3)	----	----	----
Mexico	8, 894	7, 063	9, 268	12, 844	18, 520	20, 301	15, 306	15, 013	9, 648	9, 685
New Zealand	----	----	----	----	8	8	16	17	18	8
Peru	----	----	----	----	7	1, 195	6, 900	2, 717	753	608
Portugal [2]	90	323	311	404	393	446	263	243	64	(3)
Rumania	3	----	----	----	----	----	(3)	(3)	(3)	(3)
Southern Rhodesia	19	----	5	----	175	1, 681	857	624	216	415
Spain	11	(3)	14	94	222	239	337	393	440	484
Sweden [2]	21, 480	10, 200	(3)	(3)	883	810	3, 044	6, 119	(3)	15, 000
Union of South Africa	----	----	----	----	----	----	----	100	12	3
United Kingdom	66	62	134	68	74	98	67	50	(3)	(3)
United States	15, 136	20, 267	22, 664	29, 466	26, 019	28, 306	32, 744	22, 089	9, 263	17, 014
Total [9]	69, 000	56, 500	53, 400	60, 300	63, 000	66, 400	68, 100	55, 200	38, 000	53, 000

[1] Arsenic is also believed to be produced in Czechoslovakia, Hungary, Iran, Poland, Spanish Morocco, Turkey, and U. S. S. R., but data are not available.
[2] Arsenic content of ore mined.
[3] Data not available; estimate by author of chapter included in total.
[4] Estimate.
[5] Exports.
[6] January to July, inclusive.
[7] Preliminary data for fiscal year ended Mar. 31 of year following that stated.
[8] Incomplete data.
[9] Estimated by author of chapter; excludes estimates for countries listed in footnote 1.

Bolivia.—Exports of white arsenic from Bolivia into the United States in 1947 were the first recorded since 1925.

Canada.—Virtually all 1947 production of crude and refined arsenic, excluding arsenic in ores exported from British Columbia, was from the Province of Quebec. Production was 736,000 pounds valued at C$47,800. Production in 1946 was 745,885 pounds valued at C$38,-264, of which 420,654 pounds valued at C$21,580 were from Quebec and 325,230 pounds valued at C$16,684 from Ontario. Exports of crude and refined arsenic during 1947 totaled 436,940 pounds valued at C$176,697. In 1946 exports totaled 171,830 pounds at C$74,252.

Mexico.—There was virtually no change in the rate of white arsenic production in 1947 from that of 1946. The major producers are the San Luis Potosi plant of Cia. Minera Asarco (American Smelting & Refining Co.) and the Torreon plant of Cia. Minera de Penoles (American Metal Co.). The United States received most of the white arsenic exported. Other countries to which Mexican white arsenic was exported include Canada, Uruguay, and the Netherlands, each receiving less than 100 tons.

Poland.—It is reported that arsenic is being produced under state control in Lower Silesia from arsenic-bearing ores.

Portugal.—Portuguese sources of arsenic ore are arsenopyrite deposits near Aveirs, argentiferous pyrite deposits near Vila Real, and arsenopyrite and cassiterite deposits near Braganza. White arsenic was shipped from Portugal to the United States in 1947 for the first time.

Spain.—Arsenic ores are produced in Leon, Lugo, and Salamanca Provinces.

Sweden.—Boliden Mining Co.'s annual report states that plants erected in 1946 for refining arsenic were brought to capacity operation during 1947, and output of refined white arsenic and metallic arsenic was the highest in history.

Arsenic is recovered as a byproduct in roasting copper, gold, and silver ore from the Boliden Mining Co. deposits at Boliden and is refined in the company plants at Skelleftehamn, a village about 10 miles south of Skellefteå. Most of the output in the last several years has been stored. The quantity of crude material now on hand is sufficient to meet the world demand for several years.

Union of South Africa.—Only 3 short tons of white arsenic were produced and sold locally in 1947 compared with 13 short tons in 1946.

Asbestos

By LAWRENCE G. HOUK AND F. M. BARSIGIAN

GENERAL SUMMARY

ASBESTOS is a group term including several mineral varieties having different compositions, value, properties, and uses. The bulk of the asbestos consumed is of the chrysotile variety, and considerable quantities of amosite and blue (crocidolite) are required for special uses. Tremolite, anthophyllite, and actinolite have minor significance. Certain grades of amosite and long-fiber, low-iron chrysotile have been designated as strategic, and Congress has authorized stock piling, but shortage of supply on the world market has limited procurement. Although the United States produces no amosite or blue and only about 6 percent of its chrysotile requirements, it consumes a major part of the world's production. Domestic consumption rose to 616,787 short tons, a 34-percent increase over 1946, while domestic production reached a record 25,139 short tons, a 74-percent increase over 1946, but only 4 percent of our volume requirements. Imports provided 96 percent of the asbestos used in the United States in 1947; Canada supplied 91 percent, while Southern Rhodesia and the Union of South Africa together supplied 5 percent. Demand exceeded supply throughout 1947, and industry stocks were low. Demand for virtually all commercial grades increased and was particularly strong for fiber used in asbestos-cement products and floor tile. Domestic production came principally from Vermont, with minor amounts from Arizona, North Carolina, Georgia, and California. Prices of all grades of Canadian and Vermont fiber (except Canadian Crude No. 1) increased in 1947. Canada led in world production, with about 69 percent of the estimated world total.

Salient statistics of the asbestos industry in the United States, 1946–47

	1946		1947	
	Short tons	Value	Short tons	Value
Domestic asbestos—				
Produced:				
Chrysotile	13,989	(1)	24,462	(1)
Amphibole	437	(1)	677	(1)
Total produced	14,426	(1)	25,139	(1)
Sold or used by producers:				
Chrysotile	13,645	$499,260	23,586	$912,340
Amphibole	430	5,504	449	6,218
Total sold or used by producers	14,075	504,764	24,035	918,558
Imports (unmanufactured)	456,688	18,731,378	594,839	29,821,519
Exports (unmanufactured)	11,011	1,395,367	2,087	316,414
Apparent consumption [2]	459,752	17,840,775	616,787	30,423,663
Exports of asbestos products	(1)	9,263,092	(1)	12,823,480

[1] Figure not available.
[2] Quantity sold or used by producers, plus imports, minus exports.

RESERVES

The following statement on reserves of asbestos in 1944 was prepared by the Bureau of Mines and Geological Survey and is quoted from a report on The Mineral Position of the United States, published in the hearings before a subcommittee of the Committee on Public Lands, United States Senate, Eightieth Congress, First Session, 1947:

Because of the generally inadequate data on the extent of chrysotile deposits in the United States, or the quality or grade of the contained asbestos, estimates of reserves are only approximate. On the basis of present information it is believed that the United States reserves of chrysotile asbestos of all grades total about 750,000 short tons, of which not more than 4,000 tons consist of long fiber. The annual domestic demand for long-fiber chrysotile is about 17,000 tons.

PRODUCTION

A record volume of 25,139 short tons of asbestos was mined in 1947, 74 percent more than in 1946. Vermont and Arizona produced chrysotile, while North Carolina, Georgia, and California produced amphibole. No new domestic deposits have been reported, although prospecting has been active.

Asbestos sold or used by producers in the United States, 1943–47, by varieties

Year	Chrysotile		Amphibole		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1943	3,900	$302,289	2,114	$32,526	6,014	$334,815
1944	6,275	373,112	392	7,222	6,667	380,334
1945	11,986	442,056	240	3,989	12,226	446,045
1946	13,645	499,260	430	5,504	14,075	504,764
1947	23,586	912,340	449	6,218	24,035	918,558

Alaska.—The Arctic Circle Exploration Co., Candle, Alaska, has produced tremolite and chrysotile from the Kobuk River district in recent years, but no production was reported for 1947.

Arizona.—The Arizona Chrysotile Asbestos Co., Globe, mined and milled fiber from the Regal mine. Guy G. Phillips of Globe produced from the Phillips mine. Arthur Enders purchased, milled, and resold asbestos but did not mine in 1947. Charles Ireland of Globe produced a small quantity from the Fiber King mine, Gila County. Total sales of asbestos fiber were higher than in 1946. A recent report [1] described Gila County deposits.

California.—Homer E. Fenn, Hazel Creek, reported tremolite production from the Loma Blanca mine, Shasta County. H. Zimdars and J. Delume reported amphibole production from Placer County, and the Powhatan Mining Co. (Woodland, Baltimore, Md.) produced tremolite from near Castella, Shasta County. Ray J. Sylvester of Mount Shasta produced tremolite in Shasta County near Dunsmuir.

Georgia.—Powhatan Mining Co. was the sole producer of amphibole. The mine is near Dillard, Rabun County.

North Carolina.—The Powhatan Mining Co. was the only producer in North Carolina. The mine is near Dillard, Ga., just across the State line in Macon County, N. C.

[1] Stewart, Lincoln A., and Haury, P. S., Arizona Asbestos Deposits, Gila County, Ariz.: Bureau of Mines Rept. of Investigations 4100, 1947, 28 pp.

Vermont.—The Ruberoid Co., 500 Fifth Ave., New York 18, N. Y., was the largest producer of asbestos in the United States in 1947. The mine is near Eden, Vt. Output (all chrysotile) was substantially greater than in 1946.

CONSUMPTION AND USES

The apparent domestic consumption of asbestos in the United States increased 34 percent in volume and 71 percent in value in 1947. Of the total consumption of asbestos about 97 percent is chrysotile, 2 percent amosite, and 1 percent blue. The major part of our chrysotile requirement is for grades that are used in asbestos-cement products, and a smaller amount for friction materials, insulating materials, textiles, molded products, packing, and gasket materials. Nearly all of the amosite is used for insulating products, and the blue for asbestos-cement pipe. Imported chrysotile is used for textiles and insulation.

Apparent consumption of raw asbestos in the United States, 1938–47

Year	Short tons	Value	Year	Short tons	Value
1938	187,150	$6,119,249	1943	445,902	$23,351,483
1939	255,547	9,388,496	1944	389,241	18,864,291
1940	262,199	10,259,836	1945	[1] 378,030	15,926,622
1941	438,741	18,309,005	1946	459,752	17,840,775
1942	[1] 433,949	21,582,096	1947	616,787	30,423,663

[1] Revised figure.

Figure 1 shows the relation of construction and industrial production to asbestos consumption from 1920 to 1947.

The value of asbestos-cement products manufactured in 1947 is estimated by the trade to be approximately 50 million dollars.

The demand for all grades of raw fiber was strong during 1947.

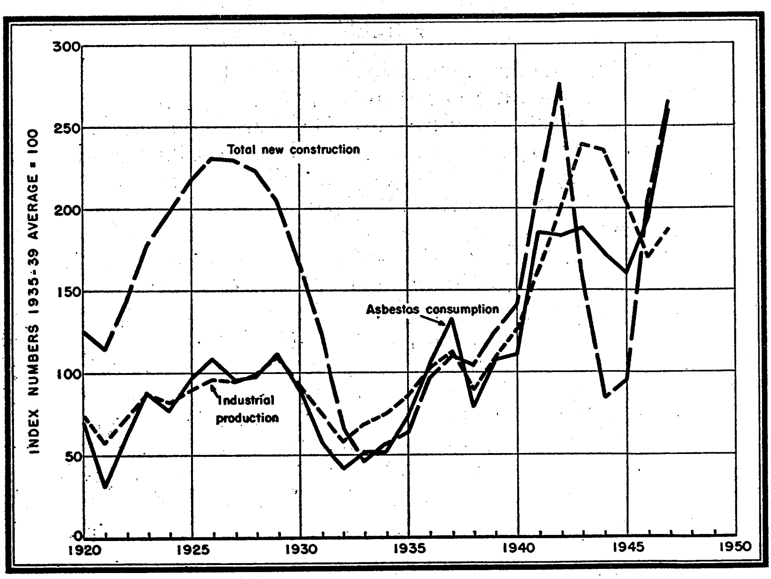

FIGURE 1.—Consumption of asbestos compared with total new construction and industrial production, 1920–47. Units are reduced to percentages of the 1935–39 average. Statistics on value of construction from Bureau of Foreign and Domestic Commerce and on industrial production from Federal Reserve Board.

Shortage of fiber limited production of asbestos cement, corrugated and flat products, asbestos paper, and brake lining. In the textile line there was some decrease in demand. In the electrical and oil-burner-wicking business, demand was below expectation, while that for friction materials, safety clothing, and packing increased. The demand for asbestos mill board was steady.

Each variety of asbestos is marketed under a different set of specifications. Chrysotile is generally sold on a basis of fiber length; yet fiber strength, flexibility, and color are important considerations. Blue is valuable for fiber length, strength, and chemical resistance, amosite for its heat-insulation properties, and tremolite for its resistance to acids.

The following new products were reported [2] during 1947: Stonekote finish for buildings, tea towels of asbestos cloth, the Unibond process for relining brakes, "Rayflex"—an aluminum and asbestos roof coating, "Thermoflex" insulating blanket used in jet propelled aircraft, "Vee"-type packing, and low-density asbestos cement board. A more efficient railroad disk brake of asbestos composition was developed.

According to the magazine Asbestos about 50 patents were issued in 1947 on asbestos products; 6 were on friction materials, 7 on heat insulation materials, 5 on packing and gaskets, 8 on asbestos cement products, 3 on opening fiber, and the remainder on a miscellaneous assortment of uses. The world's largest brake lining, for use on a 22-foot hoist drum, was reported to have been made in 1947. There has been comparatively little progress in the development of synthetic fiber.

A new type of very thin asbestos paper (Terratex) was developed by the General Electric Co. for use as insulation in high-temperature electrical equipment.

Several publications on asbestos have been issued recently.[3]

PRICES

The price of all grades of crude and milled asbestos fiber, both Canadian and Vermont, increased in 1947 with the exception of Crude No. 1 Canadian, which remained at $800 per short ton throughout the year. Canadian prices were increased in February and again in November. The range of prices for Canadian Fiber in U. S. dollars, f. o. b. mine, as of January 10, 1947, per short ton, as quoted in the magazine, Asbestos, was as follows: Group 1 (Crude No. 1), $800; group 2 (Crude No. 2, Crude Run-of-Mine, and Sundry), $275–$495; group 3 (Spinning or Textile Fiber), $155–$286; group 4 (Shingle Fiber), $75–$102.50; group 5 (Paper Fiber), $52.50–$59; group 6 (Waste, Stucco, or Plaster), $39; group 7 (Refuse or Shorts), $17.50–$34. The prices on January 10, 1948, were: Group 1, $800; group 2, $302.50–$545; group 3, $170.50–$354.50; group 4, $82.50–$127.50; group 5, $58–$73.50; group 6, $43–$47.50; group 7, $19.50–$44.50.

The price of Vermont asbestos in short tons, f. o. b. Hyde Park or Morrisville, Vt., on January 10, 1948, was as follows: Shingle Fiber, $92.50–$102.50; Paper Fiber, $65–$73; Waste, Stucco, or Plaster, $48.50; Refuse or Shorts, $25.50–$44.50.

[2] Asbestos, vol. 29, No. 6, December 1947, pp. 4 and 6.

[3] OTS, U. S. Department of Commerce, Technical and Scientific Development Related to the Asbestos Industry of Germany, PB78290. 1947, 48 pp. Bowles, Oliver, Silk of the Mineral Kingdom, published by Ruberoid Co., December 1946, 39 pp. Construction Division, Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Asbestos Cement Products, March 1948, pp. 7-12.

FOREIGN TRADE [4]

In 1947 imports increased 30 percent in quantity and 59 percent in value, while the volume of exports declined 81 percent compared with 1946.

As the United States depends upon foreign sources for 94 percent of its chrysotile, 100 percent of its amosite, and 100 percent of its blue requirements, an increase in foreign production will be necessary if the current domestic demand is to be satisfied. Meanwhile, conservation programs are required, and substitute materials utilized.

Asbestos imported for consumption in the United States, and asbestos and asbestos products exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Asbestos (unmanufactured)				Manufactured asbestos products—exports (value)
	Imports		Exports		
	Short tons	Value	Short tons	Value	
1943	440, 255	$23, 053, 524	367	$36, 856	$4, 877, 864
1944	383, 049	18, 542, 940	475	58, 983	5, 614, 243
1945	374, 354	16, 317, 752	8, 550	837, 175	7, 264, 288
1946	456, 688	18, 731, 378	11, 011	1, 395, 367	9, 263, 092
1947	594, 839	29, 821, 519	2, 087	316, 414	12, 823, 480

Asbestos (unmanufactured) imported for consumption in the United States, 1946–47,[1] by countries and classes

[U. S. Department of Commerce]

Country	Crude (including blue fiber)		Mill fibers		Short fibers		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1946								
Australia	24	$1, 804					24	$1, 804
Brazil	(2)	78					(2)	78
Canada	521	228, 073	153, 002	$10, 362, 252	288, 550	$6, 604, 040	442, 073	17, 194, 365
China	313	62, 206					313	62, 206
Italy	6	4, 320	2	2, 655			8	6, 975
Southern Rhodesia	5, 239	723, 381	224	25, 231			5, 463	748, 612
Union of South Africa	6, 050	574, 106					6, 050	574, 106
U. S. S. R.	2, 750	142, 294					2, 750	142, 294
United Kingdom	(2)	63					(2)	63
Venezuela			7	875			7	875
	14, 903	1, 736, 325	153, 235	10, 391, 013	288, 550	6, 604, 040	456, 688	18, 731, 378
1947								
Australia	(2)	198					(2)	198
Canada	497	264, 148	162, 302	13, 936, 784	396, 480	11, 053, 272	559, 279	25, 254, 204
Italy	4	2, 318	4	4, 855			8	7, 173
Southern Rhodesia	[3] 8, 894	[3] 1,735,167	98	15, 484			[3] 8, 992	[3] 1, 750, 651
Union of South Africa	20, 031	2, 144, 528			3	88	20, 034	2, 144, 616
U. S. S. R.	6, 524	663, 788					6, 524	663, 788
United Kingdom	1	705					1	705
Venezuela			1	184			1	184
	35, 951	4, 810, 852	162, 405	13, 957, 307	396, 483	11, 053, 360	594, 839	29, 821, 519

[1] Changes in Minerals Yearbook, 1946, p. 148, are as follows: 1945: Mill fibers, Canada, 137,764 tons, value, $9,109,641; total, 355,798 tons, $14,217,366. Crude, Southern Rhodesia, 2,670 tons, $560,022; total, 2, 670 tons, $560,022. Totals: Crude, 19,336 tons, $2,394,244; mill fibers, 137,764 tons, $9,109,641; total, 374,354 tons, $16,317,752.

[2] Less than 1 ton.

[3] Includes 67 tons valued at $17,778 reported by the U. S. Department of Commerce as originating in Mozambique.

[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.

The United States imports about 85 percent of the Canadian production, 66 percent of the Union of South Africa production, and 17 percent of the output from Southern Rhodesia.

The following table shows exports of asbestos products in 1946 and 1947. The value of exports increased 38 percent.

Manufactured asbestos products exported from the United States, 1946–47,[1] by kinds

[U. S. Department of Commerce]

Products	1946		1947	
	Quantity	Value	Quantity	Value
Brake blocks..........short tons..	220	$321, 387	312	$494, 165
Brake lining:				
Molded and semimolded..........do....	1, 248	1, 837, 752	1, 654	2, 907, 716
Not molded..........linear feet..	740, 670	368, 680	949, 449	552, 244
Clutch facing..........number..	1, 196, 241	500, 046	1, 636, 400	794, 688
Paper, millboard, and roll board..........short tons..	653	141, 837	1, 078	272, 823
Pipe covering and cement..........do....	1, 103	145, 010	2, 765	510, 887
Sheets..........do....	3, 644	434, 784	5, 292	641, 069
Textiles, yarn, and packing..........do....	2, 327	2, 674, 573	2, 101	2, 622, 055
Asbestos roofing..........squares..	129, 728	806, 182	164, 114	1, 152, 621
Other asbestos manufactures, except roofing..short tons..	4, 870	939, 215	(2)	1, 186, 845
Magnesia and manufactures..........do....	17, 423	1, 093, 626	(2)	1, 688, 367
	....	9, 263, 092	....	12, 823, 480

[1] Changes in Minerals Yearbook, 1946, p. 149, are as follows: 1945: Other asbestos manufactures, except roofing, should read 6,049 tons, $1,208,301. Total value should read $7,264,288.
[2] Effective Jan. 1, 1947, quantity not recorded.

WORLD REVIEW

Sixty-nine percent of the estimated world production is from Canada. Although there are no recent data on Russian production, past records indicate that it ranks second; Southern Rhodesia is third, Union of South Africa fourth, Swaziland fifth, and the United States sixth.

About 81 percent of the estimated world production is furnished by areas under the political control of the British Empire. With the exception of Russia, the major asbestos-consuming countries of the world produce little or no asbestos.

World production of asbestos, 1943–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1943	1944	1945	1946	1947
Argentina	349	292	153	(2)	(2)
Australia:					
New South Wales	422	2,598	2,674	(2)	(2)
South Australia	11	6	7	8	(2)
Tasmania	19	105	281	----------	(2)
Western Australia	247	313	1,109	380	(2)
Bolivia (exports)	22	13	61	(2)	[3] 76
Canada (sales) [4]	423,831	380,349	423,559	506,371	600,391
Chile	(2)	(2)	313	280	(2)
China	[5] 20,000	(2)	(2)	(2)	(2)
Cyprus (exports)	1,189	1,983	3,125	5,993	6,369
Egypt	7	240	[3] 50	65	(2)
Finland [6]	7,466	7,733	4,197	(2)	(2)
France	78	31	1,016	587	475
French Morocco	182	506	480	446	(2)
India	293	592	610	(2)	(2)
Indochina, French	312	242	----------	----------	(2)
Italy	[7] 7,419	(2)	4,811	8,814	10,440
Japan [8]	6,418	9,395	2,659	3,997	3,708
Kenya	321	341	389	[5] 165	(2)
Korea	5,310	4,117	(2)	(2)	(2)
Madagascar	(9)	3	1	1	(2)
New Zealand	190	17	2	----------	(2)
Portugal	(2)	(2)	20	12	(2)
Southern Rhodesia	52,749	52,882	51,119	50,686	49,073
Spain	50	----------	----------	----------	(2)
Swaziland	17,179	29,628	21,243	29,155	25,360
Switzerland	11	7	35	40	(2)
Turkey	133	231	138	55	(2)
Union of South Africa	32,347	31,372	25,597	18,348	27,344
United States (sold or used by producers)	5,456	6,048	11,091	12,769	21,804
Venezuela	(2)	(2)	(2)	65	(2)
Total (estimate)	632,500	596,800	627,400	726,500	872,700

[1] In addition to countries listed, asbestos is produced in Algeria, Brazil, Bulgaria, Czechoslovakia, Uganda, and U. S. S. R. Estimates by author of chapter included in the total.
[2] Data not available; estimates by author of chapter included in total.
[3] January to September, inclusive.
[4] Exclusive of sand, gravel, and stone (waste rock only), production of which is reported as follows: 1943, 6,272 tons; 1944, 4,101 tons; 1945–47 data not available.
[5] Estimate.
[6] Includes asbestos flour.
[7] January to June, inclusive.
[8] Preliminary.
[9] Less than 1 ton.

CANADA

The 1947 tonnage and value of asbestos in the Province of Quebec, Canada, attained a new record; volume increased 19 percent and value increased 31 percent over 1946.

The statistics in the accompanying table of Canadian sales of asbestos were supplied by the Department of Mines of the Province of Quebec.

Turner and Newhall, Ltd., plans erection of a large asbestos-cement plant at Montreal.

Canadian Johns-Manville Co., Ltd., has recently erected a 60,000-ton ore-storage building at Asbestos, Quebec. The building is 496 feet long and 90 feet wide and contains adequate storage for 6½ to 9 days' supply for the mill.[5]

[5] Asbestos, vol. 29, No. 7, January 1948, p. 42.

Sales of asbestos in Canada, 1946–47, by grades

	1946			1947 [1]		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Grade:						
Crudes	742	$334,925	$451.38	958	$503,137	$525.20
Fibers	228,234	17,181,400	75.28	222,196	20,221,444	91.01
Shorts	329,205	7,724,237	23.46	438,667	12,281,167	28.00
	558,181	25,240,562	45.22	661,821	33,005,748	49.87
Rock mined	9,127,859			9,837,045		
Rock milled	7,027,483			7,740,828		

[1] Preliminary.

AFRICA

Southern Rhodesia.—The asbestos production of Southern Rhodesia has remained virtually constant since 1936. In 1947 production dropped by 3 percent, but the value increased 4 percent.

Considerable activity has recently been taking place in the asbestos industry. Several new companies have entered or are about to enter the field.

The Mashaba-Rhodesian Asbestos Co., which operates the Mashaba mine and also owns claims in the Shabanie area, is to reopen the Croft mine, which was closed in the 1930–32 depression. Production at the Croft mine is expected to begin early in 1949.

Vanguard Asbestos Mines, a new company, has acquired extensive claims in the Belingwe area. It has been reported that the length of the asbestos strike is 2½ miles and the width just under one-half mile. Development work was expected to start immediately.[6] South African and Swiss capital are backing this venture. An asbestos-cement plant is in operation at Salisbury.

Asbestos produced in Southern Rhodesia, 1943–47

Year	Short tons	Value	Year	Short tons	Value
1943	58,146	£1,673,025	1946	55,872	£1,676,503
1944	58,293	1,674,467	1947	54,094	1,738,484
1945	56,349	1,788,386			

Swaziland.—The world production table shows that chrysotile production in 1947 decreased 13 percent to 25,360 metric tons. The entire production of Swaziland is from the Havelock Asbestos mines, which began to produce in 1939. The parent company is New Amianthus Mines, Ltd., owned by Turner & Newhall, Ltd. This firm is a large company with world-wide interest. Through subsidiary companies, it owns and operates 12 large factories in United Kingdom, 3 in India, and 3 in the United States, as well as mines in South

[6] South African Mining and Engineering Journal, vol. 58, part 2, No. 2867, Jan. 24, 1948, p. 558.

Africa and the Bell mine in Quebec. Swaziland ranks third as a producer of chrysotile asbestos [7] in the British Empire.

Union of South Africa.—Asbestos production reached a record high of 30,142 short tons in 1947. Total exports were 33,237 short tons valued at £927,371.

The Cape Asbestos Co. finds it difficult to increase its blue output because of the hardness of the rock and other local conditions; in the amosite mines the rate of production (Egnep, Ltd.) increased satisfactorily and continued to rise, according to the company annual report for 1947.

Asbestos produced in and exported from the Union of South Africa, 1943–47 [1]

Year	Production (short tons)			Exports	
	Transvaal	Cape Province	Total	Short tons	Value
1943	27,768	7,888	35,656	35,940	£880,019
1944	26,747	7,835	34,582	28,174	672,941
1945	20,016	8,200	28,216	22,005	591,124
1946	12,636	7,589	20,225	21,481	557,008
1947	21,959	8,183	30,142	33,237	927,371

[1] Data from Union of South Africa, Department of Mines, Quarterly Report.

Asbestos produced in the Union of South Africa, 1943–47, by varieties and sources in short tons [1]

Variety and source	1943	1944	1945	1946	1947
Amosite (Transvaal)	23,189	22,848	16,737	9,838	18,780
Chrysotile (Transvaal)	2,034	2,014	1,765	1,666	2,253
Blue (Transvaal)	2,456	1,831	1,471	1,102	896
Blue (Cape)	7,888	7,835	8,200	7,589	8,183
Anthophyllite (Transvaal)	89	54	43	30	30
Total	35,656	34,582	28,216	20,225	30,142

[1] Data from Union of South Africa Department of Mines, Quarterly Report.

A new asbestos-cement plant was recently opened near Nigal. This brings to seven the asbestos-cement plants in the Union, including one at Capetown, three in the Transvaal, one at Durban, and one in Johannesburg.

South Africa produces all of the world's amosite, most of the world's blue, and a small amount of chrysotile and anthophyllite. The accompanying table shows the distribution by variety and sources of the different types of asbestos mined in the Union of South Africa, according to the Department of Mines Quarterly Report. Noteworthy is the 91-percent increase in production of amosite above 1946 and the small changes in volume of production of other types.

Madagascar.—The right to search for asbestos in any form (chrysotile, tremolite, crocidolite, amosite, etc.) in Madagascar is temporarily reserved to the Colony, according to a report received from the American consulate in Tananarive.

[7] Mining and Industrial Magazine, vol. 37, No. 3, March 1947, p. 149.

OTHER COUNTRIES

Relatively minor but locally significant tonnages of asbestos are produced in many countries but do not enter into the world trade. Russia is known to have large deposits, and, on the basis of past production records, production is believed to be substantial. The 1936 output was 125,117 metric tons.

A Canadian company is reported to be interested in the Tinaquillo area in Venezuela. During the war eight new asbestos cement plants were built in Latin America—in Argentina, Brazil, Colombia, Venezuela, Mexico, and Peru. Their demand for shingle fiber is said to be 12,000 tons for 1947.

A new asbestos sheet factory has been set up at Petah Tikva near Tel Aviv, Palestine, according to the Mining Journal (London). Necessary machinery has been imported from Italy, and 1,000 tons of raw asbestos monthly will be imported from Cyprus.

The mining and milling of blue asbestos from the Wittenoom Gorge in the Hammersley Range, North Western Division, Western Australia, have been in the experimental stage for the past 3 years. Plans have been completed and work begun on erection of a township that will eventually house 1,000 people engaged in mining blue asbestos, according to the South African Mining and Engineering Journal. Lack of transportation in this area has hindered development of industry.

A high-quality asbestos source has been located recently in Joazeiro, Brazil.[8]

Asbestos is second in value of production among the minerals of Cyprus. It occurs in the serpentines in the Troödos Range and in Akamas Penninsula in the west. The present production is from the Amiandos Mines of Cyprus Asbestos Mines, Ltd. The 1947 production was about 7,500 short tons, valued at £260,000. The output for 1948 is estimated at 10,000 to 11,000 tons. The reserves of the large known deposits vary from 35 to 75 years at the 1946 rate of production. Prices have risen some 150 percent above prewar. The asbestos is mainly short fiber, the bulk of which is used in the cement-asbestos industry.[9]

[8] Chemical and Engineering News, vol. 25, No. 37, Sept. 15, 1947, p. 2654.
[9] Mining Journal (London), vol. 240, No. 5883, May 22, 1948, p. 380.

Asphalt and Related Bitumens

By A. H. REDFIELD

GENERAL SUMMARY

DOMESTIC demand [1] for petroleum asphalt was 9 percent higher in 1947 than in 1946 and export demand 40 percent higher; but export demand was only 5 percent of the total demand, domestic and foreign, in 1946 and 6 percent in 1947, so that the total demand increased 10 percent in 1947 over 1946. In numerical terms, an increase of 699,964 short tons in domestic demand and of 160,029 tons in export demand was met by an increase of 795,500 tons in refinery production and by greater imports of petroleum and lake asphalt totaling 84,393 tons. As a result, stocks held at the refineries increased 29,200 tons during 1947, compared with 9,300 tons in 1946.

Bituminous rock shared the increased activity in highway construction and maintenance during 1947, so that the tonnage sold was 29 percent larger and the value realized 31 percent higher in 1947 than in 1946. Gilsonite sales decreased slightly in quantity but increased 25 percent in value from 1946 to 1947.

NATIVE ASPHALT AND BITUMENS

Bituminous Rock.—As a result of increased activity in highway construction and maintenance in 1947 over 1946, sales of bituminous sandstone and limestone by producers in the United States increased from 777,467 short tons valued at $2,861,591 in 1946 to 1,004,740 tons valued at $3,756,074 in 1947. The increases were greatest in Texas, and in Kentucky and Alabama; a small increase occurred in Utah. Less bituminous rock was sold in Oklahoma and California in 1947 than in 1946. As no State in 1947 had three producers of bituminous rock, no disclosure of the sales by States may be made for that year.

Gilsonite.—Sales of gilsonite by producers in northeastern Utah decreased slightly, from 68,407 short tons valued at $1,400,229 in 1946 to 67,165 tons valued at $1,746,228 in 1947. The average sales value per ton at the mine or railhead, however, increased from $20.47 in 1946 to $26 in 1947.

Wurtzilite.—Sales of wurtzilite in northeastern Utah decreased from 24 short tons valued at $1,066 in 1946 to 17 tons valued at $746 in 1947.

[1] The term "domestic demand" as used in this chapter means apparent consumption, that is, production plus net imports, and changes in refiners' stocks.

MANUFACTURED OR PETROLEUM ASPHALT

Production.—Production of asphalt by petroleum refineries in the United States increased 10 percent from 1946 to 1947. The increase was general, except in the Indiana, Illinois, Kentucky, etc., district, where asphalt production was 16 percent less in 1947 than in 1946. The greater increases in tonnage were in the East Coast district and in California. Considerable increases in asphalt production occurred in the Oklahoma-Kansas-Missouri district and in the Louisiana Gulf Coast district.

Stocks.—Stocks of petroleum asphalt held at refineries were 4 percent higher on December 31, 1947, than on December 31, 1946. The national increase was due chiefly to larger stocks in the East Coast district, the Appalachian district, the Oklahoma-Kansas-Missouri district, and in Arkansas and Inland Louisiana. On the other hand, these increases in inventories were largely offset by decreases in the Indiana, Illinois, Kentucky, etc., district, in the Rocky Mountain district, in Texas, and in the Gulf Coast district of Louisiana.

Production, receipts, stocks, consumption, transfers, losses, exports, and domestic sales of asphalt (exclusive of road oil) at petroleum refineries in the United States in 1947, by districts, in short tons

District	Production	Receipts [1]	Stocks		Consumption by producers, transfers, losses, and exports	Sales to domestic consumers
			Jan. 1	Dec. 31		
East Coast	2,472,000	243,100	107,800	130,000	255,700	2,437,200
Appalachian	410,900	27,600	23,300	40,200	15,200	406,400
Indiana, Illinois, Kentucky, etc	1,580,600	93,100	161,300	112,700	88,700	1,633,600
Oklahoma, Kansas, and Missouri	828,000	10,000	58,400	102,000	50,400	744,000
Texas:						
Gulf Coast	464,500	15,900	26,500	19,700	90,400	396,800
Inland	403,100	14,600	34,200	33,300		418,600
Total Texas	867,600	30,500	60,700	53,000	90,400	815,400
Louisiana-Arkansas:						
Louisiana Gulf Coast	594,400		54,000	53,100	75,200	520,100
Arkansas and Inland Louisiana	508,200	4,300	31,100	57,600	21,100	464,900
Total Louisiana-Arkansas	1,102,600	4,300	85,100	110,700	96,300	985,000
Rocky Mountain	286,500	78,000	84,300	59,300	21,700	367,800
California	1,412,900		121,100	123,300	64,600	1,346,100
Total United States:						
1947	8,961,100	486,600	702,000	731,200	683,000	8,735,500
1946	8,165,600	493,100	692,700	702,000	1,035,100	7,614,300

[1] Receipts from interindustry refinery transfers, addition of other petroleum products blended to make cut-back asphalts, imports, and transfers from stocks formerly not classed as asphalt.

Sales.—Sales of petroleum asphalt to domestic consumers increased 15 percent in quantity and 36 percent in value from 1946 to 1947. The average value at the refinery increased from $12.34 per short ton in 1946 to $14.64 in 1947.

Of the total sold, 22 percent was manufactured from foreign petroleum (imported chiefly from Venezuela, Colombia, and Mexico) in 1947, compared with 20 percent in 1946.

Highway and street construction and airport-runway surfacing (in the form of paving asphalt, paving flux, cut-back asphalts, and asphalt emulsions) used 60 percent of the total asphalt sold to domestic consumers in 1946 and 62 percent in 1947. Sales of all grades of asphalt devoted wholly or principally to street and road construction increased 19 percent in 1947 over 1946.

Sales of asphalt (exclusive of road oil) at petroleum refineries to domestic consumers in the United States, 1946–47, by districts

District	1946		1947	
	Short tons	Value	Short tons	Value
East Coast	2,110,922	$29,932,829	2,437,172	$40,820,790
Appalachian	395,626	5,821,188	406,410	6,610,856
Indiana, Illinois, Kentucky, etc.	1,496,378	18,877,986	1,633,575	24,069,882
Oklahoma, Kansas, and Missouri	813,744	8,507,583	744,017	9,755,176
Texas:				
Gulf Coast	306,187	3,390,888	396,784	5,441,016
Inland	318,582	3,845,883	418,653	5,920,205
Total Texas	624,769	7,236,771	815,437	11,361,221
Louisiana-Arkansas:				
Louisiana Gulf Coast	430,177	5,256,239	520,111	7,446,403
Arkansas and Inland Louisiana	420,627	3,844,018	464,912	5,943,179
Total Louisiana-Arkansas	850,804	9,100,257	985,023	13,389,582
Rocky Mountain	243,924	2,590,964	367,761	4,805,649
California	1,078,200	11,923,564	1,346,091	17,056,300
Total United States	7,614,367	93,991,142	8,735,486	127,869,456

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries to domestic consumers in the United States in 1947, 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	1,772,692	$24,738,437	608,042	$10,057,694	2,380,734	$34,796,131
Roofing	1,252,858	18,072,523	621,518	10,066,277	1,874,376	28,138,800
Waterproofing	82,510	1,496,115	21,786	366,257	104,296	1,862,372
Blending with rubber	10,644	155,730	21,469	353,282	32,113	509,012
Briquetting	179,262	2,377,988	16,011	255,133	195,273	2,633,121
Mastic and mastic cake	5,095	107,090	49	814	5,144	107,904
Pipe coatings	32,161	617,900	2,143	37,836	34,304	655,736
Molding compounds	69,962	1,082,938	6,783	137,071	76,745	1,220,009
Miscellaneous uses	251,838	4,243,400	39,701	677,700	291,539	4,921,100
	3,657,022	52,892,121	1,337,502	21,952,064	4,994,524	74,844,185
Semisolid and liquid products of more than 200 penetration:						
Flux for—						
Paving	310,340	3,708,878	32,438	534,068	342,778	4,242,946
Roofing	893,813	10,749,519	66,925	1,003,054	960,738	11,752,573
Waterproofing	103	1,534	3,307	56,054	3,410	57,588
Mastic	2,448	40,881			2,448	40,881
Cut-back asphalts:						
Rapid-curing	711,561	11,662,085	260,252	4,398,519	971,813	16,060,604
Medium-curing	1,112,884	15,096,514	161,434	2,882,204	1,274,318	17,978,718
Emulsified asphalts and fluxes	51,050	791,413	4,358	84,657	55,408	876,070
Paints, enamels, japans, and lacquers	44,955	863,846	13,879	227,372	58,834	1,091,218
Other liquid products	71,215	924,673			71,215	924,673
	3,198,369	43,839,343	542,593	9,185,928	3,740,962	53,025,271
Total: 1947	6,855,391	96,731,464	1,880,095	31,137,992	8,735,486	127,869,456
1946	6,064,172	72,348,999	1,550,195	21,642,143	7,614,367	93,991,142

Roofing manufacture made the second-largest demand for asphalt, absorbing 34 percent of the total sales to domestic consumers in 1946 and 32 percent in 1947. While shipments of prepared roofing reported to the Bureau of the Census increased 15 percent—from 60,865,000 squares in 1946 to 69,840,000 squares in 1947—domestic sales of roofing asphalt and roofing flux combined increased 10 percent—from 2,568,827 short tons in 1946 to 2,835,114 tons in 1947. These figures do not include roofing asphalt and flux consumed by the companies in prepared-roofing factories owned by themselves or by affiliated companies.

Sales of emulsified asphalt were higher in 1947 than in 1946. Petroleum refineries sold 56,917 short tons (13,410,755 gallons) valued at $643,006 in 1946 and 55,408 tons (13,055,205 gallons) valued at $876,070 in 1947. In addition, 67,367,106 gallons, or 285,914 short tons, valued at $7,235,122 in 1946 and 86,242,707 gallons, or 366,025 tons, valued at $7,634,291 in 1947 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 increased 23 percent in quantity—from 80,777,861 gallons in 1946 to 99,297,912 gallons in 1947—but only 8 percent in value—from $7,878,128 in 1946 to $8,510,361 in 1947.

APPARENT CONSUMPTION

The period of high demand that had characterized 1940–46 continued into 1947. The apparent average monthly domestic consumption of petroleum asphalt (including small quantities of imported lake asphalt and grahamite) increased 9 percent to 715,636 short tons in 1947 from 657,305 tons (revised figure) in 1946. Total apparent consumption was 8,587,626 short tons in 1947 compared with 7,887,662 tons (revised figure) in 1946.

DISTRIBUTION BY RAIL

The tonnage of asphalt (natural, byproduct, or petroleum) terminated by class I railroads in the United States increased from 6,344,544 short tons in 1946 to 7,063,978 tons in 1947, according to freight-commodity statistics compiled by the Interstate Commerce Commission. Of the total deliveries, 56 percent in 1946 and 54 percent in 1947 were set down in the populous area north of the Ohio and Potomac Rivers and east of the Mississippi River, although this area comprises only 14 percent of the area of continental United States. In this area, terminations of asphalt were 7 percent larger in 1947 than in 1946. In the States lying south of the Potomac and Ohio Rivers and east of the Mississippi River 27 percent more asphalt was delivered by rail in 1947 than in 1946. Between the Mississippi River and the Rocky Mountains, decreased deliveries in Texas and Oklahoma offset increased shipments into the corn and wheat States to the north. In the Rocky Mountain States the pattern of increases and decreases was spotty, but generally higher in 1947 than in 1946. In the three Pacific Coast States terminations of asphalt increased from 1946 to 1947. It may be noted, however, that terminations of asphalt by class I railroads were equivalent to only 80 percent of the total apparent consumption of asphalt in the United States in 1946 and 82 percent in 1947 and that considerable quantities of asphalt were delivered to consumers by water and by minor railroads and motor trucks. Accordingly, these figures do not present a complete picture of the consumption of asphalt by States.

Asphalt (natural, byproduct, and petroleum) terminated by class I railroads in the United States, 1946–47, by States, in short tons

[Interstate Commerce Commission, Freight Commodity Statistics]

Region and State	1946	1947
New England	199,491	191,106
Middle Atlantic:		
New York	302,623	282,966
New Jersey	79,720	85,977
Pennsylvania	666,800	765,607
	1,049,143	1,134,550
East North Central:		
Ohio	1,116,896	1,067,766
Indiana	213,513	257,758
Illinois	550,150	643,710
Michigan	181,492	248,239
Wisconsin	227,083	249,423
	2,289,134	2,466,896
West North Central:		
Minnesota	151,529	213,669
Iowa	63,223	76,739
Missouri	149,177	157,321
North Dakota	23,089	32,491
South Dakota	32,286	50,603
Nebraska	72,538	82,310
Kansas	89,110	92,698
	580,952	705,831
South Atlantic:		
Delaware	8,373	12,426
Maryland	19,923	19,710
District of Columbia	1,603	519
Virginia	157,543	128,155
West Virginia	73,156	101,602
North Carolina	118,833	126,838
South Carolina	45,435	76,060
Georgia	66,820	88,534
Florida	80,033	115,278
	571,719	669,122
East South Central:		
Kentucky	101,381	128,606
Tennessee	112,091	161,601
Alabama	67,929	109,068
Mississippi	36,541	58,373
	317,942	457,648
West South Central:		
Arkansas	53,845	88,461
Louisiana	261,532	289,166
Oklahoma	80,116	19,722
Texas	227,842	187,621
	623,335	584,970
Mountain:		
Montana	18,169	16,981
Idaho	30,923	24,173
Wyoming	15,924	10,122
Colorado	50,631	82,359
New Mexico	56,997	44,460
Arizona	29,898	36,902
Utah	20,247	27,542
Nevada	22,564	30,335
	245,353	272,874
Pacific:		
Washington	75,119	108,890
Oregon	74,468	76,352
California	317,888	395,739
	467,475	580,981
Total United States	6,344,544	7,063,978
Canada	3,464	8,423
	6,348,008	7,072,401

FOREIGN TRADE[2]

Imports.—Imports of natural asphalt and bitumen into the United States in 1947 totaled 5,802 short tons valued at $242,526, compared with 4,449 tons valued at $92,419 in 1946. Imports of lake asphalt from Trinidad decreased from 3,943 short tons valued at $82,625 in 1946 to 3,291 tons valued at $73,017 in 1947, but imports of grahamite from Cuba increased from 315 short tons valued at $8,106 in 1946 to 466 tons valued at $11,364 in 1947.

Imports of solid petroleum asphalt increased from 97,204 short tons valued at $536,697 in 1946 to 183,365 tons valued at $1,444,545 in 1947. Virtually all of the 1946 and 1947 imports came from the Netherlands West Indies.

In addition, 140,959 barrels (25,629 short tons) of liquid petroleum asphalt valued at $234,491 were imported in 1946 and 123,795 barrels (22,508 short tons) valued at $247,847 in 1947. All of the 1947 imports came from the Netherlands West Indies.

Exports.—The tonnage of natural asphalt, unmanufactured, exported from the United States decreased from 26,588 short tons valued at $974,404 in 1946 to 23,902 tons valued at $1,065,386 in 1947. Of the 1947 exports, 76 percent went to Europe, notably to the United Kingdom, France, and Italy. Canada received 12 percent of the total.

Exports of petroleum asphalt from the United States in 1947 were 40 percent larger than in 1946 and were the largest in the history of the industry. The most marked increase was in shipments to Europe, which in 1947 constituted 67 percent of all exports of petroleum asphalt. France, Italy, Portugal, Spain, Belgium-Luxembourg, Norway, and Switzerland took more asphalt from the United States in 1947 than in 1946. Sweden, Denmark, and the Netherlands were the most notable exceptions to the general increase in asphalt exports to Europe. In Asia, the Netherlands East Indies and India increased their purchases of asphalt from the United States, offsetting declines in shipments to China, the Philippine Republic, and French Indochina. Exports to South America (notably to Brazil) and to North America (especially to Mexico) were larger in 1947 than in 1946. The Union of South Africa was the principal recipient of increased exports to Africa in 1947. Australia and New Zealand both increased their purchases of asphalt from the United States in 1947 over 1946.

[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.

Petroleum asphalt exported from the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	1945 Short tons	1945 Value	1946 Short tons	1946 Value	1947 Short tons	1947 Value
North America:						
Canada	4, 223	$215, 131	6, 260	$322, 259	8, 207	$433, 039
Canal Zone	115	3, 175	151	3, 086	290	7, 635
Cuba	299	7, 600	122	4, 824	345	16, 375
Dominican Republic	24	1, 081	12	344	1, 195	4, 118
Guatemala	93	1, 368	650	14, 139	2, 422	50, 862
Mexico	1, 274	21, 588	4, 538	67, 163	13, 058	215, 476
Newfoundland and Labrador	2, 242	45, 566	2, 040	48, 052	18	940
Nicaragua	624	14, 396	158	4, 595	206	5, 786
Panama, Republic of	429	9, 836	18	536	501	12, 588
Other North America	2, 975	67, 422	1, 222	28, 710	1, 387	45, 678
	12, 298	387, 163	15, 171	493, 708	27, 629	792, 497
South America:						
Argentina	36	1, 284	328	22, 695	182	16, 622
Bolivia	1, 524	42, 957			245	6, 029
Brazil	7, 050	145, 539	4, 419	113, 598	23, 119	687, 875
Chile	5, 780	137, 875	5, 267	144, 421	4, 534	135, 622
Uruguay	2, 643	57, 556	3, 610	109, 220	2, 592	79, 472
Venezuela	246	6, 518	146	4, 472	141	4, 361
Other South America	272	8, 530	136	4, 546	512	15, 964
	17, 551	400, 259	13, 906	398, 952	31, 325	945, 945
Europe:						
Belgium and Luxembourg			12, 726	355, 402	18, 326	455, 191
Denmark			5, 235	122, 016	30	1, 202
France	8, 813	215, 378	126, 919	3, 298, 179	177, 138	4, 213, 682
Finland			4, 276	108, 335	1, 361	39, 395
Italy			44, 743	1, 012, 745	83, 448	2, 309, 958
Netherlands	357	8, 838	5, 493	136, 868	231	25, 662
Norway	4, 592	118, 806	5, 645	147, 935	14, 452	408, 970
Portugal	4, 313	103, 797	5, 790	162, 782	28, 387	866, 803
Spain	20, 241	559, 830	24, 660	602, 738	25, 160	550, 762
Sweden	26, 870	753, 259	15, 671	407, 235	10, 637	276, 670
Switzerland	2, 971	81, 413	10, 366	267, 447	10, 939	302, 923
Other Europe	222	7, 487	1, 615	43, 546	908	27, 868
	68, 379	1, 848, 808	263, 139	6, 665, 228	371, 017	9, 479, 086
Asia:						
Ceylon	(1)	13	1, 110	22, 772	407	8, 820
China	1, 894	45, 093	24, 923	458, 841	11, 591	207, 588
French Indochina			8, 764	131, 957	1, 859	40, 442
Hong Kong			2, 709	49, 011	672	18, 470
India	48, 755	1, 142, 680	671	19, 512	12, 627	292, 188
Korea					5, 704	148, 400
Malayan Union			204	2, 839	8, 416	206, 996
Netherlands Indies			2, 381	58, 562	15, 838	424, 138
Philippines, Republic of	393	10, 403	18, 621	446, 779	10, 649	226, 211
Saudi Arabia	405	7, 764	272	8, 157	2, 953	90, 525
Other Asia	58	2, 448	1, 182	21, 805	795	19, 899
	51, 505	1, 208, 401	60, 837	1, 220, 235	71, 511	1, 683, 677
Africa:						
Algeria			3, 128	81, 834	2, 513	79, 125
Belgian Congo	236	7, 352	224	6, 464	110	6, 335
British East Africa	48	1, 908	6	362		
French West Africa	2, 211	69, 875	2, 268	68, 420	1, 260	47, 272
Mozambique	2, 594	48, 121	1, 278	20, 938	2, 389	47, 591
Nigeria	1, 216	33, 697			3	184
Tunisia			4, 470	107, 886		
Union of South Africa	13, 100	228, 266	10, 693	212, 363	17, 715	409, 136
Other Africa	827	20, 170	2, 046	63, 504	971	26, 151
	20, 232	409, 389	24, 113	561, 771	24, 961	615, 794
Oceania:						
Australia	40, 524	862, 980	7, 869	167, 785	14, 014	359, 985
New Zealand	1, 695	38, 246	10, 885	200, 175	15, 372	327, 938
Other Oceania	119	2, 637			120	3, 041
	42, 338	903, 863	18, 754	367, 960	29, 506	690, 964
	212, 303	5, 157, 883	395, 920	9, 707, 854	555, 949	14, 207, 963

[1] Less than 1 ton.

ROAD OIL

Sales of road oil by petroleum refineries in the United States increased 38 percent in quantity—from 5,034,000 barrels in 1946 to 6,958,000 barrels in 1947—and 94 percent in value—from $8,894,000 in 1946 to $17,235,000 in 1947. The increases occurred principally in California, in the Oklahoma-Kansas-Missouri district, and in the Rocky Mountain district. Four refining districts—Indiana, Illinois, Kentucky, etc.; Oklahoma-Kansas-Missouri; Rocky Mountain; and California—together made 96 percent of all road-oil sales in the United States in 1947, compared with 92 percent in 1946.

Of the total road-oil sales, 85,472 barrels valued at $200,862 in 1946 and 87,594 barrels valued at $243,545 in 1947 were made from foreign petroleum, imported chiefly from Venezuela, Colombia, and Mexico.

Production, receipts, stocks, consumption, transfers, losses, exports, and domestic sales of road oil in the United States in 1947 by districts, in thousands of barrels

District	Production	Receipts [1]	Stocks Jan. 1	Stocks Dec. 31	Consumption by producers, transfers, losses, and exports	Sales to domestic consumers
East Coast	150	45	27	26	140	56
Appalachian	7					7
Indiana, Illinois, Kentucky, etc	1,520	42	47	22	68	1,519
Oklahoma, Kansas, and Missouri	557	374	49	13	15	952
Texas	85	110	5	5	19	176
Louisiana-Arkansas	20	6	6	3	23	6
Rocky Mountain	1,363	278	186	139	699	989
California	3,372		286	405		3,253
Total: 1947	7,074	855	606	613	964	6,958
1946	6,175	584	370	606	1,489	5,034

[1] Receipts from interindustry refinery transfers, imports, and transfers from stocks formerly not classed as road oil.

Road oil sold by petroleum refineries to domestic consumers in the United States, 1946–47, by districts

District	1946 Thousands of barrels	1946 Value	1947 Thousands of barrels	1947 Value
East Coast	120	$293,000	56	$167,000
Appalachian			7	21,000
Indiana, Illinois, Kentucky, etc	1,346	2,257,000	1,519	6,480,000
Oklahoma, Kansas, and Missouri	525	1,325,000	952	1,916,000
Texas	233	337,000	176	409,000
Louisiana-Arkansas	27	41,000	6	15,000
Rocky Mountain	592	960,000	989	1,937,000
California	2,191	3,681,000	3,253	6,290,000
Total United States	5,034	8,894,000	6,958	17,235,000

Barite

By LAWRENCE G. HOUK AND F. M. BARSIGIAN

GENERAL SUMMARY

THE United States continued to lead the world in barite production, establishing a record in 1947 of 884,219 short tons. Primary barite sold or used by producers was 834,082 short tons valued at $6,171,342. The average value of primary barite sold or used increased 16 cents per ton to $7.40. Imports of crude barite rose to 53,222 short tons, a 19-percent increase. The average value of imports was $7.11, point of shipment. Barite sold or used plus imports (apparent new supply) was 887,304 short tons, 94 percent of which was from domestic sources.

The term "primary barite," as used in this chapter, applies to barite as first offered to the trade, whether lump, crushed, or ground. Such figures thus include ground barite from Malvern (Ark.), El Portal (Calif.), and Mesa (Ariz.), and lump barite from various open pits and underground workings. Where ground barite has been reported to the Bureau of Mines as original production, an estimate of the value of the lump equivalent of the ground has been assigned to such tonnage.

Arkansas produced more barite than any other State, shipping 376,017 short tons; Missouri followed with 291,619 short tons. Georgia was third, with 61,202 short tons.

Salient statistics of the barite and barium-chemical industries in the United States, 1943–47

	1943	1944	1945	1946	1947
Barite:					
Primary:					
Produced short tons	429,298	515,136	692,330	725,223	884,219
Sold or used by producers:					
Short tons	420,343	518,617	696,062	724,362	834,082
Value	$2,796,776	$3,558,489	$5,348,652	$5,242,755	$6,171,342
Imports for consumption:					
Short tons		67,888	56,894	44,662	53,222
Value		$459,664	$382,611	$274,267	$378,294
Consumption short tons	453,744	595,563	720,903	722,073	835,818
Ground and crushed sold by producers:[1]					
Short tons	208,252	344,757	468,939	455,240	549,965
Value	$3,743,919	$5,455,835	$7,519,759	$7,208,193	$8,979,400
Barium chemicals sold by producers:					
Short tons	78,323	73,591	68,084	80,871	72,919
Value	$8,345,422	$7,740,686	$6,493,448	$7,003,756	$7,035,104
Lithopone sold or used by producers:					
Short tons	135,723	142,905	136,161	147,001	165,024
Value	$10,745,305	$11,208,891	$10,645,316	$11,840,596	$17,382,592

[1] Although all barite is crushed before use in chemicals, barite used in chemicals is not included in the 1945–47 totals. In 1944 and prior years small quantities of crushed barite used by chemical producers are included.

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Consumption of crude barite (foreign and domestic) in 1947 was 835,818 short tons, an increase of 16 percent above 1946.

Eighty-five percent of the total ground barite sold was used in well drilling, 6 percent in glass, 5 percent in paint, 3 percent in rubber, and 1 percent in other industries. The use of barite in oil-well drilling muds to prevent blow-outs in high pressure fields began in the early twenties. In 1938 it overtook shipments to lithopone plants to become the major use.

Plant expansion and technical improvements in transportation and plant machinery were reported in 1947 by several operators.

RESERVES

The reserves of barite in the United States, according to testimony given by industry before the Committee for Reciprocity Information, Tariff Commission, total about 40 million tons of commercial-grade barite (roughly blocked out).

DOMESTIC PRODUCTION

Primary.—Forty-nine operations in 7 States produced a record tonnage of 884,219 short tons of primary barite in 1947, a 22-percent increase above 1946. According to reports to the Bureau of Mines, there were 23 washers in operation in Missouri. Tennessee and Nevada each reported production from 6 operations, Georgia 5, Arkansas and California 2 each, and Arizona 1. Arkansas, with its 2 large flotation mills, had the largest production, shipping 376,017 short tons to well drillers. Missouri, with its 23 washers, furnished the second-largest quantity, shipping 291,619 tons.

Domestic barite sold or used by producers in the United States, 1945–47, by States

State	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Arkansas	260,660	[1] $1,934,098	288,286	[1] $1,844,982	376,017	[1] $2,390,643
Georgia	110,393	1,056,035	69,274	686,583	61,202	639,865
Missouri	225,467	1,841,959	270,850	2,168,067	291,619	2,405,249
Nevada	28,919	106,052	(2)	(2)	37,388	261,168
Tennessee	32,812	256,756	33,595	272,169	31,476	285,853
Other States [3]	37,811	153,752	62,357	270,954	36,380	188,564
	696,062	5,348,652	724,362	5,242,755	834,082	6,171,342

[1] Partly estimated.
[2] Included with "Other States."
[3] 1945: California and North Carolina; 1946: Arizona, California, and Nevada; 1947: Arizona and California.

At Malvern, Ark., the Magnet Cove Barium Corp. is preparing for underground mining after carrying open-pit operations nearly to the economic limit. The entire production is used in oil-well drilling mud.[1]

The Paga Mining Co., Cartersville, Ga., is reopening the flotation plant of its barite mine at Cartersville, where improvements have been under way.[2] It has installed a sink-float plant using ferrosilicon as the heavy media and is producing barite concentrates of high purity.

Production from several new operations was reported during the year. The Baroid Sales Division, National Lead Co., began in

[1] Engineering and Mining Journal, vol. 149, No. 1, January 1948, p. 103.
[2] Pit and Quarry, vol. 39, No. 7, January 1947, p. 82.

June 1947 working the Rossi mine in Elko County, Nev. Production by the National Lead Co. was also reported from the Sanders mine near Red House in Humboldt County, Nev. The Williams Krebs mines near Del Rio, Cocke County, Tenn., operated by the Tennessee Mining Co., began operations during 1947.

The Mudrite Chemical Corp. of Texas is reported to have plans for construction of a mill to concentrate barite ore from a mine near Hatch, N. Mex.[3]

The New Riverside Ochre Co., Cartersville, Ga., has installed a revolving grizzly in its barite-washing plant, replacing a vibrating grizzly. This is said to have increased capacity by 25 percent. The company also started a beneficiation plant near Tiff, Mo.[4]

Twenty small deposits and prospects in Texas were described.[5]

Principal producers of barite in the United States in 1947

Name and address	Mine or mill location (nearest town)
ARIZONA	
Arizona Barite Co., Box 926, Mesa	Mesa.
ARKANSAS	
Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles 12, Calif.	Malvern.
Magnet Cove Barium Corp., Box 6504, Houston 5, Tex.	Do.
CALIFORNIA	
Barium Products Ltd., Newark	Greenville.
Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles 12	El Portal.
GEORGIA	
B. R. Cain Mining Co., Emerson	Cartersville.
New Riverside Ochre Co., Cartersville	Do.
Paga Mining Co., Cartersville	Do.
MISSOURI	
Apex Mining Co., Inc., Potosi	Mineral Point.
Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles 12, Calif.	Potosi.
Do	Richwoods.
Barite Mining Co., J. S. Detchemendy, Potosi	Potosi.
Barytes Mining Co., Potosi	Do.
Cadet Mining Co., Cadet	Mineral Point.
J. E. Carter Mining Co., Potosi	Do.
Wm. Craig Mining Co., Box 152, Cole Camp	Cole Camp.
Degonia & Cole Mining Co., Potosi	Cadet.
J. R. Dellinger, Potosi	Potosi.
De Soto Mining Co., De Soto	Richwoods.
H. & P. Mining Co., Potosi	Old Mines.
Fred Hornsey & Co., Potosi	Potosi.
A. H. Long, Cadet	Cadet.
Midwest Mining Co., 2001 Lynch Ave., East St. Louis, Ill.	Richwoods.
Potosi Mining Co., Potosi	Potosi.
Reynolds & Dickey Mining Co., Potosi	Blackwell.
Lloyd Sestak, Henley	Henley.
Star Mining Co., Potosi	Potosi.
Superior Mineral Co., Cadet	Cadet.
Do	Richwoods.
Terrace Mining Co., 450 Laurel St., St. Louis 12	Potosi.
Whaley & Scott Mining Co., Inc., Box 111, De Soto	Old Mines.
NEVADA	
California-Nevada Barytes Mines, Division of the Glidden Co., 766 50th Ave., Oakland, Calif.	Argenta.
Do	Tonopah.
Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles 12, Calif.	Dunphy.
Do	Red House.
TENNESSEE	
Clinchfield Sand & Feldspar Corp., 618 Mercantile Trust Bldg., Baltimore 2, Md.	Del Rio.
Dellinger & Duckett, Athens	Athens.
Sweetwater Mining Co., Sweetwater	Sweetwater.
Tennessee Mining Co., Wolf Creek	Del Rio.
B. C. Wood, Sweetwater	Sweetwater.
L. A. Wood, Sweetwater	Do.

[3] Mining World, vol. 10, No. 6, May 1948, p. 74.
[4] Rock Products, vol. 50, No. 1, January 1947, p. 85.
[5] Evans, Glen L., Barite Deposits in Texas: University of Texas Pub. 4301, 1945, pp. 105–111

Ground (and crushed) Barite.—The tonnage of ground (and crushed) barite produced in 1947 increased 21 percent to 552,227 short tons. Twenty-three plants sold 549,965 short tons valued at $8,979,400, a 21-percent increase in tonnage and 25-percent increase in value.

Ground (and crushed) barite produced and sold by producers in the United States, 1943–47 [1]

Year	Plants	Production (short tons)	Sales: Short tons	Sales: 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
1946	23	456,327	455,240	7,208,193
1947	23	552,227	549,965	8,979,400

[1] Barite used in chemicals, although crushed before use, is not included in 1945–47 totals. In 1944 and prior years small quantities of crushed barite used by chemical producers are included.

CONSUMPTION AND USES

The chief use of barite in 1947 was in oil-well drilling; lithopone was second, chemicals third, fillers fourth, and glass fifth. The distribution of consumption of barite in the United States in 1947 was reported as follows (1946 in parentheses): For well drilling, 467,350 short tons (372,610); for lithopone, 167,321 (154,166); for chemicals, 107,267 (102,439); for glass, 33,641 (29,181); for paint filler, 29,000 (26,000); for rubber filler, 17,000 (20,000); and for other purposes, including grinding losses, 14,239 (17,677); total, 835,818 (722,073). These figures include both foreign and domestic barite.

Crude Barite.—In 1947 the tonnage of crude barite used in the manufacture of the various barium products was as follows: 561,230 tons for ground barite (21 percent more than in 1946), 167,321 tons for lithopone (up 9 percent), and 107,267 tons for barium chemicals (up 5 percent).

Crude barite (domestic and imported) used in the manufacture of ground barite and barium chemicals in the United States, 1943–47, in short tons

Year	In manufacture of— Ground barite [1]	Lithopone	Barium chemicals	Total
1943	225,154	129,493	99,097	453,744
1944	360,045	134,597	100,921	595,563
1945	482,442	139,288	99,173	720,903
1946	465,468	154,166	102,439	722,073
1947	561,230	167,321	107,267	835,818

[1] Includes some crushed barite.

Ground (and crushed) Barite.—The oil-well drilling industry consumed 85 percent of the ground barite sold by producers in 1947. Sales for this use established a new record of 467,350 short tons, an increase of 25 percent over 1946. Among the smaller uses of ground and crushed barite, increased shipments to the paint and glass industry were noted. A decrease was recorded in the sales for rubber filler.

In the accompanying 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.

Ground (and crushed) barite sold by producers, 1945–47, by consuming industries

Industry	1945		1946		1947	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Well drilling	407,871	87	372,610	82	467,350	85
Paint	21,000	4	26,000	6	29,000	5
Glass	25,761	6	29,181	6	33,641	6
Rubber	10,000	2	20,000	4	17,000	3
Undistributed	4,307	1	7,449	2	2,974	1
	468,939	100	455,240	100	549,965	100

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-color ground barite is used in linoleum, phonograph records, dark paints, and other products where color is immaterial.

Most of the ground barite is used principally for its physical rather than its chemical properties, with the exception of barite consumed in glass batches. Its use as a flux permits lower furnace temperature or increased output at the usual temperature. The specifications of glass-grade barite are about as follows: Barium sulfate, not less than 96 percent; moisture, less than 3 percent; iron oxide, less than 0.4 percent; titanium oxide, not over a trace; no particles coarser than 16 mesh; not over 3 percent plus-20 mesh; not over 40 percent minus-100 mesh; and not less than 15 percent minus-100 mesh.

Lithopone.—Eight lithopone plants sold or used 165,024 short tons of lithopone valued at $17,382,592, a 12-percent increase in tonnage and a 47-percent increase in value. The average value of lithopone sold or used was $105.33 per ton.

Lithopone sold or used by producers in the United States, 1943–47

	1943	1944	1945	1946	1947
Plants	9	8	8	8	8
Short tons	135,723	142,905	136,161	147,001	165,024
Value	$10,745,305	$11,208,891	$10,645,316	$11,840,596	$17,382,592

The accompanying table gives the distribution of lithopone sold or used by consuming industries in 1945–47. All industries consumed more lithopone than in 1946. Paints, enamels, and lacquers continued as the major use.

Lithopone sold or used by producers, 1945–47, by consuming industries

Industry	1945		1946		1947	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Paints, enamels, and lacquers	109,398	80	123,279	84	134,830	82
Floor coverings and textiles	15,821	12	15,167	10	17,469	10
Rubber	977	1	1,607	1	3,085	2
Other	9,965	7	6,948	5	9,640	6
	136,161	100	147,001	100	165,024	100

Barium Chemicals.—The production and sales of various barium chemicals showed both increases and decreases in 1947 as compared with 1946. Production of black ash increased 6 percent, carbonate (synthetic) 7 percent, hydroxide 91 percent, and oxide 12 percent, while production of chloride declined 12 percent, sulfate (synthetic) 20 percent, and other barium chemicals 27 percent.

Barium chemicals sold decreased 10 percent in quantity from 1946 to 72,919 short tons; yet this was valued at $7,035,104—about equal to the 1946 sales value. Sales of carbonate (synthetic), hydroxide, and oxide increased, while sales of black ash, chloride, sulfate (synthetic), and other barium chemicals decreased, as shown in the accompanying table.

The oxide is used principally in ceramics, the carbonate in brick descumming and oil-well drilling, the sulfate as a paint extender, as an ingredient of photographic paper and printing inks, and as a filler in linoleum, oilcloth, wallpaper, and other materials.

The 1945 chapter of this series included a table showing consumption (partly estimated) of the three principal barium chemicals—carbonate, chloride, and the sulfate.

PRICES

The prices of crude and ground barite, witherite, and most barium chemicals increased in varying amounts in 1947 above the price range of 1946.

Crude.—Prices of crude barite advanced in 1947 both in Georgia and in Missouri. The following prices are from E&MJ Metal and Mineral Markets, December 11, 1947: Georgia, barite ore, crude, $11.50–$12 per long ton. Missouri, crude ore, minimum 94 percent $BaSO_4$ less than 1 percent iron $9.40 per short ton, 93 percent $BaSO_4$ $9–$9.15.

Ground.—Well-drilling grades of ground barite averaged $15.40 a short ton, bulk, f. o. b. mine, according to reports of grinders to the Bureau of Mines.

According to the Oil, Paint and Drug Reporter, ground bleached barite was quoted at $33.30 a short ton in bags, carlots, St. Louis, Mo.—an increase of $2.20 over the 1946 figure.

Witherite.—E&MJ Metal and Mineral Markets reported barium carbonate (witherite) at $45 per short ton, 90 percent 300-mesh carlot, works; airfloat carlot, $65; less carlot, $73.

The average value of 1947 imports of witherite, crude, unground, at port of shipment, according to the Department of Commerce, was $34.85 per ton (1946—$28.54).

Barium chemicals produced and used or sold by producers in the United States, 1943–47, in short tons

Chemical	Plants	Produced	Used by producers[1] in other barium chemicals[2]	Sold by producers[3]	
				Short tons	Value
Black ash:[4]					
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
1946	15	163,131	162,889	505	22,876
1947	15	173,385	172,987	248	15,888
Carbonate (synthetic):					
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
1946	5	43,611	21,569	21,700	1,313,233
1947	5	46,761	20,767	25,985	1,739,144
Chloride (100 percent basis):					
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
1946	3	16,037	4,974	10,821	927,155
1947	4	14,133	3,984	9,867	986,958
Hydroxide:					
1943	4	3,444	54	3,398	337,107
1944	3	2,462	98	2,429	244,072
1945	3	2,334	123	2,135	242,124
1946	3	3,024	585	2,503	320,474
1947	4	5,774	568	4,910	787,711
Nitrate:					
1943	5	12,157		12,324	2,376,631
1944	3	11,160		11,333	2,066,976
1945	2	(5)		(5)	(5)
1946	1	(5)		(5)	(5)
1947	1	(5)		(5)	(5)
Oxide:					
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
1946	3	6,507	6,105	375	64,522
1947	3	7,318	6,865	378	74,320
Peroxide:					
1943	3	4,123	1,682	2,495	563,756
1944	2	(5)	(5)	(5)	(5)
1945	2	(5)	(5)	(5)	(5)
1946	2	(5)	(5)	(5)	(5)
1947	2	(5)	(5)	(5)	(5)
Sulfate (synthetic):					
1943	7	24,606	13,087	12,028	752,089
1944	8	30,804	18,720	11,340	790,366
1945	8	30,822	17,602	12,856	922,902
1946	8	34,171	16,956	18,791	1,330,651
1947	8	27,353	10,980	16,086	1,302,869
Other barium chemicals:[6]					
1943	(7)	22,831		22,831	2,557,714
1944	(7)	30,111	2,904	27,275	3,180,939
1945	(7)	36,428	4,405	27,727	3,529,401
1946	(7)	28,880	4,395	26,176	3,024,845
1947	(7)	21,107	4,092	15,445	2,128,214
Total:[8]					
1943	24			78,323	8,345,422
1944	22			73,591	7,740,686
1945	19			68,084	6,493,448
1946	19			80,871	7,003,756
1947	20			72,919	7,035,104

[1] Of any barium chemical.
[2] Includes purchased material.
[3] Exclusive of purchased material and exclusive of sales by one producer to another.
[4] Black-ash data include lithopone plants.
[5] Included with "Other barium chemicals."
[6] Consists mostly of titanium dioxide-barium sulfate pigments, with small quantities of barium acetate, chromate, nitrate, oxide, perchlorate, peroxide, and sulfide. 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.

Barium Chemicals.—Prices of barium chemicals in recent years are shown in the following table.

Range of quotations on barium chemicals, 1945–47

[Oil, Paint and Drug Reporter]

	1945	1946	1947
Lithopone:			
Ordinary, bags, at New York ... pound	$0.04¼-$0.04¾	$0.04¼-$0.05	$0.05 -$0.06
Ordinary, barrels, at New York ... do	.04½	.04½- .05¼	.05¼- .06¼
Titanated, bags ... do	.056	.056 - .06¾	.06¾- .07¾
Titanated, barrels ... do	.0585	.0585- .07¼	.07¼- .08
Barium carbonate, precipitated, bags, carlots, works ... short ton	60.00 -70.00	60.00 -70.00	60.00 -75.00
Barium chlorate, 112-pound kegs, works ... pound	.27½- .31	.27½- .31	.25½- .31
Barium chloride, technical, crystals, barrels, carlots, works ... short ton	75.00	75.00	[1]80.00 -85.00
Barium peroxide, drums, carlots, works ... pound	.10 - .13	.10	.10 - .11¼
Barium hydrate, crystals, barrels, works ... do	.06 - .07	.06 - .07½	[1].08 - .09½
Barium nitrate, barrels, carlots, works ... do	.09½- .11½	.09½- .11½	.09½- .11½
Blanc fixe (dry):			
Direct process, bags, carlots, works ... short ton	70.00	70.00	70.00 -85.00
Byproduct, bags, carlots, works ... do	60.00	60.00	60.00 -72.50

[1] 1947 prices quoted in bags.

FOREIGN TRADE[6]

Barite.—Imports of crude barite rose 19 percent above the 1946 level to 53,222 short tons valued at $378,294. The average value of imports for 1947 was $7.11 per short ton (1946—$6.14). Imports of crude barite for consumption accounted for about 6 percent of the apparent new supply. Canada supplied the major portion—48,364 short tons, Mexico 4,856 tons, and Italy 2 tons. There were no imports of ground barite into the United States in 1947.

The General Agreement on Tariffs and Trade, signed at Geneva October 30, 1947, included a United States concession effective January 1, 1948, reducing the crude barite ore import duty from $4.00 to $3.50 per ton.

Barite imported for consumption in the United States, by countries, 1944–47

[U. S. Department of Commerce]

	1944		1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Crude barite:								
Brazil	2	$25						
Canada	67,126	456,088	49,487	$327,242	44,109	$268,839	48,364	$355,349
Cuba			2,307	29,417				
Italy							2	40
Mexico	760	3,551	5,100	25,952	553	5,428	4,856	22,905
	67,888	459,664	56,894	382,611	44,662	274,267	53,222	378,294
Ground barite:								
Canada	6,660	176,287	1	15				
Cuba	5,304	67,630						
	11,964	243,917	1	15				

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

Witherite.—Witherite is not produced in the United States except as it may be mined mixed with barite. Imports from Great Britain—the world's sole commercial source—decreased 33 percent from 1946. Witherite is used in brick descumming and steel carburizing.

Witherite, crude, unground, imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons	Value [1]	Year	Short tons	Value [1]
1943	448	$9,452	1946	1,107	$31,599
1944			1947	739	25,757
1945	896	26,736			

[1] Value at port of shipment.

Barium Chemicals.—Lithopone exports increased 41 percent above 1946 to 13,652 short tons valued at $1,784,414, an average per ton value of $130.71.

Lithopone exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1943	17,320	$1,637,217	$94.53	1946	9,651	$888,555	$92.07
1944	11,551	1,107,430	95.87	1947	13,652	1,784,414	130.71
1945	11,576	1,049,961	90.70				

Barium chemicals imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Lithopone		Barium chloride		Barium nitrate		Barium hydroxide		Other barium compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1943			18	$7,885			151	$9,850	43	$15,385
1944							95	7,382		
1945	(1)	$7					35	3,091		
1946	(2)	58								
1947	(3)	21			66	$9,511			6	1,916

[1] 75 pounds. [2] 1,000 pounds. [3] 112 pounds.

WORLD REVIEW

Estimated world production of crude barite in 1947 was 1,713,000 metric tons, a 22-percent increase above 1946. The United States was the largest producer, accounting for 802,146 metric tons, 47 percent of the total; Germany was probably second, although the production data are not yet available; Canada ranked third, with 120,745 metric tons, and the United Kingdom fourth, with 96,267 metric tons.

World production of barite, 1943–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1943	1944	1945	1946	1947
Algeria	2,988	1,340	2,778	7,437	17,445
Argentina	11,009	14,405	8,585	10,000	[2] 35,000
Australia	4,610	4,487	3,502	[3] 6,204	[3] 3,789
Austria	(4)	(4)	(4)	808	2,007
Belgium	170	300	---	(4)	(4)
Brazil	(4)	282	617	10,326	(4)
Canada	22,202	107,700	126,632	109,242	120,745
Chile	(4)	1,606	3,097	3,752	(4)
Colombia	(4)	(4)	(4)	(4)	[2] 2,800
Cuba (exports)	3,158	4,787	2,094	---	---
Egypt	76	59	54	---	167
Eire	5,485	10,519	16,714	13,557	(4)
France	18,290	9,575	11,431	26,424	50,275
Germany	373,672	[2] 330,000	(4)	(4)	(4)
Greece	(4)	(4)	(4)	(4)	[2] 20,000
India	9,002	15,545	25,051	29,558	(4)
Indochina, French	---	---	---	---	(4)
Italy	---	(4)	(4)	24,861	65,798
Japan	[5] 15,642	[5] 12,049	[5] 7,540	581	907
Korea	10,099	5,640	---	[2] 100	[2] 1,000
Palestine	---	---	23	3	(4)
Peru	---	2,352	4,240	(4)	[2] 7,000
Portugal	1	70	---	294	(4)
Southern Rhodesia	1,256	14	---	173	18
Spain	6,309	7,491	9,877	12,245	19,817
Swaziland	---	---	79	224	172
Sweden	(4)	(4)	1,250	505	(4)
Switzerland	268	233	---	---	---
Tunisia	72	76	68	408	470
Union of South Africa	2,740	3,201	2,222	2,326	2,672
United Kingdom [6]	102,736	100,422	94,711	112,705	96,267
United States	389,451	467,321	628,068	657,908	802,146
Total [7]	997,000	1,131,000	1,286,000	1,401,000	1,713,000

[1] In addition to countries listed, barite is produced in China, Czechoslovakia, Mexico, Norway, U. S. S. R. and Yugoslavia, but data on production are not available.
[2] Estimate.
[3] South Australia only.
[4] Data not available; estimate by author of chapter included in total.
[5] Preliminary data for the fiscal year ended March 31 of year following that stated.
[6] Includes witherite.
[7] Estimated by author of the chapter; excludes estimates for countries listed in footnote 1.

Australia.—Australia exported—for the first time to Great Britain—100 tons of barite in 1947. Heretofore shipments have been to New Zealand and the Near East. Reserves in the Flinders Range, South Australia, are said to be about 500,000 tons. An extensive development program is being undertaken at Blinman mines, about 60 miles northeast of Hawker in South Australia. Water shipments of barite probably will be made from Port Pirie.[7]

Canada.—Canadian Industrial Minerals expected to produce about 114,000 tons of barite in 1947 compared with 100,000 tons in 1946. The plant is at the seaport of Walton, Nova Scotia. Shipments were made in 1947 to 15 countries on 4 continents. Ground barite went to Bahamas, Colombia, Denmark, Dominican Republic, Ecuador, Egypt, Iran, Netherlands, Trinidad, Venezuela, and Canada; the crude to Belgium, England, Netherlands, United States, and Canada. The company has completed sinking a vertical shaft to develop the ore body (claimed to be the world's largest) below the quarry floor.[8]

China.—The Barium Chemical Works at Shanghai is the only lithopone factory in China. Its present maximum capacity is 40 tons per month; however, output in 1947 averaged only 15 tons per month

[7] Mining Journal (London), vol. 229, No. 5858, November 29, 1947, p. 789.
[8] Northern Miner (Toronto) vol. 33, No. 33, sec. 1, November 6, 1947, pp. 1, 4.

because of raw-material shortages. Current demand is in excess of 100 tons monthly.[9]

India.—A plant for the production of barium chloride has been put into operation by the Mettur Chemical, Ltd., Mettur, India.[10]

United Kingdom.—A recent report by the Geological Survey brings up to date geological, technical, and production data on barium minerals in England and Wales. The general supply position on witherite is satisfactory, with reserves sufficient to maintain supply at present level for 10 years, while adequate barite reserves are available for present needs.[10]

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[9] Foreign Commerce Weekly, vol. 28, No. 8, August 23, 1947, p. 26.
[10] Chemical Age (London), vol. 46, No. 1437, January 11, 1947, pp. 42–43.

Bauxite

By HERBERT L. CULLEN

GENERAL SUMMARY

DOMESTIC mine production of crude bauxite increased for the second successive year in 1947, totaling 1,427,111 long tons (1,202,055 tons, dried equivalent), a gain of 9 percent over 1946. Arkansas mines contributed 96 percent of the total domestic output in 1947.

Imports of bauxite in 1947 constituted an all-time record at 1,821,580 tons, a gain of 114 percent over the 852,005 tons received in 1946. Exports of bauxite and concentrates declined for the fourth successive year and totaled 94,369 tons, or 3 percent less than in 1946. Canada was again the largest recipient of exports.

After a substantial decline in 1946, consumption of bauxite in the United States rose 36 percent during 1947 to total 2,564,442 tons (dried equivalent), compared with 1,889,156 tons in the preceding year. The alumina industry used 83 percent of the year's total.

Salient statistics of the bauxite industry in the United States, 1943–47

	1943	1944	1945	1946	1947
Production (crude ore) [1] long tons	6,232,883	2,823,724	981,009	[2] 1,104,054	1,202,055
Value of production (as shipped)	$30,659,900	$14,402,497	$5,591,084	[2] $6,892,864	$6,884,666
Imports (as shipped) long tons	1,547,854	560,461	739,581	852,005	1,821,580
Exports (as shipped) do	417,186	146,638	126,077	97,788	94,369
World production [3] do	13,735,000	6,990,000	3,464,000	4,518,000	6,367,000

[1] Dried equivalent of mine production. [2] Revised figure. [3] As shipped.

Inventories of bauxite at mines and processing plants were 492,798 long tons (dried equivalent) on December 31, 1947, an increase of 3 percent over those on hand at the close of 1946, and consumers' stocks rose 76 percent to 446,434 tons at the end of 1947. Stocks held by the Bureau of Federal Supply were not disclosed, but the War Assets Administration held an inventory of 2,785,527 tons of medium-grade ore.

World output of bauxite in 1947 is estimated at almost 6,400,000 long tons, or over 40 percent greater than in 1946. Of the 1947 world total, about 67 percent is estimated to have been mined in the Western Hemisphere, almost entirely in the United States and the Guianas.

Aluminum metal is discussed in the Aluminum chapter of this volume.

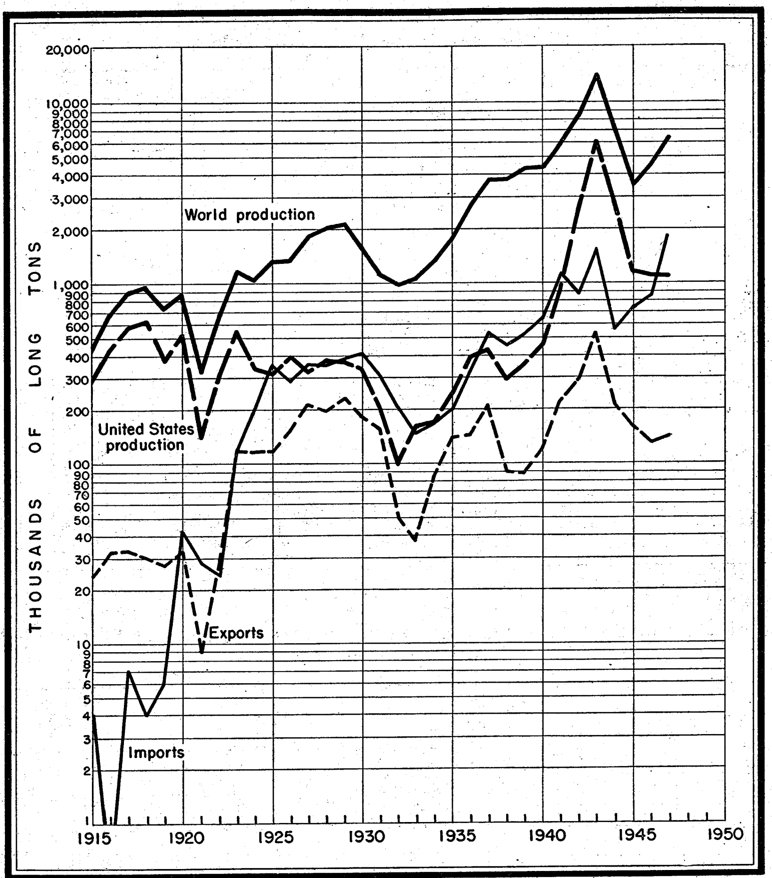

FIGURE 1.—Trends in domestic production, imports, exports, and world production of bauxite, 1915–47.

RESERVES

Domestic reserves of bauxite were estimated by the staffs of the Bureau of Mines and the Geological Survey in 1944 at 36,341,000 long tons. This included all material containing not more than 15 percent SiO_2, not more than 6 percent FeO, and not less than 40 percent Al_2O_3, recoverable bauxite on a mined and dried basis, in deposits 8 feet or more in thickness. Later information has not altered the estimate on this type of material. It may be presumed that, on the same basis and allowing for mining during the past 3 years, domestic reserves now total about 33,000,000 tons.

However, it should be noted that bauxite of a higher iron content is usable at the Hurricane Creek, Ark., alumina plant, and this fact may permit increasing the above reserve figure by as much as 50 percent.

PRODUCTION

Reflecting the unprecedented peacetime demand for aluminum, domestic mine production of crude bauxite continued to increase,

Production and shipments of crude bauxite from mines in the United States, 1943–47, 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
Alabama, Georgia, and Virginia:						
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
1946	64,371	53,707	314,594	65,026	54,206	318,516
1947	58,418	48,492	301,128	58,418	48,492	301,128
Arkansas:						
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	1,061,911	910,049	5,196,927	1,247,766	1,073,349	5,591,630
1946	[1] 1,288,764	[1] 1,050,347	[1] 6,578,270	1,282,099	1,044,939	6,546,469
1947	1,368,693	1,153,563	6,583,538	1,340,988	1,032,035	6,438,697
Total United States:						
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	1,145,237	981,009	5,591,084	1,332,656	1,145,660	5,987,347
1946	1,353,135	1,104,054	6,892,864	1,347,125	1,099,145	6,864,985
1947	1,427,111	1,202,055	6,884,666	1,399,406	1,080,527	6,739,825

[1] Revised figure.

Bauxite shipped from mines and processing plants in the United States, 1943–47, by States, in long tons

Year	Alabama, Georgia, and Virginia		Arkansas		Total	
	As shipped [1]	Dried bauxite equivalent	As shipped [1]	Dried bauxite equivalent	As shipped [1]	Dried bauxite equivalent
1943	188,842	182,350	6,348,478	5,765,491	6,537,320	5,947,841
1944	132,533	129,568	2,788,019	2,568,770	2,920,552	2,698,338
1945	77,134	80,567	988,877	991,227	1,066,011	1,071,794
1946	52,505	53,829	1,049,125	964,945	1,101,630	1,018,774
1947	50,024	51,291	1,186,726	1,108,932	1,236,750	1,160,223

[1] Includes crude, dried, calcined, activated, and sintered.

totaling 1,427,111 long tons (1,202,055 tons, dried equivalent) in 1947, despite the sharp rise in imports of foreign bauxite. Production in Alabama and Arkansas increased 3 and 10 percent, respectively; but output in Georgia declined 10 percent, and mines in Virginia remained closed throughout the year.

Alabama.—Mines in the Eufaula district, Barbour and Henry Counties, were operated by the Alcoa Mining Co. and the D. M. Wilson Bauxite Co. The latter company shipped part of its 1947 output to the Floridin Co., at whose plant in Quincy, Fla. the bauxite was activated for use in the petroleum-refining industry; the remainder of the tonnage mined was shipped directly to consumers, chiefly for use in refractories. The Alcoa Mining Co. operates a drying plant adjacent to its mines, from which dried bauxite was shipped to the chemical and refractory industries in 1947.

Arkansas.—Production of bauxite at the Saline County mines of the Alcoa Mining Co. was 8 percent greater in 1947 than in the preceding year. Both underground and open-pit mines are worked by the company in the vicinity of Bauxite and are served by a drying and calcining plant that prepares the ore for shipment to alumina, abrasive, chemical, and other plants. In Pulaski County, output from the Drury mines of the Alcoa Mining Co. declined substantially from the 1946 level. Most of the production of these mines was calcined at the Drury plant of the affiliated Aluminum Ore Co. for shipment to the abrasive and refractory industries, but a small quantity went to another processor for treatment.

At its Young mine in Saline County, the Crouch Mining Co. produced slightly less ore than was mined in 1946. The entire output was calcined at the plant near Bauxite and shipped to the abrasive industry.

The Rauch Leased mine in Pulaski County was the only one operated by the American Cyanamid Co. in Arkansas in 1947. However, shipments were made from ore in stock at the Heckler mine in Pulaski County and the Townsend mine in Saline County to the drying plant near Berger, where the bauxite was prepared for use in chemical plants. Production of ore by the company was somewhat less than in 1946 and was supplemented by purchases from another producer.

The Reynolds Mining Corp. operated the Fletcher, Hurricane Creek, Covington, and Whitley mines in Saline County and the Buzbee mine in Pulaski County in 1947. The combined output, which was 32 percent greater than 1946 production, was sold undried to the parent Reynolds Metals Co. for use at the Hurricane Creek alumina plant.

The Norton Co. did not operate the Norton mine in Saline County during 1947 but purchased ore from another company for calcining at its processing plant. The output of calcined domestic ore, 10 percent less than in 1946, was for the use of the company abrasives plants.

The Dulin Bauxite Co. operated the Vinson-Hoffman, Nutt-Bailey, and Vick mines in Pulaski County and a calcining plant near Sweet Home, Pulaski County; in addition to the calcined bauxite produced in 1947, all of which was for abrasives, the company sold crude ore to the aluminum industry. Shipments of calcined bauxite and crude ore in 1947 were both greater than in 1946.

Output of the Rummel mine of the Pulaski Mining Co. in Pulaski County was much greater than in 1946. All production went to other local processors, being destined eventually for the abrasive and chemical industries.

The Porocel Corp. continued to operate its activating plant at Berger, producing activated bauxite for oil refining and use as a catalyst, and dried ore for the chemical industry. All crude ore was purchased from local producers.

Georgia.—The American Cyanamid Co. continued to operate the Hatton and Thigpen mines in the Andersonville district, Sumter County, where output was slightly less than in 1946. All ore was dried and shipped to chemical plants. The mines of the Alcoa Mining Co. in the Hermitage district, Floyd County, were closed during 1947.

Virginia.—The Alcoa Mining Co. kept its mines near Spottswood, Augusta County, closed throughout 1947.

Recovery of processed bauxite in the United States, 1943–47, in long tons

Year	Crude ore treated	Processed bauxite recovered: Dried	Activated, calcined, or sintered	Total	Dried bauxite equivalent
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
1946	708,964	426,618	111,312	537,930	597,509
1947	655,702	410,727	102,320	513,047	564,829

Bauxite shipped from mines and processing plants in the United States, 1944–47, by consuming industries, in long tons

Industry	1944		1945		1946		1947	
	As shipped [1]	Dried bauxite equivalent	As shipped [1]	Dried bauxite equivalent	As shipped [1]	Dried bauxite equivalent	As shipped [1]	Dried bauxite equivalent
Alumina [2]	2,628,481	2,335,137	816,776	760,782	872,311	732,972	1,032,161	907,852
Chemical	128,503	127,526	98,664	97,029	109,496	109,153	91,728	91,343
Abrasive [3]	143,389	209,135	117,493	174,338	98,670	146,868	86,265	129,126
Petroleum refining, refractory,[3] and other	20,179	26,540	33,078	39,645	21,153	29,781	26,596	31,902
Total: Long tons	2,920,552	2,698,338	1,066,011	1,071,794	1,101,630	1,018,774	1,236,750	1,160,223
Value	$15,814,431		$7,386,337		$7,725,939		$8,473,704	

[1] Includes crude, dried, calcined, activated, and sintered.
[2] Includes shipments to Office of Metals Reserve stock piles as follows:
1944—1,594,487 tons (1,332,673 dried equivalent).
1945—400,096 tons (339,052 dried equivalent).
1946—33,382 tons (28,375 dried equivalent).
[3] Small quantity of bauxite shipped to makers of refractories probably included with "Abrasive."

CONSUMPTION

Consumption of bauxite for all purposes totaled 2,564,442 long tons (dried equivalent) in 1947, compared with 1,889,156 tons in 1946. The consumption figures for both years included 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 use. Consumption on an as-shipped basis totaled 2,567,033 tons, comprising 674,623 tons of crude ore, 1,726,714 tons of dried ore, 157,535 tons of calcined bauxite, and 8,162 tons of activated bauxite. Of that consumed (dried-equivalent basis) in 1947, 47 percent was domestic and 53 percent foreign. The alumina industry used 92 percent of the foreign ore consumed during 1947.

Bauxite consumed in the United States, 1946–47, by consuming industries, in long tons

[Dried bauxite equivalent]

Industry	1946			1947		
	Domestic	Foreign	Total	Domestic	Foreign	Total
Alumina [1]	684,074	831,528	1,515,602	869,796	1,258,135	2,127,931
Chemical	96,306	43,527	139,833	104,038	41,094	145,132
Abrasive and refractory	182,582	22,798	205,380	193,923	53,888	247,811
Other	20,804	7,537	28,341	33,434	10,134	43,568
	983,766	905,390	1,889,156	1,201,191	1,363,251	2,564,442

[1] Includes some bauxite used in making chemicals and other products.

Alumina.—Bauxite consumption by alumina plants totaled 2,127,931 long tons (869,796 tons from domestic mines and 1,258,135 tons from foreign sources). The alumina industry consumed 83 percent of the total, compared with 80 percent in 1946. Not all bauxite used by the alumina industry is destined to emerge finally as aluminum metal, as some of the alumina produced is used by the chemical, abrasive, and refractory industries and some is processed into activated or tabular forms for use in oil refining and ceramic products.

Chemicals.—Consumption of bauxite by producers of aluminum salts was 145,132 long tons (104,038 tons of domestic and 41,094 tons of foreign) compared with 139,833 tons (96,306 tons of domestic and 43,527 tons of foreign) in 1946. Consumption of bauxite for the production of nonmetallurgical alumina is included in the figures above and in the preceding paragraph. In addition to bauxite, producers of aluminum salts reported the consumption of 16,670 short tons of aluminum trihydrate (prepared from bauxite by other companies), 5,006 tons of secondary aluminum, 47,125 tons of clay, and a small tonnage of bichromate residue during 1947.

Production of aluminum salts increased slightly in 1947, but shipments declined fractionally. Output of alumina for purposes other than aluminum production increased 10 percent, and shipments gained 8 percent.

Aluminum salts and alumina produced and shipped in the United States, 1946–47

	1946				1947			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Shippers	Short tons	Value		Shippers	Short tons	Value
Aluminum salts:								
Alum:								
Ammonia	7,551	5	7,391	$502,509	5,007	5	5,299	$393,839
Potash	5,163	4	5,035	372,235	3,782	4	3,633	304,098
Aluminum chloride:								
Liquid	7,374	4	6,748	252,491	6,862	4	6,643	263,384
Crystal	17,812	3	17,726	2,584,133	18,268	2	18,079	3,045,440
Anhydrous		6				6		
Aluminum sulfate:								
Commercial:								
General	568,345	18	569,435	12,491,270	595,612	17	582,222	13,469,279
Municipal	11,982	8	12,268	228,184	10,755	8	10,671	162,595
Iron free	32,791	6	30,730	1,063,299	24,371	8	24,419	985,489
Sodium aluminum sulfate	29,903	2	30,323	2,015,360	25,538	2	24,103	1,829,971
Sodium aluminate		10				8		
Total aluminum salts	680,921		679,656	19,509,481	690,195		675,069	20,454,095
Alumina [1]	71,281	9	73,661	6,168,752	78,238	7	79,292	6,774,282

[1] Excludes alumina produced for use in making aluminum; includes activated, calcined, crude, light and heavy hydrate, converted to a calcined alumina equivalent.

Abrasive and Refractory.—Producers of crude aluminous abrasives and high-alumina refractories used 247,811 tons of bauxite in 1947, or almost 10 percent of the total foreign and domestic bauxite consumed. This tonnage was 21 percent greater than the corresponding 1946 consumption and comprised 193,923 tons of domestic ore and 53,888 tons of foreign bauxite.

Other.—Consumption of bauxite in the cement, steel, ferro-alloy, and petroleum-refining industries was 54 percent greater in 1947 than in the preceding year.

STOCKS

Stocks of bauxite on hand at mines and processing plants on December 31, 1947, totaled 492,798 long tons (dried equivalent) compared with 478,027 tons (revised figure) at the end of 1946. Stocks at consumers' plants increased from 252,977 tons on December 31, 1946, to 446,434 tons on December 31, 1947, a gain of 76 percent. In addition, there was a Government-owned (War Assets Administration) stock pile of 2,785,527 tons of medium-grade bauxite in Arkansas, on which the Reynolds Metals Co., as operators of the Hurricane Creek plant, held option to purchase if needed. The above figures exclude material held by the Bureau of Federal Supply.

Stocks of bauxite on hand Dec. 31, 1943–47, in long tons

Year	Producers, crude	Processors		Consumers		Government, crude	Total	
		Crude	Processed [1]	Crude	Processed [1]		Crude and processed	Dried bauxite equivalent
1943	494,182	60,727	6,767	861,497	750,481	2,855,896	5,029,550	4,413,456
1944	537,092	68,163	7,019	483,836	304,251	3,413,607	4,813,968	4,156,742
1945	346,463	119,788	5,277	126,643	296,486	3,244,707	4,139,364	3,584,132
1946	[2] 350,565	196,599	9,853	62,442	181,708	[3] 3,277,090	[2] [3] 4,078,257	[2] [3] 3,516,901
1947	378,068	182,899	11,497	35,983	399,314	[3] 3,277,090	[3] 4,284,851	[3] 3,724,759

[1] Dried, calcined, activated, and sintered.
[2] Revised figure.
[3] Excludes stocks held by Bureau of Federal Supply.

PRICES

The average selling price in 1947, f. o. b. mines and processing plants, was $4.82 a long ton for crude (undried) bauxite, $7.67 for crushed dried bauxite, $15.99 for calcined bauxite, and $55.30 for activated bauxite. The corresponding prices in 1946 were as follows: $5.10 for crude, $6.98 for dried, $15.43 for calcined, and $48.81 for activated. The decline in average price for crude ore was due to the lower grade of ore being shipped. The weighted average price for all grades of domestic ore as shipped was $6.85 a long ton in 1947 ($7.01 in 1946). The only change in nominal market quotations for domestic bauxite in 1947 was a quotation of $4 to $5 a ton on crude in place of the $5 quoted in preceding years. Quotations on foreign bauxite have not been published in domestic trade journals since February 1941.

FOREIGN TRADE [1]

Imports of bauxite established an all-time record in 1947, totaling 1,821,580 long tons or 114 percent more than was received in 1946. Of the ore imported in 1947, 1,660,823 tons were from Surinam, 108,562 tons from British Guiana, and the remaining 52,195 tons from the Netherlands Indies. By customs districts, receipts were as follows: 1,045,244 tons at Mobile, 709,914 at New Orleans, 28,617 at Philadelphia, 9,768 at Massachusetts, 8,725 at Maryland, 6,895

[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.

at Sabine, 4,549 at New York, 2,822 at Georgia, 2,714 at San Francisco, and 2,331 at Buffalo. The duty on bauxite was $1 a long ton until January 1, 1948, when it was lowered to $0.50 a ton.

Bauxite and aluminum compounds imported into the United States, 1943–47

[U. S. Department of Commerce]

Year	Bauxite			Alumina		Aluminum compounds	
	As imported (long tons)	Dried bauxite equivalent [1] (long tons)	Value	Long tons	Value	Short tons	Value
1943	1,547,854	1,541,929	$10,860,149	12,372	$1,108,104	3	$941
1944	560,461	555,647	3,844,310	(2)	1		
1945	739,581	737,081	5,273,122	179	10,940		
1946	852,005	851,148	5,965,124	4	2,607	2	654
1947	1,821,580	1,842,176	11,869,631			80	2,348

[1] Calculated by Bureau of Mines.
[2] Less than 1 ton.

Exports of bauxite and bauxite concentrates declined for the fourth successive year, totaling 94,369 long tons in 1947, compared with 97,788 tons in 1946. Of the 1947 shipments, 80,179 tons were classified as bauxite and other aluminous ores and 14,190 tons as bauxite concentrates (including alumina). All of the bauxite and other aluminous ores and 62 percent of the bauxite concentrates exported went to Canada. Most of the bauxite exported to Canada is used to manufacture crude abrasives, which are returned to the United States for final manufacture and consumption.

Bauxite and aluminum compounds exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Bauxite (including bauxite concentrates), long tons			Aluminum sulfate		Other aluminum compounds	
	As exported	Dried bauxite equivalent [1]	Value	Short tons	Value	Short tons	Value
1943	417,186	528,839	$5,575,128	37,946	$963,151	2,922	$307,288
1944	146,638	210,852	2,928,799	41,434	1,072,140	3,802	528,821
1945	126,077	156,129	2,424,921	37,972	993,869	4,106	530,350
1946	97,788	127,840	1,599,259	37,957	962,938	4,055	637,997
1947	94,369	141,235	1,888,040	23,389	706,572	3,753	738,374

[1] Calculated by Bureau of Mines.

WORLD REVIEW

Substantial increases in output of bauxite were recorded in most of the important producing countries in 1947, Surinam and Hungary making the most important gains. Total world output is estimated to have increased 41 percent over 1946. Of the 1947 total, about 67 percent was mined in the Western Hemisphere, almost entirely in the United States and the Guianas, compared with 68 percent in 1946.

World production of bauxite, 1941–47, by countries, in metric tons [1]

[Compiled by B. B. Mitchell]

Country [1]	1941	1942	1943	1944	1945	1946	1947
Australia:							
New South Wales	2,671	1,832	734	2,025	1,700	([2])	([2])
Victoria	2,793	1,655	1,855	1,842	1,792	2,351	2,555
Austria	879	554	24	18,812	8,756	----------	([2])
Brazil	14,365	29,890	[3] 93,000	[3] 19,000	[3] 23,000	[3] 17,000	[3] 17,000
British Guiana	1,060,979	1,215,744	1,919,060	928,178	678,482	[4] 1,137,991	[4] 1,318,190
France	587,420	639,560	916,350	665,630	252,416	478,242	677,372
Germany	12,478	13,752	12,276	([2])	([2])	([2])	([2])
Gold Coast	14,886	44,767	162,685	107,854	148,547	116,846	[4] [5] 82,336
Greece	18,000	23,000	25,000	10,000	----------	----------	23,500
Haiti	----------	----------	----------	----------	300	300	----------
Hungary	823,410	988,550	1,001,370	758,299	35,402	101,140	340,260
India	13,170	18,551	24,548	12,330	14,116	7,592	([2])
Indochina, French	10,200	12,800	----------	360	([2])	([2])	([2])
Italy	536,881	509,430	[6] 210,634	([2])	2,584	65,447	164,190
Jamaica	----------	----------	2,642	----------	----------	----------	----------
Japan	----------	----------	----------	2,000	----------	----------	----------
Malayan Union	[7] 26,140	[7] 54,700	[7] 168,336	[7] 72,343	----------	([2])	([2])
Netherlands Indies	171,821	[7] 297,700	[7] 649,760	[7] 275,017	([2])	----------	([2])
Palau Island [8]	59,297	135,669	104,223	1,000	----------	----------	----------
Portuguese East Africa	1,352	1,860	3,272	6,177	4,369	1,469	([2])
Rumania	9,762	15,041	12,633	([2])	([2])	663	([2])
Spain	1,393	2,214	23,947	2,921	5,119	4,926	5,775
Surinam	1,198,900	1,227,512	1,655,147	625,804	[4] 683,990	[4] 857,843	[4] 1,809,837
U. S. S. R. (estimate)	325,000	198,000	313,000	355,000	[3] 400,000	[3] 425,000	[3] 475,000
United Kingdom:							
Northern Ireland	13,090	95,724	107,924	44,502	36,981	----------	----------
United States (dried equivalent of crude ore)	952,090	2,643,797	6,332,921	2,869,045	996,754	1,121,774	1,221,348
Yugoslavia	[9] 203,000	[9] 86,000	([2])	([2])	([2])	([2])	([2])
Total	6,110,000	8,358,000	13,955,000	7,102,000	3,520,000	4,591,000	6,469,000

[1] Bauxite is produced in French West Africa, but production data are not available.
[2] Data not available; estimate by author of chapter included in total.
[3] Estimate.
[4] Exports.
[5] January to September, inclusive.
[6] January to June, inclusive.
[7] Imports into Japan, Formosa, and Korea in fiscal year ended March 31 of year following that stated; preliminary figures.
[8] Imports into Japan and Formosa in fiscal year ended March 31 of year following that stated; preliminary figures.
[9] Croatia only; estimate for rest of Yugoslavia included in total.

Australia.—In view of plans developing toward an aluminum industry in Australia, keen interest has been aroused in the discovery of extensive additional deposits of bauxite in New South Wales. The deposits are estimated to contain 14,000,000 to 20,000,000 tons of bauxite amenable to treatment by the Bayer process. Although the alumina content is low, tests indicate this disadvantage would be offset by low caustic-soda consumption. Most of the Australian deposits found thus far have been of low alumina content, those in the Gippsland area of eastern Victoria being of the highest grade. Total reserves of usable ore, as now known, would sustain the contemplated aluminum industry for about 75 years.

Brazil.—Owing to the failure of the aluminum industry in Brazil to achieve sustained operation, all bauxite output has been either exported or used internally for chemicals and other products. Output consequently has been limited to a small fraction of the extensive reserves in the Pocas de Caldas and Ouro Preto districts.

It was reported in 1947 that another attempt would be made to develop the deposits of phosphatic bauxite on the island of Trauhira off the coast of Maranhao State. Lack of labor and unfavorable climate were the most formidable barriers to exploitation.

British Guiana.—Much of the bauxite production of British Guiana in recent years has been exported to Canada by the major producer, the Demerara Bauxite Co., Ltd., controlled by the Aluminum Co. of Canada. The only other producer has been the Berbice Bauxite Co., an affiliate of the American Cyanamid Co. However, during 1947, both the Permanente Metals Corp. and the Reynolds Metals Co. obtained exploration concessions on thousands of acres in the Essequibo River area. If promising deposits are located, it is quite possible that one of the two companies will start mining operations.

China.[2]—Recent discovery of a deposit of trihydrate bauxite in China lends encouragement to the possibility of developing an aluminum industry on the Chinese mainland. Extensive deposits of alunite, aluminous shale, and bauxite of diaspore character have been known in the country for some time, but the latest find (about 500,000 tons) in the Changpu district of Fukien Province is the first gibbsite discovered and would be readily usable in Bayer-process alumina plants.

France.—Output of bauxite in France increased 42 percent in 1947 and was back to its prewar level, despite the loss of much of the export trade with the United Kingdom (where alumina reduction capacity has been decreased). Although hampered by rising prices, lack of transportation, and shortage of power for aluminum production, France's domestic consumption of bauxite was much greater in 1947 than before the war.

Greece.—Although war damage to bauxite mines in Greece was considerable, output was being expanded during 1947. The chief obstacles to production were the unsettled conditions in regard to labor and foreign exchange and the difficulty of finding markets.

Hungary.—In view of the almost complete disruption of aluminum production in Germany, sentiment in Hungary favored an attempt at establishing the country as the leading aluminum producer of Central Europe. Bauxite production under joint Russo-Hungarian operation in 1947 was greatly advanced over 1946. It was indicated at the end of the year that nationalization of the bauxite, alumina, and aluminum industries would soon be effected. Another development was a trade agreement with Yugoslavia, designed to further the growing aluminum industry.

Italy.—Loss of bauxite sources in the Istrian Peninsula, which was ceded to Yugoslavia after the war, was a blow to the Italian bauxite and aluminum industry. However, it was reported that new deposits in southern Italy were important enough to offset the loss appreciably. Rehabilitation of alumina plants called for increased production of bauxite, resulting in a rise of 150 percent in output in 1947 over 1946.

Jamaica.—Important undeveloped resources of bauxite lie on this island, which is considerably closer to the United States than the Guianas. Estimates of total reserves range from 100,000,000 tons to 350,000,000 tons. Interested companies are the Aluminum Co. of Canada, Permanente Metals Corp., and the Reynolds Metals Co. Preliminary testing by the latter company indicated adaptability of the ore, which is partly diasporic, to treatment by the Bayer process.

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[2] Kleinhans, Richard E., The Light-Metals Industries in China: Bureau of Mines, Mineral Trade Notes vol. 26, No. 2, Spec. Suppl. 23, February 1948, 18 pp.

The island may well become one of the important sources of supply for the American aluminum industry.

Netherlands Indies.—Although some shipments were made from stock early in 1947, production at the principal mines on the island of Bintan did not get under way until late in the year. Reserves on Bintan, Singkep, Pesik, Selajar, Keling, and Lalang Islands were regarded as probable bauxite sources for the rehabilitated alumina plant on Formosa, for Japan, and the United States. Most of the Bintan ore is of high grade, and transportation conditions are favorable.

Palau.—Investigation of deposits formerly worked by the Japanese on the island of Babelthuap, in the Palau group, disclosed an important new source of supply available to the United States or to possible new aluminum-plant developments in the Far East. Reserves of ore were estimated at 5,000,000 tons. However, considerable rehabilitation and new development would be necessary before actual production could begin.

Surinam.—Production in this country, the most important supplier of the United States aluminum industry, increased phenomenally in 1947. The 1,809,837 tons produced during the year eclipsed the previous record, set in 1943, by 9 percent, and the Surinaamsche Bauxiet Maatschappij (affiliate of the Aluminum Co. of America) was planning additional drying and calcining equipment, so that production could be further increased. With Alcoa furnishing bauxite for the Baton Rouge, La., plant of the Permanente Metals Corp., the burden of supply fell on the Surinam producer.

In Surinam, as in British Guiana, the Permanente Metals Corp. and the Reynolds Metals Co. were pursuing investigations toward possible development of additional sources of bauxite supply.

Bismuth

By SAMUEL A. GUSTAVSON

GENERAL SUMMARY

A 40-PERCENT increase in domestic refinery production of metallic bismuth more than offset a 26-percent decrease in imports in 1947, and the total supply of bismuth metal available for consumption in the United States (other than that provided by drafts on stocks) was 16 percent greater than in 1946. Stocks held in the United States by foreign and domestic producers decreased 8 percent during 1947. Producers' shipments to industry in 1947 indicate that the demand for bismuth for pharmaceutical use declined considerably, whereas the demand for metallurgical use showed a marked increase. Inventories of the Office of Metals Reserve were completely disposed of to industry and to the Government strategic stock pile. The quoted price of metallic bismuth rose from $1.80 per pound to $2 per pound on February 21, with no further change the remainder of the year.

DOMESTIC PRODUCTION

Bismuth is produced in the United States as a byproduct in the smelting of domestic and foreign lead and copper ores whose primary value in bismuth is negligible, and from Mexican bismuth-lead bullion. Increases in output of both lead and copper led to a 40-percent increase in production of domestic refined bismuth in 1947 over 1946. The Bureau of Mines is not at liberty to publish data showing domestic production of bismuth. The three primary producers of bismuth metal in the United States are the American Smelting & Refining Co., Anaconda Copper Mining Co., and United States Smelting, Refining, & Mining Co.

CONSUMPTION AND USES

Domestic consumption data are not available for 1947. The Office of Materials Distribution (and predecessor war agencies), United States Department of Commerce, collected these data during 1942–46, but bismuth reports to that agency were discontinued December 31, 1946. A use distribution of bismuth metal sales in the United States during 1947 has been estimated in the following table.

Bismuth consumed in the United States, 1945–47, by uses

Uses	1945 [1]		1946 [1]		1947 [2]
	Pounds	Percent of total	Pounds	Percent of total	Percent of total
Pharmaceuticals	839,458	51	831,882	63	52
Fabricating alloys	371,334	23	306,891	23	34
Ammunition solders	91,250	6	68,860	5	(3)
Fuse alloys	77,169	5	38,900	3	(3)
Aluminum alloys	58,107	3	33,514	2	3
Other	197,975	12	50,221	4	11
Total consumption	1,635,293	100	1,330,268	100	100

1 Figures compiled by Civilian Production Administration, now Office of Materials Distribution.
2 Estimated by producing companies.
3 Included in other.

Manufacturers of pharmaceuticals purchased about 52 percent of the total bismuth sold. Important pharmaceutical uses include indigestion remedies, antisyphilitic drugs, and cosmetic powders.

The metallurgical industry purchased about 48 percent of the total bismuth sold. Uses include low-melting alloys of cadmium, tin, lead, and bismuth which are used in fire-protection apparatus; molds; filling supports in bending thin-wall tubing; machinery anchors; and spray coats on wooden patterns. Other bismuth alloys are used as solders, coatings for selenium rectifiers, and electrical fuses. Aluminum alloys, malleable irons, and certain steels have better machinability if they contain a small quantity of bismuth.

STOCKS

Stocks of bismuth metal held in the United States by the three domestic producers and the Cerro de Pasco Corp. on December 31, 1947, were 8 percent less than stocks held on December 31, 1946, and considerably less than quantities held at similar periods during the years immediately preceding the recent World War. Stocks held by distributors and consumers are not available, as the Office of Materials Distribution, United States Department of Commerce, from which these figures were obtained, discontinued its bismuth canvass December 31, 1946.

Bismuth metal inventories of the Office of Metals Reserve, which totaled 586,546 pounds on January 1, 1947, were completely disposed of during the year.

PRICES

New York quoted price for bismuth metal (Engineering and Mining Journal) was \$1.80 per pound, ton lots, from January 1 to February 20 and \$2 per pound February 21 to the end of the year.

The London price of bismuth ore (Metal Bulletin), 50 percent, c. i. f., per pound of contained bismuth was 4s. 5d. throughout the year. Metallic bismuth 99.95 percent, 5-cwt. lots, was quoted at 10s. per pound from January 1 through August and at 11s. for the remainder of 1947.

FOREIGN TRADE[1]

Imports.—Imports of refined metallic bismuth totaled 310,561 pounds in 1947 compared with 422,336 pounds in 1946, a 26-percent decrease. Peru, the chief source, accounted for 310,545 pounds and Canada only 16 pounds. A quantity of bismuth, not accounted for above, contained in bismuth-lead bullion also was imported from Peru. Virtually all of the 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, 1943–47

[U. S. Department of Commerce]

Year	Bismuth ore[1]			Refined metallic bismuth		Bismuth compounds and mixtures	
	Pounds		Value	Pounds	Value	Pounds	Value
	Gross weight	Bi content					
1943	138,600	48,800	$52,400	[2] 430,874	[2] $442,301	13	$53
1944	118,739	51,349	60,878	363,980	345,796	40	352
1945				333,231	316,135		
1946	(1)	(1)	(1)	422,336	464,922		
1947	(1)	(1)	(1)	310,561	480,808		

1 Figures compiled by Foreign Economic Administration. Those for 1946–47 not available.
2 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.—Metal and alloys exported in 1947 contained 240,833 pounds of bismuth, an increase of 57 percent over 1946; exports of bismuth compounds and medicinals probably advanced. Most of the metal was shipped to United Kingdom, France, and Italy.

Bismuth exported from the United States, 1945–47, by classes

[U. S. Department of Commerce]

Class	1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value
Matte			93,960	$8,629		
Metal and alloys	115,543	$149,031	153,058	173,463	240,833	$452,147
Compounds and mixtures:						
Carbonate	22,197	35,178	(1)	(1)	(1)	(1)
Nitrate	78,895	105,061	(1)	(1)	(1)	(1)
Other	22,331	50,902	(1)	(1)	(1)	(1)

1 Beginning Jan. 1, 1946, data not separately classified.

WORLD REVIEW

World production of bismuth is estimated at approximately 1,000,000 kilograms (2,204,600 pounds) in 1947. The principal producers were the United States, Peru, Canada, and Mexico.

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.

World production of bismuth, 1942–47, by countries, in kilograms [1]

[Compiled by B. B. Mitchell]

Country [1]	1942	1943	1944	1945	1946	1947
Argentina: Metal	13,101	18,000	(2)	(2)	(2)	(2)
In ore [3]	17,000	25,000	21,000	25,000	(2)	(2)
Australia (in ore) [4]	762	5,741	3,556	4,600	(2)	(2)
Bolivia (in ore and bullion exported) [5]	8,896	12,419	605	15,337	27,867	88,964
Canada: Metal	156,605	184,882	56,188	86,098	109,090	134,489
In bullion	1,043					
China (in ore) [3]	11,000	(2)	(2)		1,380	(2)
France (metal)	11,000	5,000	3,000	(2)	(2)	(2)
Germany: In bismuth ore	17,500	(2)	(2)	(2)	(2)	(2)
In other ores	14,700	(2)	(2)	(2)	(2)	(2)
Japan (metal)	[6] 71,000	[6] 66,000	[6] 54,000	(2)	(2)	22,862
Mexico (in impure bars)	128,041	175,055	165,379	161,368	76,000	256,000
Peru: Metal	373,942	482,920	416,159	307,446	221,778	233,797
In lead-bismuth alloy	16,913			1,500	89,665	4,425
Spain (metal)	15,880	15,198	4,910	10,071	13,756	(2)
Sweden					12,441	(2)
Union of South Africa (in ore)	167	1,890	818		554	
United States	(7)	(7)	(7)	(7)	(7)	(7)
World production (estimate)	1,700,000	1,400,000	1,200,000	1,100,000	900,000	1,000,000

[1] Bismuth is believed to be produced also in Brazil, Burma, Norway, Rumania, 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] Data not available. Estimate by author included in total.
[3] Estimate.
[4] Partly estimated. Excludes content of some bismuth-tungsten concentrates.
[5] Excludes bismuth content of tin concentrates exported.
[6] Incomplete preliminary data for year ended Mar. 31 of year following that stated.
[7] Production included in total; Bureau of Mines not at liberty to publish separately.

Argentina.—Although a new bismuth mine was opened at San Francisco de Los Andes in the Province of San Juan in 1947 the total production of bismuth differed only slightly from that of 1946.

Bolivia.—The Compagnie Aramayo de Mines en Bolivia and Fabulosa Mines Consolidated were the principal producers of bismuth ore. Most of the Bolivian exports were shipped to the United Kingdom.

Canada.—Chief producers of bismuth in Canada are the Consolidated Mining & Smelting Co., Ltd., at Trail, B. C., and the La Corne mine of the Molybdenite Corp. of Canada [2] at Val d'Or, Quebec.

Peru.—The world's largest producer was the Cerro de Pasco Copper Corp. According to official figures, bismuth exports from Peru since 1939, in metric tons, were as follows:

	1939	1940	1941	1942	1943	1944	1945	1946	1947
Exports	438	383	520	346	484	446	272	311	[1] 238

[1] Estimated.

Spain.—In 1947 Spain produced 48.7 metric tons of bismuth concentrates as compared with 119 metric tons in 1946. The concentrates produced in 1946 were reported to contain 14 metric tons of bismuth metal.

United Kingdom.—Imports of bismuth metal were 342,205 pounds in 1947 compared with 486,708 pounds in 1946.

[2] Bonham, W. M., La Corne Mine: Canadian Min. Jour., vol. 68, No. 12, December 1947, pp. 881–884.

Cadmium

By RICHARD H. MOTE

GENERAL SUMMARY

DOMESTIC cadmium supplies were substantially improved in 1947 as compared with 1946. Marked gains in production of metal and compounds, together with expanded imports, combined to exceed the 12-percent rise in consumption and permitted a 39-percent expansion of total industry stocks. Prices advanced early in the year from $1.50 a pound for commercial sticks and $1.55 for patented shapes to $1.75 and $1.80, respectively.

Salient statistics of the cadmium industry in the United States, 1943–47, in pounds of contained cadmium

	1943	1944	1945	1946	1947
Production (primary)	8,466,963	8,779,856	8,383,629	6,471,187	8,508,146
Imports (metal)	48,891	66,627	28,724	17,415	20,292
Exports (metal)	156,844	548,015	102,199	140,385	303,401
Consumption	7,381,000	8,865,000	[1] 8,642,799	[1,2] 6,983,610	[1] 7,800,821

[1] Apparent consumption.
[2] Revised figure.

DOMESTIC PRODUCTION

The most important cadmium mineral is greenockite (CdS, 77.8 percent cadmium), which occurs in minor quantities associated with virtually all zinc ores and to a lesser extent with lead and copper ores containing zinc mineralization. The cadmium content is never large enough, however, to permit profitable mining for the sole purpose of recovering the cadmium. Thus the quantity of cadmium contained in ores is rarely determined. In zinc concentrates the cadmium content seldom exceeds 1 percent, which is exceptional. Zinc concentrates from the Tri-State region average 0.35 percent cadmium and concentrates from mines in the Rocky Mountain region and far West rarely carry more than 0.2 percent cadmium.

The entire domestic supply of primary cadmium is recovered concurrently with the treatment of ores of other metals as a byproduct from the flue dusts of zinc-blende roasting furnaces and lead blast furnaces, from zinc dust collected in the early stages of distillation in zinc retorts, and from the sludges of electrolytic zinc plants. A small quantity of secondary metal is recovered from old bearings and other alloys but constitutes no great part of the total supply. As most reduction plants participating in the recovery of cadmium treat both domestic and foreign cadmium-bearing materials without determining the cadmium content of either, the origin of the metal produced from domestic sources 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 of this volume for metals like copper, lead, and zinc.

Cadmium produced and shipped in the United States, 1943–47, in pounds of contained cadmium

	1943	1944	1945	1946	1947
Production:					
Primary:					
Metallic cadmium	8, 396, 292	8, 453, 470	7, 932, 579	6, 200, 398	8, 007, 287
Cadmium compounds [1]	70, 671	326, 386	451, 050	270, 789	500, 859
Total primary production	8, 466, 963	8, 779, 856	8, 383, 629	6, 471, 187	8, 508, 146
Secondary (metal and compounds) [1 2]	162, 424	106, 850	72, 473	355, 104	104, 764
Shipments by producers:					
Primary:					
Metallic cadmium	8, 326, 768	8, 551, 424	7, 938, 658	6, 180, 265	7, 852, 907
Cadmium compounds [1]	137, 952	285, 203	451, 050	270, 789	500, 859
Total primary shipments	8, 464, 720	8, 836, 627	8, 389, 708	6, 451, 054	8, 353, 766
Secondary (metal and compounds) [1 2]	187, 913	106, 850	67, 513	360, 924	134, 793
Value of primary shipments:					
Metallic cadmium	\$6, 570, 546	\$6, 435, 124	\$6, 106, 992	\$6, 094, 572	\$12, 358, 526
Cadmium compounds [3]	108, 844	213, 902	347, 308	267, 033	788, 352
Total value	6, 679, 390	6, 649, 026	6, 454, 300	6, 361, 605	13, 146, 878

[1] Excludes compounds made from metal.
[2] Bureau of Mines not at liberty to publish figures separately for secondary cadmium compounds.
[3] Value of metal contained in compounds made directly from flue dust or other cadmium raw materials (except metal).

The domestic output of primary metallic cadmium increased 29 percent in 1947 to the highest level since the peak year of 1944. The production of cadmium contained in primary compounds also increased, but the recovery of secondary metal dropped sharply.

A list of plants producing cadmium metal in the United States in 1947 follows:

Primary metallic cadmium

Colorado: Denver—American Smelting & Refining Co.
Idaho:
  Bradley—Bunker Hill & Sullivan Mining & Concentrating Co.
  Kellogg—Sullivan Mining Co.
Illinois: Fairmont City—American Zinc Co. of Illinois.
Kansas: Galena—Eagle-Picher Co.
Missouri: Herculaneum—St. Joseph Lead Co.
Montana: Great Falls—Anaconda Copper Mining Co.
Oklahoma:
  Bartlesville—National Zinc Co., Inc.
  Henryetta—Eagle-Picher Mining & Smelting Co.
Pennsylvania:
  Donora—American Steel & Wire Co.
  Josephtown—St. Joseph Lead Co.
  Palmerton—New Jersey Zinc Co.
Texas: Corpus Christi—American Smelting & Refining Co.

Secondary metallic cadmium

Arkansas: Jonesboro—Arkansas Metals Co.
Michigan: Detroit—Aetna Smelting & Refining Co.
New York: Whitestone—Neo-Smelting & Refining, Inc.

The total output of cadmium oxide and sulfide increased 10 percent in 1947 to 1,700,941 pounds of contained cadmium. Data for the production of other cadmium compounds are not available for 1947.

Cadmium oxide and cadmium sulfide produced in the United States, 1943–47, in pounds

Year	Oxide		Sulfide [1]		Year	Oxide		Sulfide [1]	
	Gross weight	Cd content	Gross weight	Cd content		Gross weight	Cd content	Gross weight	Cd content
1943	537,357	469,976	671,831	227,045	1946	364,285	317,767	3,637,177	1,225,680
1944	571,366	499,507	1,312,263	466,794	1947	449,847	392,556	3,501,508	1,308,385
1945	439,415	383,553	1,731,510	637,667					

[1] Includes cadmium lithopone and cadmium sulfoselenide.

CONSUMPTION AND USES

The apparent consumption of cadmium in all forms in 1947 totaled 7,800,821 pounds, a 12-percent increase over 1946. The gain in consumption resulted not only from increased use of the metal for plating and in alloys, but also from increased use of cadmium compounds. About 95 percent of the available cadmium is consumed in electroplating, bearing alloys, and pigments, and the remaining 5 percent goes into miscellaneous alloys, laboratory reagents, and photographic chemicals.

Electroplating.—The principal use of cadmium metal is as a protective coating for iron and steel, and, to a much smaller extent, copper alloys. Its chief advantages as an electroplating medium as compared to zinc are as follows: (1) Thinner coatings provide equal protection; (2) the rate of deposition for a given quantity of electric current is larger, hence electricity costs are reduced; (3) cadmium retains its metallic luster longer; (4) plated parts are more easily soldered; (5) cadmium has a greater resistance to atmospheric corrosion; (6) it is superior in throwing power, or ability to deposit uniformly in recesses; and (7) corrosion by galvanic action is more effectively minimized. A disadvantage of cadmium plating is its low resistance to acids.

Cadmium Bearing alloys.—Cadmium-base bearing metals are used successfully in internal-combustion engines that operate at high speeds and temperatures. The bearing alloys are generally of two types, the cadmium-nickel bearing composed of 98.5 percent or more cadmium and 1.2 percent nickel, and the cadmium-silver bearing containing 98.3 percent or more cadmium, 0.7 percent silver, and 0.6 percent copper. "Graph-alloy", a cadmium-impregnated graphite containing 30 to 35 percent cadmium, is used in oilless bearings, bushing linings, and contacts for controller switches.

Cadmium Solders and Other Cadmium Alloys.—A minor use of cadmium metal is in the manufacture of low-melting-point alloys for soldering and brazing and fusible alloys for sprinkler apparatus, fire-detector systems, and valve seats for high-pressure gas containers. Listed in the following table are the nominal compositions and typical uses of the more common cadmium alloys.

Composition of cadmium alloys for soldering and other uses, in percent

Type	Use	Cd	Ag	Zn	Pb	Sn	Cu	Bi
1. Lead-tin-cadmium	Wiping solder for joining lead covered cables.	9			68	23		
2. Do	Fusible alloy for sprinkler apparatus and other safety devices.	18			32	50		
3. Zinc-cadmium-lead	Solders for electrical and plumbing trades.	10		1.5	88.5			
4. Tin-cadmium-lead	do	10			85	5		
5. Silver-brazing alloy	For brazing copper, copper-base alloys, nickel, silver, steel, and iron.	5	20	30			45	
6. Do	Low-melting-point alloy (Easy Flo) for joining steel, stainless steel, iron, copper, copper-base alloys, nickel, and nickel alloys.	18	50	16.5			15.5	
7. Wood's alloy	For making seals and connections in glass apparatus.	12.5			25	12.5		50

Cadmium Compounds.—Cadmium sulfide and cadmium sulfoselenide are standard agents for producing yellow and red colors, respectively, in paint, soap, rubber, ceramics, paper, printing ink, and other products. Virtually all the cadmium oxide, hydrate, and chloride produced is used in cadmium plating solutions. Cadmium bromide, chloride, and iodide are used in photographic films, process engraving, and lithographing.

Apparent consumption of cadmium in the United States, 1946–47, in pounds

	1946	1947		1946	1947
Supply:			Withdrawn:		
Total stocks Jan. 1 [1]	1,723,812	1,088,419	Exports (metal)	140,385	303,401
Production (primary)	6,471,187	8,508,146	Total stocks Dec. 31 [1]	[2] 1,088,419	1,512,635
Imports (metal)	17,415	20,292			
			Total withdrawn	[2] 1,228,804	1,816,036
Total supply	8,212,414	9,616,857			
			Apparent consumption	[2] 6,983,610	7,800,821

[1] Excludes consumers' stocks, which were about 1,000,000 pounds at the end of 1944 (latest date for which figures were compiled).
[2] Revised figure.

STOCKS

Total domestic stocks of cadmium metal and compounds, excluding consumers' stocks for which data are not available, increased 39 percent in 1947. Details are given in the following table.

Cadmium stocks at end of year, 1946–47, in pounds of contained cadmium

	1946 [1]			1947		
	Metallic cadmium	Cadmium compounds	Total cadmium	Metallic cadmium	Cadmium compounds	Total cadmium
Producers	260,081		260,081	443,870		443,870
Compound manufacturers	24,657	75,539	100,196	26,620	214,960	241,580
Distributors [2]	125,545	21,637	147,182	315,710	27,013	342,723
Government [3]	580,960		580,960	484,462		484,462
Total stocks [4]	991,243	97,176	1,088,419	1,270,662	241,973	1,512,635

[1] Figures partly revised.
[2] Comprises principally 6 largest dealers.
[3] Excludes cadmium in national strategic stock pile.
[4] Excludes consumers' stocks, which were about 1,000,000 pounds at the end of 1944.

PRICES

The quoted New York price was $1.50 a pound for commercial sticks and $1.55 a pound for patented shapes until February 17, when it advanced to $1.75 and $1.80, respectively, at which levels it remained the balance of the year. The average price for domestic metal, as reported to the Bureau of Mines by primary producers, was $1.57 a pound in 1947, compared with 99 cents in 1946, 77 cents in 1945, 75 cents in 1944, and 79 cents in 1943 and 1942.

FOREIGN TRADE [1]

In 1947 total imports for consumption of metallic cadmium and of cadmium contained in flue dust increased 42 percent in weight and 166 percent in value. Exports of cadmium increased 267 percent in value.

Imports.—Imports of cadmium-bearing flue dust increased 43 percent above the 1946 rate. Mexico was the only country from which flue dust was imported in 1947. Metallic cadmium imports increased 17 percent over 1946; but, except for 1946, the quantity imported was the lowest since 1932, when no imports of cadmium metal were recorded. Of the 20,292 pounds of metal imported in 1947, Canada supplied 72 percent and Peru 18 percent. For the first time since 1941 no imports of cadmium metal were received from the Belgian Congo.

Cadmium metal and flue dust imported for consumption in the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value
Metallic cadmium						
Belgian Congo	25,798	$22,997	6,700	$5,444		
Belgium and Luxembourg			2,240	5,366	2,000	$7,073
Canada	672	793	3,568	5,459	14,612	20,551
Peru	2,254	2,029	4,907	7,629	3,658	4,508
Switzerland					2	150
United Kingdom					20	63
	28,724	25,819	17,415	23,898	20,292	32,345
Flue dust (Cd content)						
Mexico	2,192,685	992,286	1,609,366	598,494	2,355,588	1,673,153
Netherlands			43,539	19,397		
	2,192,685	992,286	1,652,905	617,891	2,355,588	1,673,153
	2,221,409	1,018,105	1,670,320	641,789	2,375,880	1,705,498

Exports.—The total value of cadmium exported in 1947 was over three and one-half times greater than that in the previous year. Cadmium-metal exports increased 116 percent in quantity and 356 percent in value; but drosses, flue dust, residues, and scrap dropped to 4 percent of the 1946 exports.

[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

Tariff.—In accordance with the Canadian Trade Agreement of 1939, the duty on cadmium metal remained at 7½ cents per pound during 1947. Cadmium contained in flue dust remained duty free.

Cadmium exported from the United States, 1945–47, gross weight, by kinds

[U. S. Department of Commerce]

Kind	1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value
Dross, flue dust, residues, and scrap	2,333,720	$197,927	459,775	$45,587	18,251	$21,838
Metal	102,199	100,493	140,385	163,879	303,401	746,804
Alloys	3	8	75	99	----------	----------
Salts and compounds	10,895	10,781	(1)	(1)	(1)	(1)
	----------	309,209	----------	209,565	----------	768,642

[1] Not available.

WORLD REVIEW

World production of cadmium in recent years, insofar as data are available, is shown in the accompanying table.

World production of cadmium, 1939–47, by countries, in kilograms

[Compiled by B. B. Mitchell]

Country	1939	1940	1941	1942	1943	1944	1945	1946	1947
Australia (Tasmania)	175,150	175,232	194,975	165,821	160,100	253,972	223,784	224,128	191,369
Belgian Congo	----------	----------	3,086	27,344	23,094	21,544	18,223	16,571	26,000
Belgium	[1] 530,800	(2)	(2)	(2)	(2)	(2)	(2)	[3] 88,900	[3] 86,300
Canada	426,234	411,917	567,573	521,158	356,804	239,032	293,048	364,073	315,671
France	130,000	100,000	20,000	10,000	10,000	5,250	7,000	47,000	43,000
Germany	400,974	296,194	371,944	243,124	275,783	209,105	(2)	(2)	(2)
Italy	146,417	214,871	184,016	122,785	95,300	38,800	13,700	25,000	38,400
Japan	[4] 80,000	(2)	(2)	[4] 102,000	[4] 112,000	[4] 85,000	[5] 22,000	[6] 900	8,710
Mexico [7]	816,584	815,734	906,577	854,264	801,992	682,295	1,052,766	717,000	778,000
Norway	138,000	28,600	25,048	13,482	11,355	10,600	13,000	28,000	50,314
Peru	----------	----------	----------	2,131	3,653	2,174	9,320	1,388	1,255
Poland	220,898	234,960	235,867	231,784	219,991	195,044	49,150	115,000	[8] 71,000
South-West Africa [7]	82,155	39,634	225,450	----------	----------	----------	----------	----------	----------
U. S. S. R.	[9] 50,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United Kingdom	105,686	182,797	148,324	152,406	167,828	197,312	178,714	107,954	106,685
United States:									
Metallic cadmium	2,001,026	2,791,484	3,146,976	3,321,797	3,808,474	3,834,409	3,598,139	2,812,439	3,632,025
Cadmium compounds (Cd content)	171,900	95,000	134,000	21,600	32,100	148,045	204,592	122,827	227,185
Total	4,577,000	4,659,000	5,172,000	4,991,000	5,337,000	5,301,000	4,899,000	4,229,000	5,123,000

[1] Exports.
[2] Data not available; estimate by author of chapter included in total.
[3] Incomplete data.
[4] Preliminary data for fiscal year ended Mar. 31 of year following that stated.
[5] April to September, inclusive.
[6] November to December, inclusive.
[7] Cadmium content of flue dust exported for treatment elsewhere; represents in part shipments from stocks on hand. To avoid duplication of figures, data are not included in the total.
[8] January to July, inclusive.
[9] Estimated average for 1936–38.

Carbon Black

By F. S. LOTT, H. BACKUS, AND P. M. TYLER

GENERAL SUMMARY

THE carbon-black industry achieved new records in output and sales in 1947, but gains over 1946 were modest in contrast with the rapid growth of 1943–46. Production increased 6 percent over the 1946 record to 1,318,965,000 pounds, with contact and furnace types participating in the gain about equally. Sales of 1,319,760,000 pounds were 4 percent greater than in 1946 and exceeded total production for the second successive year. Channel blacks were in urgent demand throughout 1947, but furnace grades were in easier position after the first few months, when sales decreased.

Producers' stocks of contact blacks declined to 8,619,000 pounds on December 31, 1947, less than 5 days' supply; but furnace stocks increased over 7 million pounds to 66,493,000 pounds, equal to about 36 days' supply at the December rate of sales.

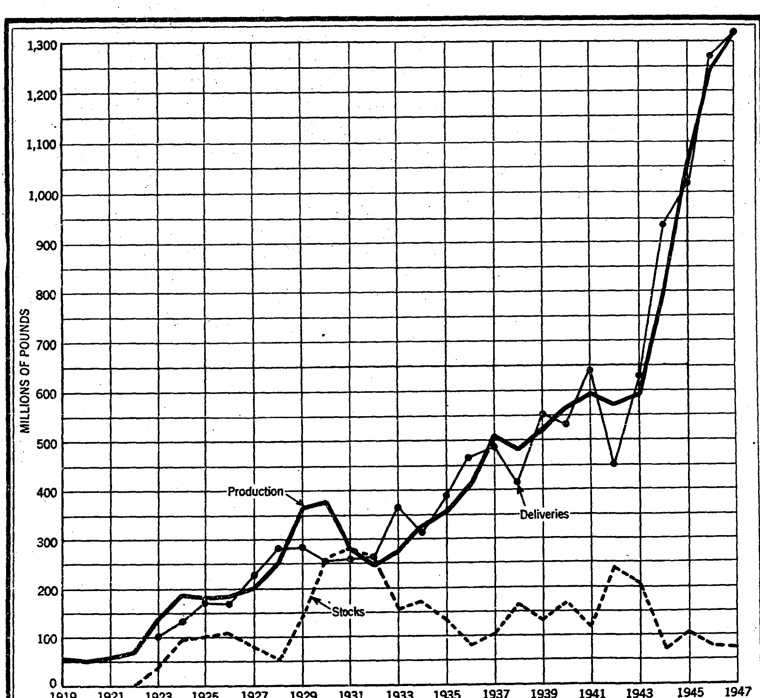

FIGURE 1.—Production, stocks, and deliveries of carbon black, 1919–47.

A further expansion of exports to 319,076,000 pounds, 18 percent above the 1946 record, represented the only significant gain in markets for carbon black in 1947 and undoubtedly was a factor in maintaining the high rate of demand for contact blacks. Requirements for rubber processing in the United States were reduced after the first quarter of 1947, but sales to the rubber industry were slightly higher than the 1946 record, increasing from 941,464,000 pounds to 943,580,000 pounds.

Deliveries of 32,260,000 pounds of carbon black to ink companies exceeded the 1946 record by 9 percent, reflecting a high rate of activity in printing and publishing. Sales to paint and miscellaneous trades declined from the unusually high levels of 1946.

Although the growing importance of furnace-type blacks has restrained investment in new channel plants since the war, demand for channel-type blacks has continued at record levels, stimulated by the resumption of large-scale processing of natural rubber in the United States and many foreign countries.

Salient statistics of carbon black produced in the United States, 1943–47

	1943	1944	1945	1946	1947
Number of producers reporting	21	22	21	22	21
Number of plants	54	54	59	60	63
Quantity produced:					
By States and districts:					
Louisiana ... pounds	109,609,000	160,019,000	168,229,000	191,857,000	190,252,000
Texas:					
Panhandle district ... do	345,447,000	401,556,000	541,464,000	596,678,000	633,250,000
Rest of State ... do	61,898,000	99,606,000	179,974,000	234,172,000	262,523,000
Total Texas ... do	407,345,000	501,162,000	721,438,000	830,850,000	895,773,000
Other States ... do	76,467,000	140,679,000	163,131,000	221,714,000	232,940,000
Total United States ... do	593,421,000	801,860,000	1,052,798,000	1,244,421,000	1,318,965,000
By processes:					
Contact processes [1] ... do	379,923,000	414,676,000	538,539,000	619,109,000	653,966,000
Furnace processes ... do	213,498,000	387,184,000	514,259,000	625,312,000	664,999,000
Stocks held by producers Dec. 31:					
Contact types ... do	196,913,000	58,036,000	64,956,000	17,006,000	8,619,000
Furnace types ... do	8,302,000	11,207,000	37,049,000	59,222,000	66,493,000
Total ... do	205,215,000	69,243,000	102,005,000	76,228,000	75,112,000
Losses ... do	1,661,000	402,000	1,000	458,000	321,000
Quantity sold:					
Domestic deliveries—					
To rubber companies ... do	473,473,000	738,029,000	804,386,000	941,464,000	943,580,000
To ink companies ... do	23,530,000	24,479,000	22,824,000	29,561,000	32,260,000
To paint companies ... do	3,945,000	5,315,000	7,421,000	9,312,000	8,137,000
For miscellaneous purposes ... do	23,440,000	12,616,000	11,631,000	18,318,000	16,707,000
Total domestic deliveries ... do	524,388,000	780,439,000	846,262,000	998,655,000	1,000,684,000
Export ... do	104,912,000	156,991,000	173,773,000	271,085,000	319,076,000
Total sold ... do	629,300,000	937,430,000	1,020,035,000	1,269,740,000	1,319,760,000
Value (at plants) of carbon black produced:					
Total	$20,248,000	$29,411,000	$42,323,000	$59,988,000	$70,639,000
Average per pound ... cents	3.41	3.67	4.02	4.82	5.36
Estimated quantity of natural gas used M cubic feet	315,562,000	355,770,000	431,830,000	478,349,000	484,882,000
Average yield of carbon black per M cubic feet ... pounds	1.88	2.20	2.32	2.44	2.51
Average value of natural gas used per M cubic feet ... cents	1.47	1.62	2.28	3.02	3.57

[1] Principally channel.

CURRENT TRENDS AND PROSPECTS

In many foreign countries, as in the United States, much more rubber is being processed than in prewar years. Natural rubber, rather than synthetics, is the dominant raw material, and established techniques for processing it are widely understood and applied. For this reason it is expected that consumers will continue to prefer channel-type blacks over ordinary furnace types, such as were developed in this country and widely accepted during and since the war.

Even in the United States, the demand for furnace blacks is becoming more and more selective. To compete with channel black in milling batches containing normal proportions of natural rubber, it is necessary to furnish material of relatively fine particle size and comparable processing characteristics. As the use of synthetic rubber declined after the war, the demand for semireinforcing (SRF) furnace grade especially was drastically reduced. The trend toward using easy-processing (EPC) channel blacks has been quite marked, but recently the rubber companies have turned more and more toward the medium-processing (MPC) grade, which makes tougher rubber. Although the yield of easy-processing black per thousand feet of gas is slightly less than that of other grades of channel black, the difference is considered too slight to justify a price differential above the ordinary grades of channel blacks. However, the spread in price between channel and furnace blacks has widened greatly owing to the rapidly rising prices of natural gas.

To produce some of the finer grades of furnace blacks, liquid hydrocarbons are increasingly employed, alone or mixed with natural gas.

Owing to the large quantities of gas required, the carbon-black industry for many years was a "scavenger industry," consuming principally gas for which no other market was available. As other uses developed for the gas from a given field the carbon-black industry retreated to new locations. Today, however, it has been driven in the continental United States to its last geographic frontier, so henceforth it seems destined to compete with pipe-line companies for its gas supplies at ever-rising prices. In 1947 the average price of gas used by the carbon-black industry advanced to 3.57 cents a thousand cubic feet and is probably headed higher. As recently as 1939 it was less than 1 cent.

A partial answer to the economic challenge of higher field prices for natural gas has been the rapid increase of production by furnace methods which permit yields as high as 12 pounds per thousand cubic feet and still leave enough fuel value to furnish the necessary heat units to keep the process going. The quality of ordinary furnace blacks, however, falls short of that of high-grade contact black; but competitive grades are now being produced using liquid hydrocarbons. preferably carbon-rich, light liquid refinery fractions.

Growing out of this development are plans to build plants in foreign countries nearer points of consumption, notably in England. Liquid hydrocarbons can be transported long distances more easily and cheaply than equivalent quantities of carbon black, which have to be carried on dry cargo vessels at relatively high rates owing to low bulk density and the fact that bag shipments require careful handling and protection from moisture. The cost of shipment from United

States plants to European destinations exceeds 2 cents a pound. A material further increase in the field cost of natural gas would encourage a shift toward liquid carbons as the raw material in the United States and require price increases, particularly for channel blacks. Commenting on this problem, the Columbian Carbon Co. made the following statement in its annual report for 1947:

> At the present price level carbon black is still at least one-third cheaper on a volume basis than the rubber it replaces. This does not take into account its unique reinforcing value. Even if rising costs should necessitate a further increase of as much as 33 percent, carbon black would still be no more expensive to the consumer than the corresponding value of rubber.

PRODUCTION

By States.—New production records were made in 1947 in New Mexico, Oklahoma, and Texas, and the output in Louisiana was far ahead of that of any year before 1946.

Texas produced 68 percent of the United States total, Louisiana 14 percent, and other States 18 percent. The Panhandle district of Texas is still the principal source; but, notwithstanding its steady expansion in production, the dominance of its position has diminished greatly as new plants sprang up elsewhere. Rapid expansion in other Texas districts was speeded during the war by the addition of Government-built, channel-type plants that utilized large quantities of gas produced with oil.

During the 5-year prewar period, 1935–39, Texas contributed 83 percent of the output, Louisiana 12 percent, and other States less than 5 percent. The Panhandle district then produced 78 percent of the entire output of the country, compared with only 48 percent in 1947.

Carbon black produced from natural gas in the United States in 1947, by States and by major producing districts

State and district	Producers reporting [1]	Number of plants	Production			Natural gas used			
			Pounds	Value at plant: Total	Value at plant: Average (cents)	M cubic feet	Average yield per M cubic feet of gas (pounds)	Value: Total	Value: Average per M cubic feet (cents)
California	1	1							
Kansas	3	4	123, 400, 000	$5, 770, 000	4. 68	21, 891, 000	5. 64	$915, 000	4. 18
Louisiana	6	6	190, 252, 000	7, 292, 000	3. 83	25, 977, 000	7. 32	961, 000	3. 70
New Mexico	3	4	49, 212, 000	2, 833, 000	5. 76	31, 510, 000	1. 56	889, 000	2. 82
Oklahoma	3	4	[2] 60, 328, 000	2, 957, 000	4. 90	17, 628, 000	3. 25	904, 000	5. 13
Texas:									
Panhandle district	15	32	[2] 633, 250, 000	36, 755, 000	5. 80	302, 126, 000	1. 76	11, 151, 000	3. 69
Rest of State	5	12	262, 523, 000	15, 032, 000	5. 73	85, 750, 000	3. 06	2, 496, 000	2. 91
Total Texas	[1] 16	44	[2] 895, 773, 000	51, 787, 000	5. 78	387, 876, 000	2. 05	13, 647, 000	3. 52
Total United States	[1] 21	63	[2] 1, 318, 965, 000	70, 639, 000	5. 36	484, 882, 000	2. 51	17, 316, 000	3. 57

[1] In counting total number of producers reporting, a producer operating in more than one State, district, or county is counted but once.
[2] Includes carbon black made from liquid hydrocarbons.

Meanwhile, the rest of Texas increased its contribution from only 5 percent to 20 percent of the national total.

Production in Louisiana has increased only slightly more than that of the country as a whole, while the output from other States has increased notably. During the First World War, West Virginia was the leading producing State; but the last of its plants closed in 1930, only 7 years after production was begun in Texas. Oklahoma and Wyoming were the only other sources from 1930 until Kansas entered the field in 1937. Wyoming ceased producing in 1939, and New Mexico and California were added to the list of producing States in 1942.

Methods and Yields.—The average yield of 2.51 pounds of carbon black per thousand cubic feet of natural gas used in 1947 continues the rising trend, since the large-scale introduction of furnace black. In 1919 the average yield was only 1.04 pounds. Not before 1937 did it reach 1.50, which hitherto has been considered as near the maximum obtainable by the contact process.

When a high proportion of easy-processing grades is produced, the yield by the channel process may fall below 1.40 pounds per thousand feet of gas. In 1947 the average yield of contact plants jumped to a new high of 1.57 pounds compared with 1.49 in 1946, 1.42 in 1945, and 1.32 in 1944. As shown in the following table, contact blacks are produced principally in the Texas Panhandle, West Texas, and New Mexico.

Furnace plants consumed 417,004 million cubic feet of natural gas and over 31 million gallons of liquid hydrocarbons in 1947. The indicated yield of black from natural gas exceeded 8 pounds per thousand cubic feet consumed. It has been estimated that approximately 10 percent of the domestic production of carbon black in 1948 will be made from liquid hydrocarbons.

Number and Capacity of Plants.—There were 63 operating plants in 1947 compared with 60 in 1946. The number of contact types increased from 42 to 44 as 1 new channel plant was operated in New Mexico and 1 in Texas. One channel plant in Texas was shut down, and a roller-type plant in Kansas that was shut down during 1946 was put in production in 1947. The number of furnace plants increased from 18 to 19 as a new plant was started in the Panhandle district.

The total productive capacity of all operating plants increased 11 percent from 3,658,400 to 4,071,300 pounds a day. Furnace plant capacity rose from 1,953,000 to 2,260,500 pounds a day, and that of contact plants—after declining slightly in 1946 from its 1945 peak (1,770,600 pounds)—rose from 1,705,400 to 1,810,800 pounds a day.

Early in 1948 the War Assets Administration sold a channel-type plant at Seagraves, Tex., to the Columbian Carbon Co. for $1,420,000. This plant cost $2,226,179 and was considered one of the best equipped of the Government's wartime carbon-black projects. The plant at Monument, N. Mex., which was operated by Charles Eneu Johnson & Co. and designed for annual capacity of 15,200,000 pounds of carbon black, was sold to the Cabot Carbon Co. in 1948. This is the last of the six Government plants to be taken over by private industry.

Producers.—The number of producers was reduced from 22 in 1946 to 21 in 1947. Carbon Blacks, Inc., closed its Texas plant preparatory to moving to Louisiana.

Number and capacity of carbon-black plants operated in the United States, 1946–47

State or district	County or parish	Number of plants				Total daily capacity (pounds)	
		1946		1947		1946	1947
		Contact	Furnace	Contact	Furnace		
California	Contra Costa	------	1	------	1	381,700	429,400
Kansas	Grant	1	2	2	2		
Louisiana	Avoyelles	------	1	------	1	664,700	660,800
	Evangeline	------	1	------	1		
	Ouachita	2	2	2	2		
Total Louisiana		2	4	2	4	664,700	660,800
New Mexico	Lea	3	------	4	------	105,400	176,600
Oklahoma	Pontotoc	1	------	1	------	212,000	212,000
	Texas	1	2	1	2		
Total Oklahoma		2	2	2	2	212,000	212,000
Texas:							
Panhandle district	Carson	[1] 1	------	[1] 1	------	1,669,600	1,877,300
	Gray	7	1	6	1		
	Hutchinson	[1] 13	2	[1] 13	3		
	Moore	7	1	7	1		
		28	4	27	5	1,669,600	1,877,300
Rest of State	Aransas	1	1	1	1	625,000	715,200
	Brazoria	------	1	1	1		
	Ector	1	------	1	------		
	Gaines	1	------	1	------		
	Harris	------	1	------	1		
	Montgomery	------	1	------	1		
	Nueces	1	------	1	------		
	Terry	------	1	------	1		
	Ward	1	------	1	------		
	Winkler	1	------	1	------		
		6	5	7	5	625,000	715,200
Total Texas		34	9	34	10	2,294,600	2,592,500
Total United States		42	18	44	19	3,658,400	4,071,300

[1] One plant in both Carson and Hutchinson Counties tabulated under Hutchinson County.

MONTHLY PRODUCTION, SHIPMENTS, AND STOCKS

Through the courtesy of the National Gas Products Association, monthly figures are available for production and shipments of most of the carbon-black-producing companies. These figures, augmented by data from reports of other producers to the Bureau of Mines, are shown in an adjacent table.

Production of both contact and furnace blacks increased irregularly throughout the year; and shipments of contact black ran ahead of production, resulting in a substantial reduction in stocks at producers' plants. Shipments of furnace black likewise exceeded production during the earlier months; and stocks were reduced to only 5 days' supply in May, after which they increased steadily. Based on December rates of shipment, stocks of contact black represented only 4 days' supply at the end of 1947.

Production, shipments, and exports of carbon black in the United States in 1947, by months, in thousands of pounds

Month	Production [1]				Shipments [1]			Exports [2]
	Contact	Furnace	Total	Daily average	Contact	Furnace	Total	Contact and furnace
January	53,197	53,900	107,097	3,455	59,175	66,729	125,904	33,423
February	50,269	51,000	101,269	3,617	50,165	62,918	113,083	18,424
March	55,776	55,862	111,638	3,601	57,411	68,100	125,511	30,245
April	54,018	54,799	108,817	3,627	54,826	60,591	115,417	23,397
May	46,141	50,002	96,143	3,101	45,513	57,205	102,718	24,888
June	53,710	57,499	111,209	3,707	53,529	52,067	105,596	28,177
July	56,099	57,803	113,902	3,674	55,085	47,989	103,074	28,553
August	56,731	56,949	113,680	3,667	57,251	46,493	103,744	40,478
September	56,159	56,040	112,199	3,740	57,770	42,525	100,295	32,470
October	57,282	56,639	113,921	3,675	58,552	50,953	109,505	20,625
November	56,144	56,813	112,957	3,765	55,647	48,972	104,619	16,145
December	58,440	57,693	116,133	3,746	57,429	52,865	110,294	22,251
	653,966	664,999	1,318,965	3,614	662,353	657,407	1,319,760	319,076

[1] Compiled from reports of the National Gas Products Association and from reports of producing companies not included in the association figures.
[2] Figures from U. S. Department of Commerce.

Total stocks at the end of the year amounted to 75,112,000 pounds, slightly less than the 1946 total and almost down to the critically low level of 1944. End-of-year stocks before the recent war, when consumption averaged only about one-third as much as in 1947, ranged from 79,582,000 pounds in 1936 to 166,159,000 in 1938. Invisible stocks in consumers' hands were fairly large before and shortly after Pearl Harbor; but, as the war progressed, the rapid increase in production failed to pace demand, and these accumulations were rapidly depleted.

DOMESTIC DEMAND—SALES

The apparent consumption of carbon black in the United States, as indicated by deliveries to domestic consumers and neglecting possible changes in consumers' stocks, increased slightly to still another new record, totaling 1,001 million pounds compared with 999 million pounds in 1946. Sales for export likewise topped the 1946 record, rising from 271 to 319 million pounds. Total sales on domestic and foreign accounts amounted to 1,320 million pounds, 50 million pounds (4 percent) more than in 1946.

The indicated sales of contact (principally channel) blacks were 662 million pounds, and those of furnace blacks were 658 million pounds. Although considerably more furnace blacks were sold in 1947 than in any previous year, demand did not quite pace production during the latter part of the year, whereas, the demand for contact blacks continued to exceed current capacity throughout most of 1947, as during the preceding year.

Sales to rubber companies increased by 2 million pounds to 943,-580,000, thereby accounting for over 94 percent of domestic deliveries, roughly the same proportion as in 1945 and 1946 but considerably more than the prewar average (1935–39) of 88 percent. The ratio of sales to domestic consumption of virgin rubber declined more than

5 percent following a 10-percent reduction in 1946. In the absence of data as to stocks of black in the hands of manufacturers of tires and other rubber goods, actual consumption of carbon black per ton of crude rubber can be only approximated.

According to estimates of the London Rubber Secretariat, the world consumed 1,725,000 long tons of virgin rubber in 1947—18 percent more than in the preceding year. Domestic consumption amounted to 1,122,327 long tons, of which slightly over 50 percent was natural rubber, compared with 27 percent in 1946. The 1947 consumption of rubber outside the United States approximated 603,000 long tons, of which about 89 percent was natural.

Allowing 100 million pounds for use in reclaimed rubber, shipments of carbon black in 1947 to rubber companies in the United States equaled 752 pounds per long ton of virgin rubber consumed. Assuming that 94 percent of exports also went to foreign rubber processors, average shipments outside of the United States amounted to 497 pounds per long ton of virgin rubber.

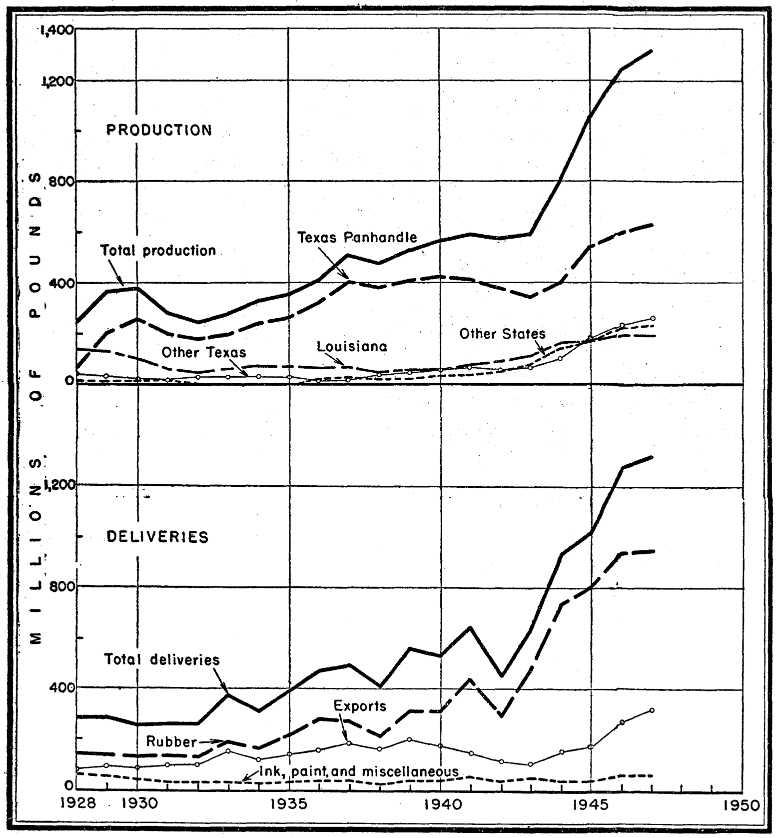

FIGURE 2.—Production and deliveries of carbon black 1928–47. Production in "Other Texas" includes Oklahoma and Wyoming in 1932–35.

Percentagewise, the largest increase in sales was the 3-million-pound (9-percent) jump in deliveries to the ink industry following a 30-percent increase in 1946 over 1945. These increases roughly parallel increases in the apparent consumption of newsprint. As reported by the American Newspaper Publishers' Association, this barometer increased from 3,481,302 short tons in 1945 to 4,296,268 tons in 1946 and 4,753,000 tons in 1947. The 32,260,000 pounds of black sold to ink companies in 1947 is an all-time record—almost double the annual average in 1935–39 and substantially higher than it was during the prosperous years 1928 and 1929.

Departing from the general pattern, sales of carbon blacks to the paint industry receded from the 1946 peak of 9.3 million pounds to 8.1 million pounds. The 1947 total is a relatively high figure compared with an average of only 6 million pounds a year prewar (1935–39) but is still far below the records established in the late 1920's. In 1928, for example, which is the first year for which separate statistics are available, the paint companies purchased 20,040,000 pounds.

Miscellaneous uses likewise declined, dropping 9 percent from 18.3 million pounds in 1946 to 16.7 million pounds in 1947. The 1935–39 average was only 10.3 million pounds a year.

PRICES AND MARKETING

The average value of carbon black, f. o. b. United States producing plants, rose from 4.82 cents a pound in 1946 to 5.35 cents a pound in 1947.

As shown in the subjoined table, prices of leading grades of furnace black remained unchanged, while those of channel blacks increased

Prices of carbon black in carload lots, f. o. b. Texas Panhandle, 1940–48 in cents per pound

[Rubber Age and company records]

Date	Channel blacks			Furnace blacks		
	Ordinary rubber grades [1]		Ordinary ink grades [2]	Semi-reinforcing grades (SRF)	High modules grades (HMF)	Fine grades (FF)
	Bags	Bulk	Bags	Bags	Bags	Bags
Jan. 1, 1940	2.425	2.30	2.55	3.00		
Apr. 1, 1940	2.65	2.50	2.80	3.00		
July 1, 1940	2.925	2.75	3.075	3.00		
Apr. 1, 1941	3.175	3.00	3.325	3.00		
July 1, 1941	3.35	3.15	3.425	3.00		
Jan. 1, 1942 [3]	3.55	3.30	3.625	3.50		
Apr. 1, 1944 [3]	3.55	3.30	3.625	3.50	5.00	
Jan. 1, 1946 [3]	5.25	5.00	5.325	3.50	5.00	
Oct. 1, 1946 [3]	5.75	5.50	5.825	3.50	5.00	
Jan. 1, 1947	6.32	6.00	7.00	3.50	5.00	6.00
Oct. 1, 1947	6.32	6.00	7.50	3.50	5.00	6.00
Jan. 1, 1948	6.82	6.50	7.50	3.50	5.00	6.50
Apr. 1, 1948	7.32	7.00	8.00	3.50	5.00	7.32
Oct. 1, 1948	7.32	7.00	8.32	3.50	5.00	7.32

[1] Chiefly easy-processing (EPC) and medium-processing (MPC) but also includes hard-processing (HPC) and conductive (CC) channel blacks.
[2] Uncompressed.
[3] Office of Price Administration ceiling prices. Average realization on sales to the Rubber Reserve Company was generally higher.

progressively following final relaxation of controls by the Office of Price Administration on October 9, 1946. Although price ceilings were raised during the period of Government regulation, most quotations before September 30, 1945, were below prices paid to producers by the Defense Supplies Corporation. Subsequent price advances reflected higher manufacturing costs resulting from increased labor and material costs and some plant readjustments which necessitated lower throughput in order to produce finer grades of product.

All but a small fraction of present-day shipments of carbon black are pelletized by one of three processes. Even the ink industry, now the principal consumer of uncompressed blacks, is beginning to take an interest in free-flowing or "dustless" products.

Until the latter part of 1939, shipments were made either in bulk or bags at the same price. But, as the cost of packaging increased, the differential on ordinary rubber grades increased until in 1947 it was 0.32 cent a pound. The standard package is a 25-pound bag, although shipments are also made in bags containing 50 pounds each. Recently considerable stimulus has been given to bulk handling. Equipment has been developed that simplifies operations at large consuming plants without excessive break-down of the pellets. Bulk shipments are made in covered-hopper or tank cars, which are readily unloaded by gravity. In addition to the differential in price of bag as against bulk black, a small saving in shipping cost may be realized by bulk shipments. Disposal of empty bags is an item of expense as well as the labor cost of handling and emptying the bags; and losses of black frequently occur owing to breakage during handling.

A feature of carbon-black marketing is the concentration of sales among four big domestic rubber companies. Even the export market is characterized by a relatively small number of large consumers. Recently manufacturers of synthetic rubber have been buying carbon black for milling into the rubber before sale to makers of tires and other rubber goods. This trend may even further reduce direct purchases by small consumers.

FOREIGN TRADE [1]

Imports.—After reaching a wartime peak of 1,526,758 pounds in 1945, imports of "gas black and carbon black" from Canada dropped sharply, amounting in 1947 to only 25 pounds having a total value of $2. Imports of acetylene black increased from 3,945,836 pounds to 7,639,716 pounds, and the average value rose from 10.2 to 10.91 cents a pound. Except for 224 pounds from Australia in 1947, these imports are all from Canada.

[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.

Exports.—The sharp rise of 48 million pounds in exports to a new record total of 319 million pounds in 1947 resulted principally from increased demand from the British Commonwealth of Nations, western Europe (except France and Spain), and Latin America. Approximately 60 percent of all exports were estimated as consisting of channel black and 40 percent of furnace black.

Carbon black exported from the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value
Argentina	2, 382, 148	$171, 618	6, 988, 074	$602, 767	10, 112, 153	$905, 655
Australia	15, 407, 249	982, 087	12, 523, 962	1, 015, 150	15, 159, 188	1, 412, 446
Austria			141, 050	6, 212	493, 650	33, 585
Belgium and Luxembourg	3, 018, 925	202, 515	3, 731, 625	265, 362	11, 928, 375	1, 082, 997
Brazil	5, 319, 529	334, 799	6, 403, 875	466, 474	11, 341, 072	929, 282
British Malaya			462, 300	39, 573	728, 050	55, 695
Canada	45, 103, 317	2, 019, 005	42, 087, 414	2, 036, 554	56, 382, 871	3, 050, 370
Chile	475, 800	30, 624	965, 885	63, 808	1, 129, 875	100, 488
China			4, 521, 187	425, 975	1, 544, 745	149, 277
Colombia	717, 668	45, 252	565, 139	54, 862	1, 673, 236	138, 953
Cuba	880, 985	57, 143	1, 028, 072	72, 066	1, 198, 260	81, 238
Czechoslovakia			2, 974, 425	165, 960	2, 217, 088	157, 982
Denmark	271, 155	31, 370	1, 766, 495	126, 013	1, 736, 500	167, 765
Eire	15, 450	2, 782	1, 375, 550	110, 626	1, 386, 313	142, 895
France	3, 837, 000	243, 973	46, 698, 747	2, 954, 845	37, 541, 122	2, 934, 075
Finland			2, 029, 210	148, 825	615, 875	59, 184
Hungary					425, 950	37, 159
India	5, 606, 928	351, 029	8, 126, 276	576, 511	7, 625, 445	606, 891
Italy			10, 119, 318	608, 382	19, 078, 369	1, 451, 272
Mexico	4, 835, 794	240, 050	6, 224, 266	328, 486	6, 364, 681	381, 824
Netherlands	136, 500	11, 852	4, 031, 610	297, 173	4, 414, 944	452, 962
Netherlands Indies			117, 675	10, 955	975, 600	75, 358
New Zealand	722, 455	41, 523	840, 326	83, 423	2, 293, 591	187, 447
Norway	844, 350	53, 947	1, 787, 925	113, 523	1, 384, 170	125, 924
Peru	456, 435	29, 629	490, 956	38, 867	770, 410	66, 315
Poland			339, 200	13, 528	448, 000	36, 065
Portugal	520, 913	32, 374	746, 752	53, 761	714, 742	65, 591
Spain	1, 051, 630	62, 350	5, 971, 900	399, 665	3, 199, 225	266, 665
Sweden	1, 793, 935	120, 469	6, 949, 230	478, 407	7, 150, 399	636, 061
Switzerland	280, 900	21, 306	2, 461, 045	204, 023	1, 666, 840	145, 326
Union of South Africa	8, 335, 514	539, 659	8, 598, 967	649, 627	11, 625, 340	1, 284, 300
Uruguay	559, 000	57, 950	710, 900	47, 049	875, 550	74, 040
U. S. S. R	803, 445	48, 440	555, 000	50, 227	500, 000	25, 000
United Kingdom	69, 549, 113	4, 039, 658	75, 824, 863	5, 367, 506	91, 891, 486	9, 320, 271
Venezuela	377, 220	21, 720	389, 250	25, 855	359, 920	28, 501
Yugoslavia			568, 300	26, 459	550, 500	22, 085
Other countries	469, 260	37, 729	1, 968, 011	159, 933	1, 572, 170	157, 692
Total	173, 772, 618	9, 830, 853	271, 084, 780	18, 088, 432	319, 075, 705	26, 848, 636

Cement

By G. RICHARDS GWINN AND ESTHER V. BALSER

GENERAL SUMMARY

PRODUCTION, apparent consumption, and demand for cement in 1947 increased over the previous year's totals. Despite labor difficulties in New York, eastern Pennsylvania, Maine, and Virginia, which closed plants in those States for approximately 1 month, production for the year was not only above estimates made at the beginning of the year but reached a new all-time high for the industry. Total production of 189,470,445 barrels of hydraulic cements was 14 percent higher than in 1946. The portland-cement industry operated at 75 percent and the "all other" group at 85 percent of productive capacity in 1947. Mill shipments of portland cement, which totaled 187,492,000 barrels—an increase of 11 percent over the 1946 figures—was also a new all-time record. Shipments of the "all other" group gained 16 percent. Stocks of all hydraulic cements at mills on December 31, 1947, were 10,132,477 barrels, 9 percent less than at the end of 1946.

The average net mill realization per barrel of portland cement reached $1.90 per barrel, an increase of 18 cents over the 1946 price. "All other hydraulic cements," as a group, reported a gain of 33 cents a barrel to $1.97.

The long-term trend, as shown by the moving 12-month total of production of finished portland cement in the Bureau of Mines Monthly Cement Reports, continued the upward swing started in 1945 and reached a new all-time high in December 1947.

Monthly output during 1947, with the exception of the last quarter, bore little resemblance to the usual seasonal pattern. Production reached 13,406,000 barrels in January, declined slightly in February, increased through the next 2 months, and then declined in May. The reduction in May is attributed to the strike in eastern Pennsylvania, New York, Maine, and Virginia plants (33 plants in all) which were idle for most of the month. From June through October output increased, and the October total of 18,300,000 barrels is an all-time record. Production declined to 16,123,000 barrels in December for a monthly average of 15,544,000 for the year.

The accompanying table presents the principal statistics of the cement industry for the 1943–47 period.

Salient statistics of the cement industry in the United States, 1943–47 [1]

	1943	1944	1945	1946	1947
Production of finished cement:					
Portland ... barrels	133,423,788	90,905,696	102,804,884	164,064,188	186,519,347
Masonry, natural, and puzzolan (slag-lime) ... barrels	1,830,266	1,246,703	1,483,763	2,474,674	2,951,098
Total production ... do	135,254,054	92,152,399	104,288,647	166,538,862	189,470,445
Capacity used at portland-cement mills ... percent	55.0	37.8	42.5	67.9	74.9
Production of portland-cement clinker [2] ... barrels	135,692,400	90,508,803	102,702,976	165,126,403	187,602,420
Active plants:					
Portland	153	151	145	153	150
Masonry, natural, and puzzolan (slag-lime)	10	9	9	9	9
Shipments from mills:					
Portland ... barrels	127,631,859	94,271,881	106,353,595	169,567,593	187,491,869
Value [3]	$200,103,216	$150,357,754	$173,337,010	[4] $292,396,343	$356,213,976
Per barrel	$1.57	$1.59	$1.63	$1.72	$1.90
Masonry, natural, and puzzolan (slag-lime) ... barrels	1,846,803	1,320,274	1,479,513	2,533,106	2,927,885
Value [3]	$2,357,112	$1,638,892	$2,093,848	$4,155,171	$5,764,398
Per barrel	$1.28	$1.24	$1.42	$1.64	$1.97
Total shipments ... barrels	129,478,662	95,592,155	107,833,108	172,100,699	190,419,754
Value	$202,460,328	$151,996,646	$175,430,858	[4] $296,551,514	$361,978,374
Stocks at mills, Dec. 31:					
Portland:					
Finished cement ... barrels	23,188,975	19,952,711	16,454,775	[4] 10,969,755	[5] 9,997,233
Clinker [2] ... do	5,959,170	5,328,986	4,462,633	[4] 3,886,443	[5] 3,598,332
Masonry, natural, and puzzolan (slag-lime) ... barrels	227,152	166,889	170,324	[4] 112,031	[5] 135,244
Imports ... do	13,658	169	323	3,734	4,606
Exports ... do	1,731,956	4,040,405	[4] 6,474,721	5,163,362	6,771,250
Apparent consumption [6] ... do	127,760,364	91,551,919	[4] 101,358,710	166,941,071	183,653,110

[1] Figures include Puerto Rico and Hawaii.
[2] Compiled from monthly reports by producers.
[3] Value received f. o. b. mill, excluding cost of containers.
[4] Revised figure.
[5] Subject to revision.
[6] Shipments plus net imports.

Monthly shipments from mills in 1947, for the last quarter, bore little resemblance to 1946 or the 1935–39 average. Shipments reached 8,395,000 barrels in January; increased to 15,414,000 barrels in April and after a slight decline in May continued upward to 20,365,000 barrels in August; declined again in September; reached the year's peak of 20,562,000 barrels in October; and declined sharply to 12,379,000 barrels in December.

Consumption trends of portland cement in 1947, as shown in figure 1, are essentially the same as in the previous year. The Middle States[1] in 1947 were again the largest consumers followed closely by the Southern States. Consumption in the Northeastern States has increased steadily during the 1944–47 period and is approaching that of the Southern States.

[1] The States comprising each region are found in Bureau of Mines Minerals Yearbook, 1945, p. 1222.

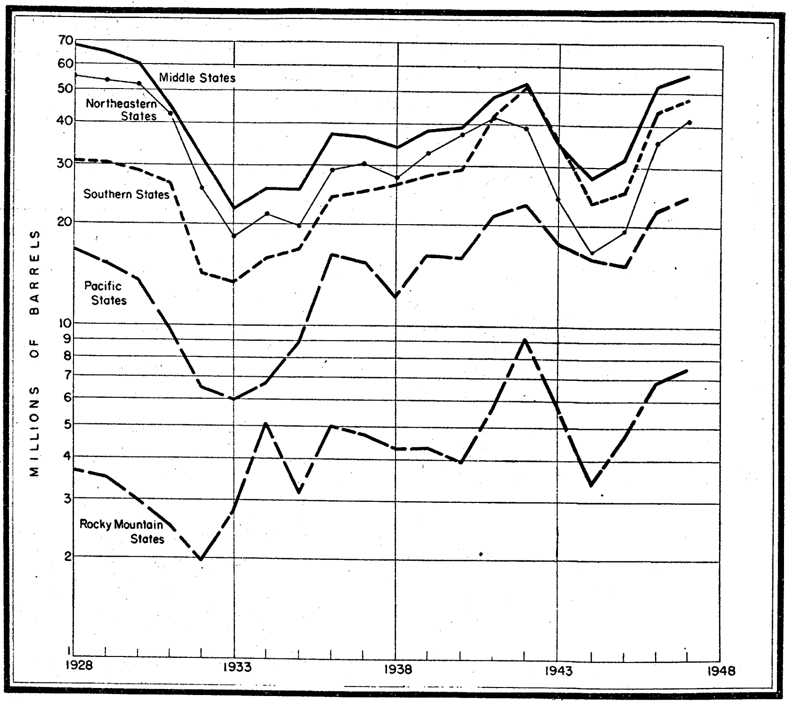

FIGURE 1.—Trends of indicated consumption of portland cement in continental United States, 1928–47, by regions.

The program of rehabilitation and expansion of cement plants, begun in 1946, continued through 1947. The Marquette Cement Manufacturing Co. purchased the plant of the Hermitage Portland Cement Co., Nashville, and the Cumberland Portland Cement Co., Cowan, Tenn. The two companies will maintain their identities, however, and the parent organization will direct manufacturing operations. A new company—the General Portland Cement Co.—was formed during 1947 by the merger of the Signal Mountain Portland Cement Co., Chattanooga, Tenn., the Florida Portland Cement Co., Tampa, Fla.; and the Trinity Portland Cement Co., with plants at Dallas, Houston, and Fort Worth, Tex. The headquarters of the new company is in Chicago, Ill. The following companies have started expansion programs that will increase considerably the capacity of the plants: The Ideal Cement Co., Calaveras Cement Co., Lone Star Cement Corp, Idaho Portland Cement Co., Lehigh Portland Cement Co., and Riverside Portland Cement Co. New plants are either under construction or in the planning stage in Minnesota, Arizona, North Carolina, Arkansas, Texas, and Alaska.

The Coldwater and Quincy, Mich., plants of the Wolverine Portland Cement Co. were dismantled and sold during 1947, and the Portland Point, N. Y., plant of the Pennsylvania Dixie Cement Co. was closed for an indefinite period.

Demand for portland cement in 1947 has been estimated at 200,000,000 barrels, and it is believed that demand will remain at the same level in 1948. Because of the extraordinary demand, profits are being made despite cost increases that have far excelled price increases per unit of output. When demand levels off, the efficiency of operation will again determine whether or not a profit can be made.

The increase in the f. o. b. and the delivered price for cement in 1947 is attributed largely to increased costs of labor, coal, and freight. In March 1947 the United States Supreme Court agreed to review Federal Trade Commission findings that numerous cement producers had conspired to restrict competition by the use of a delivered price system. On April 26, 1948, the Supreme Court ordered the cement companies to cease and desist to quote or sell cement on a multiple-basing-point delivered price system or to discriminate among customers by charging different mill net prices on orders going to different destinations.

Despite record production and shipments of portland cement in 1947, demands were not met, and shortages occurred in some sections. For the most part, however, the shortages were local and were felt by small consumers, as contracts for large orders were given first call by producers. Increased interest is being shown in blast-furnace or other types of puzzolan cements in the United States. These cements have enjoyed considerable success in Europe and Japan, and, as they meet or exceed performance of portland cement in some uses, there is a realization in the United States that they deserve more attention. The benefits of air-entraining cement are now well established, and the American Society for Testing Materials has instituted a program to evaluate the properties of the various entraining admixtures for concrete.

PRODUCTION, SHIPMENTS, AND STOCKS

PORTLAND CEMENT

Portland cement, which constituted 98 percent of the total output of hydraulic cements in 1947, was manufactured and shipped from 150 plants in 34 States and Puerto Rico during the first half of the year, and from 149 plants for the last 6 months. The dismantling of the two Wolverine Portland Cement Co. plants in Michigan and the production from the new Ideal Cement Co. plant at Mobile, Ala., account for the change.

Production in 1947 was higher in all districts than in 1946. The increases ranged from 5 percent in Michigan to 26 percent in the Oregon-Washington district. Quantitywise, the Eastern Pennsylvania-Maryland district led with an output of 29,602,680 barrels, followed by California which reported the production of 22,788,173 barrels. It is believed that the strike in Eastern Pennsylvania, New York, Maine, and Virginia plants in May caused a reduction of approximately 4,000,000 barrels in the total output of portland cement for the year.

Shipments in 1947 were also greater in all districts than in 1946. The gains ranged from 0.2 percent in Iowa to 20.6 percent in the Western Pennsylvania-West Virginia and 20.7 in the Oregon-Washington districts.

Stocks of finished cement were 9 percent lower on December 31, 1947, than on the same date in 1946. Eleven districts showed decreases in stocks from the December 1946 total, and eight reported increases. The trend of month-end stocks of clinker in 1947 varied from the usual seasonal trend. They showed the usual strong increase from January through March, but rather than showing a decline after March, continued upward through April and reached their peak in May. They declined slowly in June and July and then sharply reaching the year's low in November.

Alaska.—The Alaska Cement Corp. expected to get the first cement plant in Alaska into operation in 1948. Equipment for the plant, near Anchorage, has been obtained from the former Orofino, Idaho, plant of the Washington-Idaho Lime Products Co. Limestone will be obtained from a deposit near Seldovia and gypsum from Sheep Mountain, about 130 miles from the plant. Capacity will be 600 barrels of cement per day.

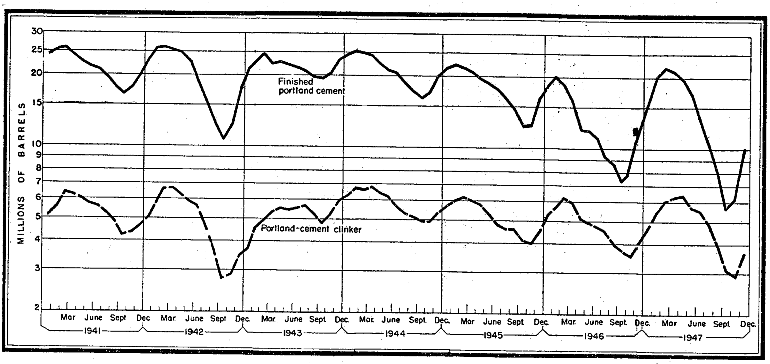

FIGURE 2.—Trends in end-of-month stocks of finished portland cement and portland-cement clinker, 1941–47

Stocks of finished portland cement and portland-cement clinker at mills in the United States[1] on December 31, and yearly range in end-of-month stocks, 1943–47

	Dec. 31 (barrels)	Range			
		Low		High	
		Month	Barrels	Month	Barrels
1943 Cement	23, 188, 975	October	19, 583, 000	March	24, 111, 000
1943 Clinker	5, 959, 000	January	3, 771, 000	December	5, 959, 000
1944 Cement	19, 952, 711	October	16, 049, 000	February	25, 073, 000
1944 Clinker	5, 329, 000	November	4, 856, 000	April	6, 687, 000
1945 Cement	16, 454, 775	October	12, 385, 000	February	22, 171, 000
1945 Clinker	4, 462, 633	November	4, 022, 000	March	6, 185, 000
1946 Cement	[2] 10, 969, 755	October	7, 298, 000	February	20, 034, 000
1946 Clinker	[2] 3, 886, 443	November	3, 512, 000	March	6, 281, 000
1947 Cement	[3] 9, 997, 233	October	5, 668, 000	do	22, 178, 000
1947 Clinker	[3] 3, 598, 332	November	2, 929, 000	May	6, 353, 000

[1] Includes Hawaii and Puerto Rico. [2] Revised figure. [3] Subject to revision.

Finished portland cement produced, shipped, and in stock in the United States, 1946–47, by districts

District	Active plants 1946	Active plants 1947	Production: Barrels 1946	Production: Barrels 1947	Production: Percent of change from 1946	Shipments 1946: Barrels	Shipments 1946: Value Total	Shipments 1946: Value Average	Shipments 1947: Barrels	Shipments 1947: Value Total	Shipments 1947: Value Average	Shipments 1947: Percent of change from 1946 in— Barrels	Shipments 1947: Percent of change from 1946 in— Average value	Stocks at mills on Dec. 31: Barrels 1946	Stocks at mills on Dec. 31: Barrels 1947 [1]	Stocks: Percent of change from 1946
Eastern Pennsylvania and Maryland	21	21	26,489,149	29,602,680	+11.8	26,897,558	$43,601,389	$1.62	29,903,222	$53,741,512	$1.80	+11.2	+11.1	[2] 1,965,794	1,665,252	−15.3
New York and Maine	12	12	11,411,868	12,132,952	+6.3	11,350,167	19,149,446	1.69	12,548,319	23,031,143	1.84	+10.6	+8.9	[2] 1,426,222	1,010,855	−29.1
Ohio	9	9	8,034,762	9,382,564	+16.8	8,187,531	13,293,126	1.62	9,296,311	16,611,421	1.79	+13.5	+10.5	[2] 542,830	629,083	+15.9
Western Pennsylvania and West Virginia	8	8	6,741,134	8,168,412	+21.2	6,843,407	[2] 10,962,691	1.60	8,250,695	14,616,077	1.77	+20.6	+10.6	[2] 642,055	559,772	−12.8
Michigan	9	9	9,693,767	10,211,809	+5.3	9,974,692	16,727,145	1.68	10,470,766	18,868,187	1.80	+5.0	+7.1	[2] 1,150,541	891,584	−22.5
Illinois	4	4	6,270,252	7,227,748	+15.3	6,675,584	11,646,747	1.74	7,155,280	13,219,260	1.85	+7.2	+6.3	412,000	484,468	+17.6
Indiana, Kentucky, and Wisconsin	6	6	10,571,385	11,636,308	+10.1	10,792,114	18,073,335	1.67	11,696,651	21,377,465	1.83	+8.4	+9.6	[2] 627,523	567,180	−9.6
Alabama	7	7	7,897,157	9,514,190	+20.5	8,071,979	13,120,084	1.63	9,509,697	16,663,543	1.75	+17.8	+7.4	310,049	314,542	+1.4
Tennessee	6	6	5,218,370	5,900,618	+13.1	5,372,964	9,386,582	1.75	6,101,108	11,017,225	1.81	+13.6	+3.4	[2] 459,954	259,464	−43.6
Virginia, Georgia, Florida, and Louisiana	6	6	5,656,967	6,118,256	+8.2	5,950,863	[2] 10,652,910	1.79	6,147,130	12,190,232	1.98	+3.3	+10.6	237,890	209,016	−12.1
Iowa	5	5	5,513,070	6,335,666	+14.9	6,145,326	11,312,627	1.84	6,155,670	12,054,420	1.96	+0.2	+6.5	[2] 329,255	509,251	+54.7
Eastern Missouri, Minnesota, and South Dakota	6	6	7,641,752	9,134,368	+19.5	8,128,243	14,541,928	1.79	9,127,591	17,360,892	1.90	+12.3	+6.1	[2] 472,781	479,558	+1.4
Kansas	6	6	6,404,648	7,131,802	+11.4	6,894,353	11,574,910	1.68	7,208,147	13,017,277	1.81	+4.6	+7.7	[2] 345,209	268,864	−22.1
Western Missouri, Nebraska, Oklahoma, and Arkansas	6	6	5,703,483	6,392,194	+12.1	6,165,696	10,549,732	1.71	6,378,721	11,779,421	1.85	+3.5	+8.2	[2] 267,331	280,804	+5.0
Texas	10	10	10,712,538	12,462,925	+16.3	10,996,478	19,946,600	1.81	12,349,219	24,111,833	1.95	+12.3	+7.7	[2] 403,631	517,337	+28.2
Colorado, Wyoming, Montana, Utah, and Idaho	8	7	4,088,203	4,586,069	+12.2	4,384,860	9,687,617	2.21	4,631,303	10,737,902	2.32	+5.6	+5.0	[2] 222,644	177,410	−20.3
California	12	11	19,540,790	22,788,173	+16.6	20,173,231	33,906,675	1.68	22,846,458	46,539,749	2.04	+13.3	+21.4	[2] 644,722	586,437	−9.0
Oregon and Washington	9	9	4,706,979	5,917,445	+25.7	4,812,993	10,320,602	2.14	5,811,456	13,937,036	2.40	+20.7	+12.1	[2] 457,856	563,845	+23.1
Puerto Rico	2	2	1,729,909	1,875,168	+8.4	1,711,549	3,825,506	2.24	1,904,125	5,339,381	2.80	+11.3	+25.0	[2] 51,468	22,511	−56.3
Hawaii	1	----	38,005	(3)	-------	38,005	116,691	3.07	(3)	(3)	(3)	-------	-------	----------	----------	------
	153	150	164,064,188	186,519,347	+13.7	169,567,593	[2] 292,396,343	1.72	187,491,869	356,213,976	1.90	+10.6	+10.5	[2] 10,969,755	9,997,233	−8.9
Pennsylvania	24	24	29,202,494	33,349,859	+14.2	29,686,909	48,294,891	1.63	33,655,687	60,998,207	1.81	+13.4	+11.0	[2] 2,313,563	2,007,735	−13.2
Missouri	5	5	6,511,905	8,013,550	+23.1	6,887,517	12,142,018	1.76	8,030,939	15,066,390	1.88	+16.6	+6.8	411,480	394,091	−4.2

[1] Subject to revision. [2] Revised figure. [3] Operations terminated December 1946.

Production, shipments from mills, and stocks at mills of finished portland cement in the United States in 1947, 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	2,408	2,173	2,501	2,385	724	2,625	2,739	2,850	2,815	2,899	2,735	2,735
New York and Maine	872	728	833	887	459	1,159	1,149	1,227	1,228	1,307	1,156	1,123
Ohio	659	640	672	747	673	779	854	866	858	994	887	752
Western Pennsylvania and West Virginia	526	524	651	695	669	749	716	788	728	772	744	606
Michigan	447	595	585	606	904	958	882	1,045	1.084	1,258	1,065	783
Illinois	651	511	521	560	568	513	506	612	752	754	693	608
Indiana, Kentucky, and Wisconsin	901	724	892	813	1,011	979	1,030	1,128	1,113	1,144	980	922
Alabama	662	659	791	773	822	807	837	880	796	895	784	804
Tennessee	369	315	345	413	513	529	489	576	579	585	592	594
Virginia, Georgia, Florida, and Louisiana	541	466	477	528	411	384	481	600	598	587	529	532
Iowa	441	548	296	463	521	538	679	642	571	626	542	468
Eastern Missouri, Minnesota, and South Dakota	558	538	713	769	882	791	782	936	809	829	748	778
Kansas	515	517	582	458	586	602	613	692	658	692	642	580
Western Missouri, Nebraska, Oklahoma, and Arkansas	415	437	460	581	567	522	506	512	603	646	587	555
Texas	889	914	1,007	1,013	1,032	1,043	1,089	993	1,013	1,155	1,137	1,176
Colorado, Wyoming, Montana, Utah, and Idaho	318	297	332	337	410	393	396	433	435	431	418	387
California	1,797	1,613	1,907	1,901	1,938	1,906	1,899	1,949	1,931	1,964	1,969	2,015
Oregon and Washington	295	296	460	523	523	519	563	585	585	589	462	517
Puerto Rico	142	123	180	114	176	175	132	166	163	173	144	188
United States: 1947	13,406	12,618	14,205	14,566	13,389	15,971	16,342	17,480	17,319	18,300	16,814	16,123
1946	9,635	9,250	11,305	12,650	12,091	14,489	15,420	16,213	16,450	16,410	15,335	14,557
SHIPMENTS												
Eastern Pennsylvania and Maryland	1,388	1,399	2,038	2,800	1,417	3,255	3,330	3,235	2,976	3,253	2,704	2,102
New York and Maine	424	467	596	1,013	880	1,463	1,474	1,520	1,411	1,531	1,080	691
Ohio	262	261	468	740	900	1,007	1.136	1,078	1,033	1,082	837	494
Western Pennsylvania and West Virginia	258	254	358	556	928	826	930	983	936	1,102	725	396
Michigan	235	231	385	669	921	1,162	1,404	1,365	1,339	1,295	915	476
Illinois	154	158	329	529	592	662	864	908	1,089	920	666	285
Indiana, Kentucky, and Wisconsin	315	345	645	862	1,010	1,171	1,350	1,514	1,447	1,448	964	625
Alabama	538	635	743	786	915	837	876	871	894	902	743	772
Tennessee	278	261	358	517	582	531	589	590	579	655	636	525
Virginia, Georgia, Florida, and Louisiana	406	392	475	569	472	380	544	669	595	637	501	517
Iowa	107	114	368	557	615	697	899	793	651	711	497	146

Eastern Missouri, Minnesota, and South Dakota	248	270	622	697	754	715	1,080	1,218	1,225	1,040	770	488
Kansas	281	307	414	514	621	659	739	827	773	845	702	525
Western Missouri, Nebraska, Oklahoma, and Arkansas	311	258	440	515	587	582	653	647	656	688	589	449
Texas	827	818	997	1,064	1,064	1,084	1,157	1,037	1,050	1,181	1,062	1,009
Colorado, Wyoming, Montana, Utah, and Idaho	169	184	313	409	493	492	487	432	444	451	404	339
California	1,818	1,600	1,896	1,924	1,858	1,948	1,902	1,923	1,976	2,090	1,906	1,996
Oregon and Washington	244	325	517	561	561	522	552	591	597	568	415	353
Puerto Rico	132	155	171	132	158	186	133	164	169	163	151	191
United States: 1947	8,395	8,434	12,133	15,414	15,328	18,179	20,099	20,365	19,840	20,562	16,267	12,379
1946	7,391	7,853	12,718	15,369	16,066	14,564	16,249	17,955	17,153	17,721	14,803	11,494
STOCKS (END OF MONTH)												
Eastern Pennsylvania and Maryland	3,000	3,774	4,238	3,822	3,129	2,498	1,905	1,519	1,357	1,002	1,031	1,664
New York and Maine	1,880	2,141	2,377	2,251	1,829	1,526	1,202	909	728	498	576	1,007
Ohio	912	1,292	1,497	1,504	1,277	1,049	767	555	380	307	357	615
Western Pennsylvania and West Virginia	909	1,179	1,472	1,612	1,352	1,276	1,063	867	660	330	349	559
Michigan	1,363	1,726	1,927	1,863	1,847	1,568	1,046	727	472	435	585	892
Illinois	905	1,252	1,437	1,468	1,444	1,295	936	641	304	137	164	487
Indiana, Kentucky, and Wisconsin	1,207	1,588	1,836	1,787	1,788	1,596	1,276	891	557	254	270	567
Alabama	435	460	508	495	403	373	333	341	243	236	278	310
Tennessee	551	606	593	489	420	418	318	304	303	234	190	259
Virginia, Georgia, Florida, and Louisiana	373	447	448	408	346	350	286	218	216	167	194	209
Iowa	665	1,099	1,026	932	838	678	458	308	228	142	187	509
Eastern Missouri, Minnesota, and South Dakota	783	1,051	1,142	1,214	1,343	1,419	1,122	839	422	210	188	479
Kansas	579	790	957	901	866	809	684	549	428	274	214	269
Western Missouri, Nebraska, Oklahoma, and Arkansas	370	548	567	633	613	554	404	269	216	176	174	281
Texas	438	534	544	493	461	420	352	308	271	245	320	487
Colorado, Wyoming, Montana, Utah, and Idaho	371	484	503	431	344	235	146	147	138	118	130	177
California	624	637	648	625	706	664	661	687	643	517	577	596
Oregon and Washington	505	475	419	381	343	339	351	344	332	353	400	564
Puerto Rico	61	29	39	22	39	28	27	29	23	33	25	22
United States: 1947	15,931	20,112	22,178	21,331	19,388	17,095	13,337	10,452	7,921	5,668	6,209	[1] 9,953
1946	18,653	20,034	18,651	15,974	11,957	11,894	11,064	9,308	8,612	7,298	7,830	[2] 10,921

[1] Subject to revision.
[2] Revised figure.

NATURAL, MASONRY (NATURAL), AND PUZZOLAN CEMENTS

Hydraulic cements other than portland were produced in 9 plants in 1947. Output and shipments in 1947 were, respectively, 19 and 16 percent greater and year-end stocks 21 percent greater than in 1946. Producers reported the consumption of 35,531 short tons of coal and of gas equivalent to approximately 3,725 short tons of coal.

Natural, masonry (natural), and puzzolan (slag-lime) cements produced, shipped, and in stock at mills in the United States, 1943–47

Year	Production		Shipments		Stocks on Dec. 31
	Active plants	Barrels (376 pounds)	Barrels (376 pounds)	Value	Barrels (376 pounds)
1943	10	1,830,266	1,846,803	$2,357,112	227,152
1944	9	1,246,703	1,320,274	1,638,892	166,889
1945	9	1,483,763	1,479,513	2,093,848	170,324
1946	9	2,474,674	2,533,106	4,155,171	[1] 112,031
1947	9	2,951,098	2,927,885	5,764,398	[2] 135,244

[1] Revised figure.
[2] Subject to revision.

TYPES OF CEMENT

A break-down of total production of portland cement by types for the 1943–47 period is shown in the accompanying table.

The output of six, and shipments of eight types, of portland cement in 1947 show increases over the quantities reported in 1946. High-early-strength, low-heat, and sulfate-resisting show decreases in production, but only high-early-strength shows a decline in shipments. The large increase in production and shipments of portland-puzzolan which started in 1946 and continued through 1947 are indicative of the acceptance by the trade of the improved product now being manufactured.

Prepared Masonry Mortars.—Production of these mixed materials was reported by 83 plants in 1947 and totaled 9,304,309 barrels. Shipments reached 9,104,566 barrels valued at $19,916,126, an average mill value of $2.19 per barrel. These data are not included in the statistical tabulations in this chapter, but the portland cement used in manufacturing these mixtures is included.

Portland cement produced and shipped in the United States,[1] 1943–47, by types

Type and year	Active plants	Production (barrels)	Shipments		
			Barrels	Value	
				Total	Average
General use and moderate heat (types I and II):					
1943	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	145	89,922,894	93,379,480	148,653,647	1.59
1946	153	[3] 139,173,936	[3] 144,038,503	[3] 244,051,517	1.69
1947	150	157,525,464	158,637,287	297,619,024	1.88
High-early-strength (type III):					
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
1946	111	6,716,488	7,183,209	14,977,117	2.09
1947	92	6,015,985	5,899,830	13,284,390	2.25
Low-heat (type IV):					
1943	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
1946	3	139,996	136,541	248,057	1.82
1947	5	125,113	137,469	252,721	1.84
Sulfate-resisting (type V):					
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
1946	4	65,880	60,950	125,204	2.05
1947	5	64,126	94,455	231,523	2.45
Oil-well:					
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
1946	17	[3] 1,510,843	[3] 1,568,881	[3] 3,110,351	[3] 1.98
1947	18	1,701,305	1,708,719	3,592,577	2.10
White:					
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
1946	5	774,215	797,194	3,299,200	4.14
1947	4	855,323	837,489	3,762,417	4.49
Portland-puzzolan:					
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
1946	5	1,092,607	1,091,854	1,696,870	1.55
1947	5	1,519,961	1,529,551	2,970,919	1.94
Air-entrained:					
1945 [4]	52	5,075,332	4,903,355	7,773,719	1.59
1946	69	13,765,384	[5] 13,850,983	23,173,284	1.67
1947	73	17,850,165	17,768,010	32,359,835	1.82
Miscellaneous: [6]					
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
1946	21	824,839	839,478	1,714,743	2.04
1947	20	861,905	879,059	2,140,570	2.44

[1] Including Puerto Rico and Hawaii.
[2] Includes air-entrained and Vinsol resin cements classed as modified cements by producers.
[3] Revised figure.
[4] Figures reported separately for the first time in 1945.
[5] Corrected figure.
[6] Includes hydroplastic, plastic, and waterproofed cements.

CAPACITY OF PLANTS

The aggregate annual capacity of all portland-cement plants in 1947, as reported to the Bureau of Mines by producers, increased 3 percent over that reported in 1946.

The over-all rate of operation in 1947 was at 75 percent of total capacity. As shown in the following table, the percentage of capacity utilized gained in all districts except Puerto Rico. The increases in percentage points ranged from 3 in the New York-Maine and Michigan districts to 13 in the Oregon-Washington and Colorado-Wyoming-Montana-Utah-Idaho districts. The percentage of capacity used in each month of 1947 was higher than in the corresponding months of 1946 and, with the exception of a decline in May, followed the normal trend of low rates in January, February, and March, a steady increase to a peak in October, and a decline in November and December.

Portland-cement-manufacturing capacity of the United States, 1946–47, by districts

District	Estimated capacity (barrels)		Percent of capacity utilized	
	1946	1947	1946	1947
Eastern Pennsylvania and Maryland	42, 537, 325	42, 819, 325	62.3	69.1
New York and Maine	17, 051, 715	17, 391, 715	66.9	69.8
Ohio	12, 191, 515	12, 483, 515	65.9	75.2
Western Pennsylvania and West Virginia	13, 751, 300	13, 961, 300	49.0	58.5
Michigan	12, 881, 605	12, 974, 046	75.3	78.7
Illinois	9, 864, 510	9, 864, 510	63.6	73.3
Indiana, Kentucky, and Wisconsin	17, 264, 000	17, 908, 000	61.2	65.0
Alabama	10, 403, 106	10, 980, 810	75.9	86.6
Tennessee	7, 417, 000	7, 417, 000	69.4	79.6
Virginia, Georgia, Florida, and Louisiana	7, 580, 000	7, 580, 000	74.6	80.7
Iowa	7, 930, 000	7, 930, 000	69.5	79.9
Eastern Missouri, Minnesota, and South Dakota	11, 148, 795	11, 322, 295	68.5	80.7
Kansas	9, 115, 000	9, 440, 000	70.3	75.5
Western Missouri, Nebraska, Oklahoma, and Arkansas	7, 446, 000	7, 670, 000	76.6	83.3
Texas	14, 080, 000	14, 936, 000	76.1	83.4
Colorado, Wyoming, Montana, Utah, and Idaho	5, 065, 000	4, 890, 000	80.7	93.8
California	26, 790, 000	29, 438, 702	72.9	77.4
Oregon and Washington	7, 300, 000	7, 600, 000	64.5	77.9
Puerto Rico	1, 730, 000	2, 500, 000	100.0	75.0
Hawaii	75, 000	(1)	50.7	(1)
	241, 621, 871	249, 107, 218	67.9	74.9

[1] Operations terminated December 1946.

Percentage of capacity used in the finished portland-cement industry in the United States, 1946–47

Month	Monthly		12 months ended—		Month	Monthly		12 months ended—	
	1946	1947	1946	1947		1946	1947	1946	1947
January	47	66	44	70	July	75	80	56	75
February	50	68	46	71	August	79	86	59	75
March	55	69	48	72	September	83	88	62	76
April	64	74	50	73	October	81	90	64	77
May	59	66	51	74	November	78	85	66	77
June	73	81	54	74	December	71	79	68	78

The increase in capacity of wet-process mills that began in 1944 continued through 1947. The wet-process plants utilized the greatest percentage of capacity and manufactured the largest part of the total finished cement produced.

A grouping of the cement plants, based on their estimated annual capacity, is shown in the following table.

Number of portland-cement plants in the United States (including Puerto Rico), by size groups, in 1947

Estimated annual capacity, barrels:	*Number of plants*
Less than 1,000,000	30
1,000,000 to 2,000,000	93
2,000,000 to 3,000,000	17
3,000,000 to 10,000,000	11
	151

Capacity of portland-cement plants in the United States,[1] 1945–47, by processes

Process	Capacity						Percent of capacity utilized			Percent of total finished cement produced		
	Thousands of barrels			Percent of total								
	1945	1946	1947	1945	1946	1947	1945	1946	1947	1945	1946	1947
Wet	124,688	125,227	129,116	51.6	51.8	51.8	45.9	70.2	78.0	55.6	53.6	54.0
Dry	116,943	116,395	119,991	48.4	48.2	48.2	39.0	65.4	71.5	44.4	46.4	46.0
	241,631	241,622	249,107	100.0	100.0	100.0	42.5	67.9	74.9	100.0	100.0	100.0

1 Includes Puerto Rico and Hawaii.

CLINKER PRODUCTION

The production of clinker in 1947, the intermediate product of the portland-cement industry, was 14 percent greater than in 1946. Peak production in 1947 was reached in October, and stocks reached their peak in May. Stocks on December 31, 1947, were 7 percent below those reported for December 1946.

Portland-cement clinker produced and in stock at mills in the United States,[1] 1946–47, by processes, in barrels of 376 pounds [2]

Process	Plants		Production		Stocks on Dec. 31—	
	1946	1947	1946	1947	1946 [3]	1947 [4]
Wet	[3] 87	88	[3] 88,381,503	101,663,716	1,485,059	1,722,087
Dry	[3] 63	61	[3] 76,744,900	85,938,704	2,401,384	1,876,245
	150	149	165,126,403	187,602,420	3,886,443	3,598,332

1 Including Puerto Rico and Hawaii.
2 Compiled from monthly estimates of producers.
3 Revised figures.
4 Subject to revision.

Production and stocks of portland-cement clinker at mills in the United States in 1947, 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	2,387	2,368	2,535	2,378	708	2,511	2,683	2,795	2,757	2,890	2,738	2,865
New York and Maine	924	839	960	891	409	1,038	1,084	1,180	1,120	1,275	1,109	1,136
Ohio	728	640	730	800	746	767	867	807	814	869	869	890
Western Pennsylvania and West Virginia	641	623	654	708	708	708	700	745	662	728	721	674
Michigan	654	583	731	790	854	834	942	965	958	1,094	1,062	979
Illinois	618	582	609	619	586	547	545	565	670	710	677	672
Indiana, Kentucky, and Wisconsin	990	878	1,004	866	1,015	970	993	1,017	1,013	1,062	1,043	993
Alabama	677	676	817	818	846	807	841	863	803	868	801	816
Tennessee	507	458	434	397	500	517	496	580	570	563	568	596
Virginia, Georgia, Florida, and Louisiana	542	527	485	555	428	367	483	579	581	586	545	551
Iowa	520	454	337	509	621	506	639	615	541	572	542	602
Eastern Missouri, Minnesota, and South Dakota	606	605	739	699	816	779	739	831	680	779	747	789
Kansas	624	513	574	576	550	602	576	651	612	656	654	607
Western Missouri, Nebraska, Oklahoma, and Arkansas	439	430	490	523	578	519	472	564	561	611	556	584
Texas	905	950	990	1,022	1,055	1,067	1,097	1,022	1,069	1,145	1,116	1,177
Colorado, Wyoming, Montana, Utah, and Idaho	356	330	345	341	403	398	403	425	415	443	411	416
California	1,702	1,538	1,910	1,920	1,977	1,885	1,962	2,005	1,922	1,964	1,937	2,023
Oregon and Washington	298	361	426	514	489	527	560	513	569	597	513	466
Puerto Rico	156	141	133	126	162	145	149	159	149	185	125	187
United States: 1947	14,274	13,496	14,903	15,052	13,451	15,494	16,231	16,881	16,466	17,597	16,734	17,023
1946	10,541	9,749	12,031	12,652	11,424	14,453	15,403	16,104	15,960	16,240	15,356	15,043
STOCKS (END OF MONTH)												
Eastern Pennsylvania and Maryland	861	1,040	1,074	1,043	1,017	856	783	694	608	588	559	633
New York and Maine	266	388	516	535	494	389	339	304	211	206	184	230
Ohio	284	283	331	365	418	398	385	330	296	175	140	256
Western Pennsylvania and West Virginia	346	447	470	463	509	451	439	388	283	183	125	166
Michigan	474	458	596	746	684	515	531	429	266	92	66	236
Illinois	47	110	192	244	257	283	313	255	164	111	87	141
Indiana, Kentucky, and Wisconsin	275	398	496	516	520	512	441	326	214	114	180	232
Alabama	137	141	157	192	201	197	183	157	144	105	109	110
Tennessee	206	333	416	393	371	346	335	330	309	271	232	217
Virginia, Georgia, Florida, and Louisiana	67	112	115	123	135	107	98	72	50	36	39	38
Iowa	209	111	134	179	267	233	201	161	128	77	85	202
Eastern Missouri, Minnesota, and South Dakota	208	276	350	301	262	273	260	197	93	72	97	121
Kansas	156	146	131	237	198	189	152	122	76	41	54	76
Western Missouri, Nebraska, Oklahoma, and Arkansas	103	92	122	76	91	93	78	122	97	77	41	62
Texas	89	115	74	74	102	108	110	131	173	144	107	97
Colorado, Wyoming, Montana, Utah, and Idaho	88	115	125	126	113	113	117	105	85	90	83	104
California	541	463	441	457	482	458	501	538	518	527	496	468
Oregon and Washington	189	256	226	220	192	208	209	156	143	153	207	165
Puerto Rico	47	70	30	48	40	17	39	38	31	52	38	44
United States: 1947	4,593	5,354	5,996	6,338	6,353	5,746	5,514	4,855	3,889	3,114	2,929	[1] 3,598
1946	5,304	5,774	6,281	5,964	5,111	4,928	4,788	4,580	3,898	3,598	3,512	[2] 3,886

[1] Subject to revision.

[2] Revised figure.

RAW MATERIALS

In 1947, 69 percent of the output of portland cement was made from limestone and clay or shale as raw materials. These materials have been the predominant constituents in portland cement in the United States since 1908. Cement rock and pure limestone supplied 23 percent in 1947 compared with 24 percent in 1946. The combination of blast-furnace slag and limestone in 1947, as in the previous year, supplied 6 percent of the output.

Marl and clay supplied only a very minor part of the raw materials utilized by the cement industry in 1947 accounting for 1 percent of the total used.

Production and percentage of total output of portland cement in the United States,[1] 1899–1914, 1926, 1929, 1933, 1935, and 1941–47, according to raw materials

Year	Cement rock and pure limestone		Limestone and clay or shale [2]		Marl and clay		Blast-furnace slag and limestone	
	Barrels	Percent	Barrels	Percent	Barrels	Percent	Barrels	Percent
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	101, 637, 866	61. 8	3, 324, 408	2. 0	15, 477, 239	9. 4
1929	51, 077, 034	29. 9	97, 623, 502	57. 2	4, 832, 700	2. 9	17, 112, 800	10. 0
1933	14, 135, 171	22. 3	43, 638, 023	68. 7	1, 402, 744	2. 2	4, 297, 251	6. 8
1935	23, 811, 687	31. 0	45, 073, 144	58. 8	1, 478, 569	1. 9	6, 378, 170	8. 3
1941	46, 534, 193	28. 4	102, 285, 699	62. 3	3, 142, 021	1. 9	12, 068, 646	7. 4
1942	49, 479, 304	27. 0	115, 948, 373	63. 4	3, 009, 562	1. 7	14, 343, 945	7. 9
1943	29, 915, 157	22. 4	92, 310, 018	69. 2	2, 300, 636	1. 7	8, 897, 977	6. 7
1944	17, 609, 055	19. 4	65, 478, 178	72. 0	2, 078, 530	2. 3	5, 739, 933	6. 3
1945	20, 383, 505	19. 8	73, 409, 831	71. 4	2, 035, 236	2. 0	6, 976, 312	6. 8
1946	39, 070, 643	23. 8	112, 142, 154	[3] 68. 3	2, 720, 500	1. 7	10, 130, 891	6. 2
1947	43, 428, 201	23. 3	129, 338, 247	69. 3	2, 408, 845	1. 3	11, 344, 054	6. 1

[1] Includes Puerto Rico and Hawaii, 1941–47.
[2] Includes output of 2 plants using oystershells and clay in 1926; 3 plants in 1929, 1933, and 1935; 4 plants in 1941–45; and 5 plants in 1946–47.
[3] Corrected figure.

The quantity of raw materials (exclusive of fuels and explosives) required for the production of portland cement during recent years is shown in the accompanying table. Limestone, cement rock, and clay and shale make up 93 percent of the total materials consumed. With the exception of marl, which shows a decrease, all types of raw material consumed in 1947 show substantial gains over the 1946 totals.

Raw materials used in producing portland cement in the United States, 1945–47 [1]

Raw material	1945	1946	1947
	Short tons	*Short tons*	*Short tons*
Cement rock	5,656,390	10,781,078	11,728,062
Limestone [2]	22,747,654	34,579,673	40,034,322
Marl	646,391	860,798	563,148
Clay and shale [3]	3,162,458	4,845,224	5,373,591
Blast-furnace slag	380,970	706,986	864,617
Gypsum	683,158	1,157,324	1,445,622
Sand and sandstone [4]	272,077	460,910	821,017
Iron materials [5]	128,312	218,634	257,048
Miscellaneous [6]	36,100	144,139	147,056
Total	33,713,510	53,754,766	61,234,483
Average total weight required per barrel (376 pounds) of finished cement	*Pounds* 656	*Pounds* 655	*Pounds* 657

[1] Includes Puerto Rico and Hawaii.
[2] Includes oystershells.
[3] Includes bentonite, diatomaceous shale, fuller's earth, and other clays.
[4] Includes silica and quartz.
[5] Includes iron ore, pyrite cinders and ore, and mill scale.
[6] Includes diatomite, fluorspar, pumicite, flue dust, pitch, red mud and rock, hydrated lime, tufa, cinders, calcium chloride, sludge, grinding aids, and air-entraining compound.

FUEL AND POWER

The annual consumption of all types of fuel (coal, fuel oil, natural gas, and byproduct gas) in 1947 shows increases over that reported for 1946. The increases are: Coal, 13 percent; fuel oil, 16 percent; natural gas, 8 percent; and byproduct gas, 28 percent. Average monthly consumption of these fuels in 1947 compared to that reported in 1946 (1946 totals in parentheses) was, respectively, 661,465 (584,061) short tons; 385,344 (332,202) barrels; 5,264,974 (4,833,676) million cubic feet; and 223,457 (174,175) million cubic feet.

Finished portland cement produced and fuel consumed by the portland-cement industry in the United States,[1] 1946–47, by processes

Process	Finished cement produced			Fuel consumed [2]		
	Plants	Barrels of 376 pounds	Percent of total	Coal (short tons)	Oil (barrels of 42 gallons)	Natural gas (M cubic feet)
1946						
Wet	[3] 88	[3] 87,990,049	[3] 53.6	[3] 3,556,280	2,348,759	35,171,680
Dry	[3] 64	[3] 76,074,139	[3] 46.4	[3] 3,452,450	1,637,662	[4] 22,832,429
	152	164,064,188	100.0	[5] 7,008,730	3,986,421	58,004,109
1947						
Wet	88	100,696,955	54.0	3,980,760	2,852,511	41,054,656
Dry	62	85,822,392	46.0	3,956,814	1,771,613	[4] 22,125,029
	150	186,519,347	100.0	[6] 7,937,574	4,624,124	63,179,685

[1] Including Puerto Rico and Hawaii.
[2] Figures compiled from monthly estimates of producers.
[3] Revised figure.
[4] Includes byproduct gas: 1946—2.090,100 M cubic feet; 1947—2,681,487 M cubic feet.
[5] Includes 19,120 tons of anthracite and 6,989,610 tons of bituminous coal.
[6] Includes 18,564 tons of anthracite and 7,919,010 tons of bituminous coal.

Portland cement produced in the United States,[1] 1946–47, by kind of fuel

Fuel	Finished cement produced			Fuel consumed [2]		
	Number of plants	Barrels of 376 pounds	Percent of total	Coal (short tons)	Oil (barrels of 42 gallons)	Natural gas (M cubic feet)
1946						
Coal	91	[3] 92,469,773	56.3	5,746,785		
Oil	13	[3] 12,615,568	7.7		2,583,183	
Natural gas	12	[3] 11,762,138	7.2			17,397,628
Coal and oil	10	14,566,471	8.9	883,015	554,919	
Coal and natural gas	13	13,281,081	8.1	359,160		[4] 16,025,258
Oil and natural gas	7	13,324,422	8.1		764,048	15,034,902
Coal, oil, and natural gas	6	6,044,735	3.7	19,770	84,271	9,546,321
	152	164,064,188	100.0	[5] 7,008,730	3,986,421	58,004,109
1947						
Coal	89	[3] 105,011,561	56.3	6,440,596		
Oil	12	[3] 14,601,599	7.8		3,032,878	
Natural gas	11	[3] 13,702,618	7.3			19,946,198
Coal and oil	10	14,474,204	7.8	920,289	555,908	
Coal and natural gas	13	15,072,126	8.1	467,362		[6] 15,020,189
Oil and natural gas	5	12,968,637	7.0		784,396	14,228,314
Coal, oil, and natural gas	10	10,688,602	5.7	109,327	250,942	13,984,984
	150	186,519,347	100.0	[7] 7,937,574	4,624,124	63,179,685

[1] Including Puerto Rico and Hawaii.
[2] Figures compiled from monthly estimates of the producers.
[3] Average consumption of fuel per barrel of cement produced was as follows: 1946—coal, 124.3 pounds; oil, 0.2048 barrel: natural gas, 1,479 cubic feet. 1947—coal, 122.7 pounds; oil, 0.2077 barrel; natural gas, 1,456 cubic feet.
[4] Includes 2,090,100 M cubic feet of byproduct gas.
[5] Includes 19,120 tons of anthracite, and 6,989,610 tons of bituminous coal.
[6] Includes 2,681,487 M cubic feet of byproduct gas.
[7] Includes 18,564 tons of anthracite, and 7,919,010 tons of bituminous coal.

Electric energy used at portland-cement-producing plants in the United States,[1] 1946–47, 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		
1946								
Wet	31	692,119,678	75	1,287,115,691	1,979,235,369	51.2	87,990,049	22.5
Dry	34	1,193,871,747	52	691,336,772	1,885,208,519	48.8	76,074,139	24.8
	65	1,885,991,425	127	1,978,452,463	3,864,443,888	100.0	164,064,188	23.6
Percent of total electric energy used		48.8		51.2	100.0			
1947								
Wet	31	710,978,300	75	1,506,086,691	2,217,064,991	52.9	100,696,955	22.0
Dry	34	1,182,877,720	48	793,962,560	1,976,840,280	47.1	85,822,392	23.0
	65	1,893,856,020	123	2,300,049,251	4,193,905,271	100.0	186,519,347	22.5
Percent of total electric energy used		45.2		54.8	100.0			

Including Puerto Rico and Hawaii.

EMPLOYMENT AND PRODUCTIVITY

Trends in employment and output per man in the cement industry were traced from 1928 to 1938 in Minerals Yearbook, 1935 (pp. 891–905) and 1940, Review of 1939 (pp. 1141–1153). Similar information for 1939 and 1940 appeared in Minerals Yearbook, 1941 (pp. 1215–1222), for 1941 and 1942 in Minerals Yearbook, 1943 (pp. 1265–1273), and for 1943 and 1944 in Minerals Yearbook, 1945 (pp. 1242–1247). Industry-wide totals for 1945 and 1946 are shown in the following tables. Owing to space limitations in this volume, data by districts have been published separately in a Mineral Market Report.

Employment in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States,[1] 1942–46

Year	Employment					Production			Percent of industry represented[2]
	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				
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
1945	20,695	287	5,937,680	8.0	47,612,919	101,340,500	17.07	2.13	98.6
1946	25,044	313	7,836,818	8.0	62,384,279	162,296,274	20.71	2.60	98.9

1 Exclusive of Hawaii and Puerto Rico.
2 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,[1] 1942–46

Year	Employment—cement mills only					Production			Percent of industry represented[2]
	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				
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
1945	16,142	299	4,820,735	8.0	38,551,413	101,340,500	21.02	2.63	98.6
1946	18,101	325	5,874,801	7.9	46,610,834	162,296,274	27.63	3.48	98.9

1 Exclusive of Hawaii and Puerto Rico.
2 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 [1] handled at quarries included in study, and average output of material per man in the United States, [2] 1942–46

Year	Employment—quarries and crushers only					Material handled—quarry rock and overburden				Percent of industry represented [3]
	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					
1942	5,090	280	1,423,290	7.8	11,089,206	50,959,664	10.4	35.80	4.60	90.9
1943	4,403	262	1,152,041	8.0	9,231,784	39,191,018	--------	34.02	4.25	92.1
1944	3,489	245	855,934	8.2	7,001,742	28,307,328	--------	33.07	4.04	91.6
1945	3,500	245	857,117	8.1	6,954,881	29,122,715	--------	33.98	4.19	90.8
1946	4,307	271	1,166,537	8.0	9,370,921	45,065,371	--------	38.63	4.81	90.9

[1] Tonnage of quarry rock and overburden included in 1942 but overburden excluded 1943–46.
[2] Exclusive of Hawaii and Puerto Rico.
[3] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.

Number of men employed in the portland-cement industry in the United States [1] and output per man-hour, 1944–46, classified according to hours of labor per day

Hours per day	1944			1945			1946		
	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	------	------	------	------	------	------	------	------	------
6 and less than 7	694	3.4	1.92	402	1.9	1.60	772	3.1	2.51
7 and less than 8	1,920	9.4	1.73	944	4.6	2.50	1,339	5.3	2.83
8 and less than 9	17,045	83.7	2.04	18,731	90.5	2.12	22,783	91.0	2.57
9 and less than 10	494	2.4	1.42	618	3.0	2.04	150	.6	3.73
10 and less than 11	92	.5	1.34	------	------	------			
11 and less than 12	131	.6	1.97	------	------	------	------	------	------
	20,376	100.0	1.99	20,695	100.0	2.13	25,044	100.0	2.60

[1] Exclusive of Puerto Rico and Hawaii.

TRANSPORTATION

The quantity and proportion of cement shipped by each of the major methods of transportation for 1945–47 are shown in the accompanying table.

The proportions carried by rail, truck, and boat have changed little in this period. Railroads in 1947, as in previous years, were the major carrier, accounting for 82 percent of the total shipped. The quantity of cement shipped in bulk and paper bags increased in 1947 over the previous year's total, but cloth and other containers declined. Bulk shipments increased 37 percent, paper bags increased 8 percent, and cloth bags decreased 29 percent.

Shipments of portland cement from mills in the United States,[1] 1945–47, 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 [2]	Total		
			Paper	Cloth				
1945	*Barrels*	*Percent*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Percent*
Truck	[3] 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	(4)	70.0	100.0	
1946								
Truck	[3] 10,466,492	20.7	14,987,432	3,830,531		18,817,963	29,284,455	17.3
Railroad	38,586,917	76.3	75,889,354	22,996,350	13,967	98,899,671	137,486,588	81.1
Boat	1,521,447	3.0	1,142,487	132,616		1,275,103	2,796,550	1.6
	50,574,856	100.0	92,019,273	26,959,497	13,967	118,992,737	169,567,593	100.0
Percent of total	29.8		54.3	15.9	(4)	70.2	100.0	
1947								
Truck	[3] 13,343,705	19.3	14,635,937	2,006,759		16,642,696	29,986,401	16.0
Railroad	54,198,948	78.5	82,457,113	17,044,651	13,617	99,515,381	153,714,329	82.0
Boat	1,525,322	2.2	2,139,597	126,220		2,265,817	3,791,139	2.0
	69,067,975	100.0	99,232,647	19,177,630	13,617	118,423,894	187,491,869	100.0
Percent of total	36.8		53.0	10.2	(4)	63.2	100.0	

[1] Includes Hawaii and Puerto Rico.
[2] Includes steel drums and iron and wood barrels.
[3] Includes cement used at mills by producers as follows—1945: 217,968 barrels; 1946: 584,224 barrels; 1947: 813,830 barrels.
[4] Less than 0.05 percent.

CONSUMPTION

The following table shows that the indicated consumption of portland cement in 1947 gained in all but six States (Delaware, Indiana, Mississippi, Nevada, North Carolina, and South Carolina). With the exception of Indiana, all the States showing a decrease are non-cement-producing. California, New York, Texas, Pennsylvania, Ohio, Illinois, and Michigan in that order in 1947, as in the previous year, were the largest consumers of cement. These seven States accounted for 44 percent of the total consumption. The 15 non-cement-producing States (including the District of Columbia) accounted for 12 percent of total consumption.

Destination of shipments of finished portland cement from mills in the United States, 1945–47, by States

Destination	1945 (barrels)	1946 (barrels)	1947 Barrels	1947 Percentage of change from 1946
Continental:				
Alabama	1,912,267	2,744,143	2,930,108	+6.8
Arizona [1]	740,332	1,171,168	1,491,197	+27.3
Arkansas	974,515	1,331,500	1,349,460	+1.3
California	11,791,720	17,341,128	19,301,504	+11.3
Colorado	1,134,256	1,726,667	1,837,330	+6.4
Connecticut [1]	996,729	2,120,160	2,156,811	+1.7
Delaware [1]	210,283	484,159	431,850	−10.8
District of Columbia [1]	765,140	1,011,075	1,130,816	+11.8
Florida	2,067,746	3,731,283	4,221,661	+13.1
Georgia	1,446,831	3,049,291	3,051,785	+0.1
Idaho	431,585	707,091	838,121	+18.5
Illinois	5,382,144	8,766,933	9,331,506	+6.4
Indiana	3,629,275	5,256,194	5,216,917	−0.7
Iowa	2,186,491	3,758,932	4,262,177	+13.4
Kansas	1,771,706	2,954,100	3,724,882	+26.1
Kentucky	1,205,966	2,319,754	2,903,057	+25.1
Louisiana	1,928,381	2,563,968	3,134,441	+22.2
Maine	305,691	657,951	787,507	+19.7
Maryland	1,655,621	2,751,643	3,145,913	+14.3
Massachusetts [1]	1,298,674	2,526,515	2,941,870	+16.4
Michigan	4,636,388	7,570,738	8,048,093	+6.3
Minnesota	2,134,964	3,716,917	3,914,258	+5.3
Mississippi [1]	788,402	1,686,806	1,537,801	−8.8
Missouri	2,579,047	4,885,365	4,893,203	+0.2
Montana	355,504	553,373	556,765	+0.6
Nebraska	1,030,485	1,813,766	1,817,942	+0.2
Nevada [1]	310,060	400,329	268,823	−32.8
New Hampshire [1]	253,771	517,126	519,317	+0.4
New Jersey [1]	2,772,450	5,122,199	5,272,019	+2.9
New Mexico [1]	798,601	1,073,385	1,108,513	+3.3
New York	5,251,853	10,231,890	12,730,701	+24.4
North Carolina [1]	1,368,730	3,506,313	3,170,599	−9.6
North Dakota [1]	382,307	672,182	753,385	+12.1
Ohio	4,777,250	9,027,415	9,684,692	+7.3
Oklahoma	1,579,949	3,025,839	3,295,015	+8.9
Oregon	921,048	1,477,665	1,835,962	+24.2
Pennsylvania	5,474,146	9,702,251	10,974,095	+13.1
Rhode Island [1]	266,330	495,436	546,547	+10.3
South Carolina [1]	588,720	1,347,237	1,335,828	−0.8
South Dakota	383,393	727,561	924,729	+27.1
Tennessee	1,771,512	3,665,692	4,102,443	+11.9
Texas	6,594,518	9,904,082	11,520,189	+16.3
Utah	675,278	932,799	954,883	+2.4
Vermont [1]	157,590	378,325	497,077	+31.4
Virginia	2,065,911	3,492,109	3,571,849	+2.3
Washington	2,304,247	3,364,011	3,512,855	+4.4
West Virginia	1,080,405	2,006,952	2,400,206	+19.6
Wisconsin	2,608,043	4,443,029	4,585,162	+3.2
Wyoming	219,924	342,817	397,814	+16.0
Unspecified	490,825	36,397	333,666	+816.7
Total continental United States	96,457,004	163,093,661	179,253,344	+9.9
Outside continental United States [2]	9,896,591	6,473,932	8,238,525	+27.3
Total shipped from cement plants	106,353,595	169,567,593	187,491,869	+10.6

[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 (1945–47) and Hawaiian mill (1945–46 only).

Destination of shipments of finished portland cement from mills in the United States in 1947, by months, in barrels

Destination	January	February	March	April	May	June	July	August	September	October	November	December
Alabama	171,024	168,276	202,733	225,965	270,194	270,834	264,959	305,267	307,009	294,681	235,633	224,965
Arizona	113,856	104,286	116,977	124,764	127,297	127,626	107,929	131,241	129,037	116,151	138,694	151,568
Arkansas	63,460	61,910	106,836	92,319	104,629	129,825	143,984	141,179	128,973	122,539	125,356	124,280
California	1,456,889	1,392,158	1,596,948	1,636,989	1,622,813	1,641,585	1,608,831	1,619,226	1,645,165	1,780,414	1,613,408	1,673,602
Colorado	82,752	72,231	112,595	157,637	174,260	175,002	187,394	170,016	177,565	171,145	161,931	182,363
Connecticut	63,367	88,488	108,236	178,685	162,842	258,618	261,460	257,804	222,035	264,308	184,542	104,695
Delaware	20,553	18,836	29,653	37,480	29,301	43,972	39,867	52,373	40,057	50,935	42,293	24,823
District of Columbia	47,748	55,147	76,340	100,798	85,615	110,922	113,277	104,388	102,182	118,638	97,831	112,947
Florida	252,510	276,154	339,900	315,102	358,493	333,756	377,458	399,486	383,345	349,295	364,888	472,056
Georgia	172,033	170,791	205,687	256,337	299,559	286,105	331,060	293,343	300,399	302,936	220,270	221,434
Idaho	38,569	39,921	70,407	73,577	80,522	79,125	67,813	76,474	85.493	100,675	71,677	52,317
Illinois	245,947	268,607	532,894	740,610	823,691	828,965	1,128,748	1,148,371	1,123,767	1,229,240	852,490	410,353
Indiana	126,607	120,532	261,986	447,719	440,513	499,011	620,143	663,628	622,459	607,524	497,297	293,392
Iowa	66,216	62,618	216,974	324,448	341,755	380,380	602,780	670,947	668,935	506,973	311,602	106,668
Kansas	107,490	140,524	178,926	291,781	330,310	368,035	398,578	406,074	397,413	489,030	400,621	213,855
Kentucky	73,404	86,858	152,715	236,888	233,892	246,544	326,270	333,063	334,147	358,575	310,188	208,205
Louisiana	227,720	226,239	237,635	236,042	275,799	278,185	289,825	257,022	301,742	314,083	235,738	257,294
Maine	13,243	21,186	28,547	58,067	51,031	117,882	105,883	97,162	114,033	91,082	72,630	23,796
Maryland	128,960	147,542	210,384	272,503	240,169	304,496	326,483	353,459	292,262	345,149	320,180	215,537
Massachusetts	83,423	131,124	163,157	237,973	250,224	336,046	303,389	339,824	282,998	361,838	276,354	159,312
Michigan	188,821	173,966	314,116	533,739	642,722	917,591	996,878	994,093	1,076,223	1,024,577	714,580	414,179
Minnesota	71,785	86,921	224,023	284,838	384,724	462,144	575,959	529,013	486,971	419,310	289,998	96,306
Mississippi	85,791	126,379	122,821	116,794	122,056	133,736	155,574	172,741	122,978	132,627	130,878	118,273
Missouri	188,487	189,190	320,477	389,638	405,639	408,920	506,671	539,869	554,988	593,959	461,363	324,957
Montana	8,672	15,152	26,649	43,152	62,758	67,020	62,772	52,736	59,579	76,619	57,578	19,986
Nebraska	38,779	37,594	88,682	148,483	174,532	151,296	229,428	201,414	235,636	227,898	171,332	112,405
Nevada	18,468	14,948	26,497	21,461	18,474	20,674	26,196	24,583	25,280	27,580	19,583	18,987
New Hampshire	16,945	20,420	24,888	49,252	41,293	72,193	47,548	54,577	58,473	59,122	58,359	15,455

New Jersey	246,163	238,674	327,140	488,554	340,079	511,231	554,432	571,325	513,893	622,288	534,131	319,984
New Mexico	72,370	63,447	87,089	86,277	98,697	87,796	93,782	97,519	99,663	102,860	99,890	117,760
New York	415,296	432,264	604,802	935,629	892,813	1,455,979	1,518,233	1,631,115	1,507,972	1,561,337	1,156,560	621,276
North Carolina	129,522	157,269	201,104	268,972	319,029	366,320	365,206	328,808	294,744	269,222	245,553	222,790
North Dakota	4,407	7,854	45,310	53,255	83,019	105,119	140,255	97,554	73,931	77,267	56,870	7,532
Ohio	292,455	280,311	474,940	685,890	774,347	956,437	1,147,816	1,198,922	1,165,735	1,337,150	868,166	495,789
Oklahoma	216,558	185,179	267,670	260,896	282,270	292,361	270,496	312,293	274,464	316,524	297,765	315,459
Oregon	75,238	110,439	138,612	144,409	171,411	189,245	177,081	183,436	190,175	185,424	138,391	132,688
Pennsylvania	402,629	381,400	551,752	899,272	805,698	1,167,686	1,306,852	1,353,901	1,209,707	1,441,385	920,836	521,753
Rhode Island	13,762	25,691	33,259	44,990	43,971	50,750	56,318	63,127	51,302	74,791	52,406	34,066
South Carolina	89,234	83,598	100,577	115,102	126,179	117,086	126,810	137,265	110,233	124,218	98,500	106,321
South Dakota	10,079	12,248	43,446	59,814	84,290	105,490	143,527	123,565	117,375	114,402	81,552	27,186
Tennessee	142,716	159,535	416,178	367,745	367,377	333,362	391,351	426,199	486,025	527,293	416,394	265,839
Texas	765,429	727,347	766,829	954,945	955,436	986,018	1,068,666	1,020,738	1,033,903	1,106,311	1,001,065	949,992
Utah	30,039	42,845	81,308	91,067	102,708	97,108	88,605	91,456	104,619	90,978	79,231	41,503
Vermont	3,557	5,296	10,001	31,812	33,407	66,715	67,152	69,848	86,847	62,214	54,869	7,076
Virginia	164,621	152,343	198,987	346,448	292,773	390,194	368,468	384,587	343,382	348,341	341,260	234,050
Washington	133,489	195,673	335,347	371,437	376,766	339,088	346,694	377,054	374,162	324,482	253,010	204,651
West Virginia	104,368	78,446	105,720	205,218	225,208	256,726	255,416	258,086	263,050	260,656	243,394	139,951
Wisconsin	91,168	98,503	214,984	313,731	387,548	522,360	598,676	628,816	669,514	526,944	353,278	147,020
Wyoming	8,521	12,650	22,060	56,642	43,732	36,456	46,426	40,981	45,056	45,882	40,103	28,464
Unspecified	8,589	18,550	24,774	16,090	13,393	1,058	4,290	3,746	644	5,363	0	6,330
Continental United States	7,593,729	7,787,560	11,149,572	14,431,236	14,975,258	17,485,073	19,343,709	19,789,714	19,295,540	20,062,235	15,770,518	11,301,490
Outside continental United States [1]	801,271	646,440	983,428	982,764	352,742	693,927	755,291	575,286	544,460	499,765	496,482	1,077,510
Total	8,395,000	8,434,000	12,133,000	15,414,000	15,328,000	18,179,000	20,099,000	20,365,000	19,840,000	20,562,000	16,267,000	12,379,000

[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.

LOCAL SUPPLY

An indication of the surplus or deficiency in the quantity of cement locally available, based on shipments from mills and on consumption as shown by State receipts of mill shipments, is reported in the following table. In 1947 deficiencies occurred in two States and four districts. The total surplus of producing States in 1947 was distributed as follows: 23,773,185 barrels to non-cement-producing States, Hawaii, and Alaska; 6,025,924 barrels to destinations outside continental United States (excluding local consumption of Puerto Rico production); and 333,666 barrels to unspecified destinations.

Estimated surplus or deficiency in local supply of portland cement in cement-producing States, 1946–47, in barrels

State or division	1946			1947		
	Shipments from mills	Estimated consumption	Surplus or deficiency	Shipments from mills	Estimated consumption	Surplus or deficiency
Alabama	8, 071, 979	2, 744, 143	+5, 327, 836	9, 509, 697	2, 930, 108	+6, 579, 589
California	20, 173, 231	17, 341, 128	+2, 832, 103	22, 846, 458	19, 301, 504	+3, 544, 954
Hawaii	38, 005	433, 040	−395, 035	(1)	(1)	(1)
Illinois	6, 675, 584	8, 766, 933	−2, 091, 349	7, 155, 280	9, 331, 506	−2, 176, 226
Iowa	6, 145, 326	3, 758, 932	+2, 386, 394	6, 155, 670	4, 262, 177	+1, 893, 493
Kansas	6, 894, 353	2, 954, 100	+3, 940, 253	7, 208, 147	3, 724, 882	+3, 483, 265
Michigan	9, 974, 692	7, 570, 738	+2, 403, 954	10, 470, 766	8, 048, 093	+2, 422, 673
Missouri	6, 887, 517	4, 885, 365	+2, 002, 152	8, 030, 939	4, 893, 203	+3, 137, 736
Ohio	8, 187, 531	9, 027, 415	−839, 884	9, 296, 311	9, 684, 692	−388, 381
Pennsylvania	29, 686, 909	9, 702, 251	+19, 984, 658	33, 655, 687	10, 974, 095	+22, 681, 592
Puerto Rico	1, 711, 549	1, 432, 567	+278, 982	1, 904, 125	1, 601, 869	+302, 256
Tennessee	5, 372, 964	3, 665, 692	+1, 707, 272	6, 101, 108	4, 102, 443	+1, 998, 665
Texas	10, 996, 478	9, 904, 082	+1, 092, 396	12, 349, 219	11, 520, 189	+829, 030
Colorado, Montana, Utah, Wyoming, and Idaho	4, 384, 860	4, 262, 747	+122, 113	4, 631, 303	4, 584, 913	+46, 390
Oregon and Washington	4, 812, 993	4, 841, 676	−28, 683	5, 811, 456	5, 348, 817	+462, 639
Georgia, Kentucky, Virginia, Florida, and Louisiana	7, 225, 311	15, 156, 405	−7, 931, 094	7, 516, 763	16, 882, 793	−9, 366, 030
Indiana, Wisconsin, Minnesota, Nebraska, Oklahoma, South Dakota, and Arkansas	16, 924, 088	20, 314, 806	−3, 390, 718	17, 802, 391	21, 103, 483	−3, 301, 092
Maryland and West Virginia	4, 054, 056	4, 758, 595	−704, 539	4, 498, 230	5, 546, 119	−1, 047, 889
New York and Maine	11, 350, 167	10, 889, 841	+460, 326	12, 548, 319	13, 518, 208	−969, 889
	169, 567, 593	142, 410, 456	+27, 157, 137	187, 491, 869	157, 359, 094	+30, 132, 775

[1] Mill dismantled. Operations terminated in December 1946.

PRICES

The average net mill realization of all portland cement shipped from mills in 1947 advanced to $1.90 per barrel from $1.72 per barrel in 1946. The increase was spread over the four quarters, but the greatest changes were reported in the first and last quarters. All districts show an increase from the first to last quarter—the maximum spread being 24 cents reported in Ohio.

The composite wholesale price of portland cement f. o. b. destination, according to the Bureau of Labor Statistics index (1926=100), was 115.7 in 1947; in 1946 it was 104.1.

Average mill value per barrel, in bulk, of portland cement in the United States,[1] 1943–47

1943	$1.57	1946	$1.72
1944	1.59	1947	1.90
1945	1.63		

[1] Includes Puerto Rico and Hawaii.

FOREIGN TRADE[2]

Imports.—Imports of cement have been small during recent years and in 1947 for the most part represented purchases from the United Kingdom (England). Imports of all hydraulic cements, 1945–47, are listed by country of origin in an accompanying table. There were no imports of white nonstaining or other special cements in 1947.

Exports.—Exports of cement in 1947 reached 6,771,250 barrels valued at $21,826,718. As shown in the accompanying table, the bulk of the shipments were to countries in the western hemisphere. Canada and Venezuela were the largest purchasers. Substantial quantities were also exported to Cuba, Mexico, Brazil, and the Dominican Republic.

Shipments of hydraulic cements to noncontiguous Territories of the United States for the 1945–47 period are shown in a following table. Shipments to Alaska and Hawaii in 1947 increased over the previous year's total, but Puerto Rico, Virgin Islands, and American Samoa declined. The increase in shipments to Hawaii is attributed partly to the closing at the end of 1946 of the one producing cement plant in the islands.

Hydraulic cement imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Barrels	Value	Year	Barrels	Value
1943	13,658	$55,560	1946	3,734	$15,531
1944	169	418	1947	4,606	28,668
1945	323	700			

Roman, portland, and other hydraulic cements imported for consumption in the United States, 1945–47, by countries[1]

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Barrels	Value	Barrels	Value	Barrels	Value
Belgium and Luxembourg			2	$4		
Canada	320	$685	2,498	8,124	334	$1,078
Chile	(2)	2				
Dominican Republic	3	13				
United Kingdom			1,091	6,922	4,272	27,590
	323	700	3,591	15,050	4,606	28,668

[1] Excludes "white, nonstaining, and other special cement."
[2] Less than 1 barrel.

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

Hydraulic cement exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Barrels	Value	Percent of total shipments from mills
1943	1,731,956	$4,654,862	1.3
1944	4,040,405	10,044,838	4.2
1945	6,474,721	15,567,490	6.0
1946	5,163,362	13,484,933	3.0
1947	6,771,250	21,826,718	3.6

Hydraulic cement exported from the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Barrels	Value	Barrels	Value	Barrels	Value
North America:						
Bermuda	15,361	$41,582	10,972	$25,055	12,712	$37,443
Canada	40,932	151,874	295,101	979,906	1,100,559	3,558,874
Central America:						
British Honduras	7,519	16,401	1,621	3,882	3,425	16,594
Canal Zone	87,215	182,616	75,646	178,671	332,509	883,943
Costa Rica	163,162	348,183	60,897	168,958	120,716	362,731
El Salvador	110,137	242,483	82,585	197,794	138,911	481,106
Guatemala	6,051	16,168	37,546	103,915	27,623	87,893
Honduras	56,699	131,185	40,150	90,048	97,365	329,996
Nicaragua	23,749	51,075	24,649	56,314	12,696	41,414
Panama, Republic of	380,549	836,466	151,196	383,248	253,512	822,452
Mexico	1,012,556	2,587,794	1,033,474	2,811,361	481,961	1,681,811
Newfoundland and Labrador	2,259	4,951	3,636	8,499	53,406	143,773
West Indies:						
British:						
Bahamas	17,855	45,270	14,197	42,449	20,185	73,357
Barbados	3,657	7,814			7,642	16,573
Jamaica	16,471	36,249	6,105	13,540	12,907	42,376
Leeward and Windward Islands	18,269	42,112	463	1,018		
Trinidad and Tobago	28,988	62,567			68,300	198,187
Cuba	450,969	1,016,204	284,389	717,738	518,339	1,682,314
Curacao (N. W. I.)	116,499	257,394	49,037	128,232	36,516	115,191
Dominican Republic	229,328	497,232	323,072	730,119	352,458	1,066,324
French West Indies	67,430	140,082	58,412	125,588	60,238	175,129
Haiti	62,491	139,658	37,025	88,366	32,277	98,639
Other North America	14,304	30,049	25	284	1,020	4,700
	2,932,450	6,885,409	2,590,198	6,854,985	3,745,277	11,920,820
South America:						
Argentina	5,786	32,403	14,045	81,786	14,287	77,095
Bolivia	417	2,116	878	5,449	1,880	12,907
Brazil	1,234,255	3,074,391	735,094	1,853,186	403,333	1,462,542
Chile	199,770	440,097	7,509	32,558	3,192	24,955
Colombia	185,187	531,599	286,660	796,790	337,544	1,382,666
Ecuador	8,521	21,663	35,652	85,329	85,361	255,399
Paraguay	2,165	6,471	7,804	21,200	3,960	14,125
Peru	54,937	141,092	70,732	188,398	91,699	257,239
Surinam	18,125	40,918	3,250	6,975	6,181	17,363
Uruguay	6,158	30,536	3,024	21,176	2,711	17,561
Venezuela	1,443,087	3,438,870	1,066,317	2,590,675	1,600,581	4,908,461
Other South America	4,697	10,691	4,701	10,974	5,419	17,859
	3,163,105	7,770,847	2,235,666	5,694,496	2,556,148	8,448,172

Hydraulic cement exported from the United States, 1945–47, by countries—Con.

Country	1945		1946		1947	
	Barrels	Value	Barrels	Value	Barrels	Value
Europe:						
France	157,181	$352,998				
Norway	8,843	18,215	121	$12,255		
Portugal	1,082	6,478	434	2,552	461	$2,737
U. S. S. R	472	5,146			751	7,242
United Kingdom			3	345	554	3,802
Other Europe	668	4,264	636	5,306	367	2,431
	168,246	387,101	1,194	20,458	2,133	16,212
Asia:						
Bahrein, State of	274	1,453	301	2,895	1,639	5,679
Ceylon					78,170	227,971
China	500	1,080	156,252	424,987	3,981	19,938
French Indochina	23,400	53,352			380	1,024
Hong Kong			18,073	39,559	5,901	19,168
India	2,180	6,619	703	4,371	13,287	57,812
Kuwait					37,922	112,421
Netherlands Indies	6,681	14,404	1,000	2,325	17,087	43,760
Philippines, Republic of	90,048	211,414	93,819	261,954	152,117	470,590
Saudi Arabia	6,934	21,166	31,977	76,169	77,308	237,107
Syria	850	4,800			1,461	6,352
Turkey			8	25	901	7,571
Other Asia	11,437	25,900	5,385	21,690	802	2,455
	142,304	340,188	307,518	833,975	390,956	1,211,848
Africa:						
Egypt			250	785	167	1,550
Ethiopia					1,750	4,908
French West Africa			145	312	1,297	3,320
Liberia	4,788	15,807	5,014	11,197	11,575	30,940
Mozambique	14,507	40,005	300	957	7,064	25,807
Nigeria	633	1,367			1,786	4,536
Portuguese Guinea and Angola	44,468	99,035	13,813	38,549	20,036	55,135
Southern Rhodesia			500	1,130	1,325	8,200
Tangier	500	1,500	3,247	7,077		
Union of South Africa	1,439	9,209	5,031	19,758	17,849	55,524
Other Africa	1,569	10,314	423	1,084	1,292	3,756
	67,904	177,237	28,723	80,849	64,141	193,676
Oceania:						
Australia	587	5,500				
French Pacific Islands			63	170	1,796	5,804
New Zealand	120	1,184			10,783	30,095
Other Oceania	5	24			16	91
	712	6,708	63	170	12,595	35,990
	6,474,721	15,567,490	5,163,362	13,484,933	6,771,250	21,826,718

Hydraulic cement shipped to noncontiguous Territories of the United States, 1945–47

[U. S. Department of Commerce]

Territory	1945		1946		1947	
	Barrels	Value	Barrels	Value	Barrels	Value
Alaska	40,599	$113,430	43,929	$124,259	53,424	$140,051
American Samoa	83	232	304	919	25	90
Guam					2,937	8,798
Hawaii	208,394	405,208	469,565	865,444	547,184	1,106,942
Puerto Rico	5,271	28,661	41,762	109,682	16,005	78,184
Virgin Islands	19,082	48,663	25,964	66,088	17,360	56,196

TECHNOLOGY

The definition of puzzolan has been broadened to include other material than loosely compacted siliceous rock of volcanic origin, or tuff. It now includes other siliceous materials such as diatomaceous earths, calcined clays and shales, and artificial or synthesized puzzolans. These materials, although not cementitious in themselves, contain constituents that will combine with lime in the presence of water to form compounds that have cementing properties.[3] A standard specification for low-heat cement, recently released in Great Britain, covers a type of portland cement used in large structures such as dams. The reduction in heat of hydration as compared with ordinary portland cement is achieved by fine grinding of the cement and by a reduction in the maximum permissible lime content.[4] The favorable results obtained in recent years in the use of long rotary kilns in both wet- and dry-process plants may change some of the current theories as to the most efficient type and length of kiln desired.

A review of the comparative performance of the long and short rotary kilns in cement plants has recently been released.[5]

A rapid spectrographic procedure for the determination of the minor metallic elements in portland cement has been developed at the National Bureau of Standards. The method promises to extend to determination of cement raw materials and many ceramic materials, provided reliable standard samples of these materials are available.[6] By this method determination of the aluminum, iron, magnesium, potassium, sodium, manganese, and titanium content is obtained. The direct use of pellets of cement powder is a distinct advantage over methods requiring solution of the sample and chemical separations.

There has recently been much discussion concerning grinding practices in the manufacture of cement. The trend toward fine grinding requiring at least 90 percent of the product to be minus 200-mesh, which started about 1931, reached a peak between 1938 and 1942 and now is being questioned. A review and history of grinding practices in the cement industry has recently been released.[7]

Lightweight portable equipment for accurate, rapid measurement of the volume of air entrained in concrete has supplanted the cumbersome gravimetric method. It has also been established that air entrainment, used with appreciation of its sensitivity, is beneficial in all types of concrete. It is believed that the improvement in bond offsets the slight reduction in bond strength, and thus air-entrained concrete can be used in reinforced concrete as well as pavement-type structures.

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[3] Ledyard, E. A., Puzzolan Cements: Rock Products, vol. 50, No. 12, December 1947, p. 143.
[4] Chemical Age (London), Low-Heat Cement: Vol. 56, No. 1456, June 1947, p. 739.
[5] Nordburg, B., Long Kiln v. Short Kiln Performance: Rock Products, vol. 50, No. 8, August 1947, pp. 122–125.
[6] Kiez, A. W., Bourdon, F. S., Spectrographic Determination of Minor Elements in Portland Cement: Pit and Quarry vol. 40, No. 4, October 1947, pp. 71–76.
[7] Wolfe, J. M., What is the Future for Grinding: Rock Products, vol. 50, No. 1, January 1947, pp. 119–123, 148–149.

WORLD PRODUCTION

Available statistics on world production in 1942–47 are given in the following table.

World production of hydraulic cements, 1942–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country	1942	1943	1944	1945	1946	1947
North America:						
Canada	1,448,818	1,159,286	1,141,594	1,344,934	1,835,302	1,894,956
Cuba	166,090	169,609	173,750	180,753	240,406	276,369
Guatemala	[2] 19,000	[2] 21,000	[2] 23,000	[2] 29,000	[2] 29,000	[2] 27,600
Mexico	588,476	578,253	[2] 662,800	[2] 900,800	[2] 1,072,500	[2] 1,300,000
Nicaragua	620	12,030	10,034	[2] 16,000	9,975	15,959
United States	31,610,471	23,067,914	15,716,820	17,786,688	28,403,616	32,314,655
South America:						
Argentina	1,076,858	957,076	1,079,974	1,087,578	1,140,529	1,363,400
Bolivia	22,908	23,006	28,154	27,174	30,742	38,828
Brazil	752,833	[3] 747,409	809,908	774,378	825,869	913,525
Chile	364,584	374,747	362,877	411,088	579,906	602,299
Colombia	207,793	258,578	281,626	300,981	332,000	343,228
Ecuador	19,802	27,860	34,691	37,504	38,497	29,808
Peru	188,882	206,792	248,537	264,892	260,617	254,600
Uruguay	150,069	131,544	189,314	216,592	272,490	279,353
Venezuela	121,833	111,721	119,670	124,447	128,329	153,120
Europe:						
Austria	682,000	773,000	(4)	(4)	367,200	380,924
Belgium	[5] 510,670	[5] 459,520	600,000	646,900	1,889,772	2,609,172
Bulgaria	(4)	(4)	126,044	245,100	(4)	(4)
Czechoslovakia	[6] 320,000	[6] 350,000	(4)	(4)	920,000	(4)
Denmark	434,765	639,038	646,837	219,996	501,835	633,560
Eire	202,000	251,980	222,515	(4)	(4)	(4)
Finland	178,802	238,279	180,221	277,679	329,792	(4)
France	2,496,620	2,926,250	1,485,560	1,524,000	3,372,000	3,857,000
Germany	[7] 7,287,000	[7] 9,073,000	(4)	(4)	[8] 2,529,000	[8] 2,897,000
Greece	30,000	(4)	(4)	(4)	[2] 110,000	(4)
Hungary	728,190	701,290	[9] [10] 153,290	[10] [11] 38,280	163,590	209,060
Italy	2,243,319	(4)	(4)	(4)	(4)	2,790,000
Luxembourg	(4)	(4)	(4)	(4)	(4)	89,272
Netherlands	370,000	358,000	214,000	231,000	402,654	519,262
Norway	373,648	311,152	(4)	(4)	425,000	470,000
Poland	(4)	(4)	(4)	[12] 300,906	1,398,915	1,519,327
Portugal	243,600	246,799	244,974	262,980	330,100	427,500
Rumania	370,614	455,030	326,262	249,420	314,892	421,398
Spain	1,646,280	1,701,520	1,843,037	1,926,052	2,145,140	2,186,654
Sweden	823,890	922,734	1,061,140	1,213,513	1,461,676	1,550,000
Switzerland	439,000	367,000	430,000	415,000	694,000	994,790
U. S. S. R.[2]	(4)	(4)	(4)	1,800,000	3,400,000	4,800,000
United Kingdom	7,376,523	7,081,869	4,633,188	4,116,019	6,681,545	7,071,708
Yugoslavia	(4)	[2] 750,000	(4)	(4)	(4)	(4)
Asia:						
China	[13] 1,572,000	[13] 1,538,247	[13] 1,177,890	42,500	208,057	608,692
Formosa	228,107	309,394	245,000	(4)	(4)	(4)
India	2,220,000	2,148,000	2,076,000	2,244,000	2,807,461	[14] 1,764,000
Indochina, French	177,600	127,000	-	4,910	36,430	39,871
Iran	55,000	35,000	38,000	[15] 25,000	[15] 35,000	(4)
Japan	4,356,023	3,767,666	2,959,686	1,172,273	929,000	1,236,000
Korea	1,181,429	1,400,000	1,003,002	139,049	160,696	168,191
Netherlands Indies	(4)	(4)	(4)	(4)	(4)	10,000
Palestine	216,577	166,804	176,499	147,237	265,935	328,300
Philippines, Republic of	(4)	(4)	(4)	[11] 27,231	56,261	133,918
Syria and Lebanon	214,800	151,900	155,000	190,000	189,000	212,116
Turkey	210,853	153,815	286,332	271,876	321,462	350,456

See footnotes at end of table.

World production of hydraulic cements, 1942–47, by countries, in metric tons [1]—Continued

Country	1942	1943	1944	1945	1946	1947
Africa:						
Algeria	(4)	80,900	96,445	104,400	116,400	150,000
Belgian Congo	64,340	69,221	84,776	76,264	85,314	(4)
Egypt	420,980	322,859	423,902	432,088	587,577	648,353
Eritrea	25,000	27,500	38,000	(4)	(4)	
Ethiopia [2]	20,000	25,000	(4)	(4)	(4)	(4)
Morocco, French	(4)	[2] 140,000	109,020	76,900	175,191	218,862
Mozambique	24,941	30,647	27,932	33,919	26,275	(4)
Tunisia	56,300	23,000	58,500	59,600	82,550	115,100
Union of South Africa	948,000	915,600	1,113,600	1,050,000	1,180,200	1,379,818
Oceania:						
Australia:						
New South Wales	337,947	351,887	313,976	312,185	(4)	(4)
Tasmania	53,324	43,530	(4)	42,782	(4)	(4)
Victoria	172,017	(4)	127,971	133,407	152,763	194,777
New Zealand	217,200	226,800	226,800	237,600	229,900	219,409
Total [16]	80,900,000	72,550,000	55,576,000	50,090,000	74,633,000	84,267,000

[1] In addition to countries listed, cement is produced in Albania, Hong Kong, Queensland, Siam, and South Australia, but data are not available.
[2] Estimate.
[3] Beginning in 1943, white cement is included.
[4] Data not available; estimate by senior author of chapter included in total.
[5] Excludes portland-cement data, which are not yet available.
[6] Slovakia only.
[7] Includes Sudetenland.
[8] Excludes Russian zone of occupation.
[9] January to June, inclusive.
[10] Data represents Trianon Hungary subsequent to October 1944.
[11] June to December, inclusive.
[12] April to December, inclusive.
[13] Data represent area designated as Free China during the period of Japanese occupation, and Manchuria.
[14] Beginning in September 1947, excludes Pakistan.
[15] Production in Government-operated mines for fiscal year ended March 20 of year following that stated.
[16] Estimated by senior author of chapter; excludes estimates for countries listed in footnote 1.

Chromium

By NORWOOD B. MELCHER

GENERAL SUMMARY

THE position of the United States with regard to chromite in 1947 changed from one of acute shortages to one of excess supply. Domestic production, however, dropped as a result of low prices and amounted to only 948 short tons, compared with 4,107 tons in 1946 and a peak wartime production (1943) of 160,120 tons. Imports, especially metallurgical-grade, were slow during the first quarter of 1947, and chromite was in short supply during that period. The total available supply (imports and domestic output) totaled only 188,000 short tons during the quarter, whereas consumption amounted to 218,000 tons. The supply of chromite improved during the second quarter of the year and was considerably in excess of consumption during the remainder of the year. Receipts of metallurgical chromite from the Soviet Union, amounting to 46 percent of the total receipts, assured an adequate supply of metallurgical chromite in 1947.

Salient statistics of chromite in the United States, 1946–47

	1946		1947	
	Short tons	Value	Short tons	Value
New supply:				
Domestic production (shipments)	4,107	$105,041	948	(1)
Imports for consumption	757,391	11,459,121	1,106,180	$18,866,895
Total	761,498	11,564,162	1,107,128	(1)
Distribution:				
Consumption	734,759	(1)	833,357	(1)
Exports	2,158	80,958	3,435	113,479
Additions to stocks [2]	24,581	(1)	270,336	(1)
Total	761,498	11,564,162	1,107,128	(1)

[1] Data not available.
[2] Calculated.

The total new supply of all grades of chromite available to industry in 1947 increased 45 percent over 1946 and totaled 1,107,128 short tons—an all-time record. Consumption amounted to 833,357 short tons—a 13-percent increase over 1946. The excess of supply over consumption in 1947, amounting to 273,771 tons, permitted a substantial increase in domestic stocks. Consumers' stocks of chromite at the close of 1947 totaled 411,067 short tons. Of this, 191,104 tons were metallurgical, 144,381 tons were refractory, and 75,582 tons were chemical.

Total supply, imports for consumption, domestic production, and consumption of chromite, 1943–47, in short tons

	1943	1944	1945	1946	1947
Total supply	1,088,696	894,019	928,738	761,498	1,107,128
Imports for consumption	928,576	848,390	914,765	757,391	1,106,180
Domestic production	160,120	45,629	13,973	4,107	948
Consumption	964,600	848,449	808,120	734,759	833,357

Chromite was free from Government control in 1947 for the first time in 7 years. However, the United States Government, under the authority of the Stockpiling Act of 1946 (Public Law 520), was a potential buyer of both domestic and foreign chromite during 1947 but at prices directly competitive with those paid by industry. Any acquisitions of strategic materials purchased by the Government are for the strategic stockpile and are made by the Strategic and Critical Materials Division, Bureau of Federal Supply, U. S. Department of the Treasury. Stockpiling activities under this act are the responsibility of the Munitions Board, acting under the direction of the Secretary of War, Secretary of the Navy, and the Secretary of the Interior. Metallurgical and refractory grades of chromite are classified by the Munitions Board as Group A (materials of a strategic and critical nature for which stockpiling is deemed the only satisfactory means of insuring an adequate supply for a future emergency). The Bureau of Federal Supply has no price schedule for the purchase of chromite, and any offers for sale should be accompanied bv a statement as to price expected.

DOMESTIC PRODUCTION

The output of domestic chromite, as measured by shipments from mines, in 1947, was the lowest since 1938 and came entirely from two mines in California. The largest producer, as in 1946, was the French Hill mine in Del Norte County, Calif., which was operated in 1947 by Sam Wilson of Patrick Creek, Calif. This mine had been operated previously by the Tyson Chrome Mines, Ltd. Helmke, Thomas & Janssen, operating the Lambert mine in Butte County, Calif., produced 308 short tons (275 long tons) of chromite in 1947 containing 40 percent Cr_2O_3 and 11 percent FeO. An accompanying table gives a history of production of domestic chromite since 1880.

Chromite production (shipments) in the United States, 1943–47 by States, in short tons, and number of producers in 1947

State	1943	1944	1945	1946	1947			
					Number of producers	Cr_2O_3, percent: 45 or over	Cr_2O_3, percent: 35 to 45	Total
Alaska	5,569	1,845						
California	62,495	34,715	9,607	[1] 4,107	2		948	948
Montana	75,691	1,251						
Oregon	16,363	7,818	4,366	(1)				
Texas	2							
Total	160,120	45,629	13,973	4,107	2		948	948

[1] California and Oregon production combined. Bureau of Mines not at liberty to publish separate State totals for 1946.

Chromite shipped from mines in the United States, 1880–1947 [1]

Year	Short tons	Year	Short tons	Year	Short tons	Year	Short tons
Before 1880	224,000	1897–99		1917	48,972	1935	577
1880	2,563	1900	157	1918	92,322	1936	301
1881	2,240	1901	412	1919	5,688	1937	2,600
1882	2,800	1902	353	1920	2,802	1938	909
1883	3,360	1903	168	1921	316	1939	4,048
1884	2,240	1904	138	1922	398	1940	2,982
1885	3,024	1905	25	1923	254	1941	14,259
1886	2,240	1906	120	1924	323	1942	112,876
1887	3,360	1907	325	1925	121	1943	160,120
1888	1,680	1908	402	1926	158	1944	45,629
1889	2,240	1909	670	1927	225	1945	13,973
1890	4,031	1910	230	1928	739	1946	4,107
1891	1,537	1911	134	1929	301	1947	948
1892	1,680	1912	225	1930	90		
1893	1,624	1913	286	1931	300	Total	844,100
1894	4,122	1914	662	1932	174		
1895	1,949	1915	3,675	1933	944		
1896	880	1916	52,679	1934	413		

[1] Production of chromite before 1880 was "about 200,000 long tons" (224,000 short tons), all from Maryland and Pennsylvania, according to Mineral Resources, 1908, pt. 1, p. 760. Most of the figures for 1880–95 represent conversions to short tons from rounded long tons.

CONSUMPTION AND USES

Domestic consumption of chromite increased 13 percent over 1946 and amounted to 833,357 short tons. This increase resulted chiefly from a 36-percent rise in the use of refractory-grade chromite during the year, whereas metallurgical and chemical uses increased only 2 percent and 5 percent, respectively. Of the chromite used in 1947, 46 percent was metallurgical, 37 percent refractory, and 17 percent was chemical, compared with 51, 31, and 18 percent, respectively, in 1946. The accompanying tables show tonnages and grades of ore used since 1941 and tonnages used by primary consumer groups since 1943.

The consumption of ferrochromium in the United States in 1947 totaled 113,491 short tons, compared with 122,562 tons in 1946 and 144,447 tons in 1945.

Consumption of chromite and tenor of ore used by primary consumer groups in the United States, 1941–47, in short tons

Year	Consumption		Tenor of ore (percent Cr_2O_3)		
	Gross weight (short tons)	Average tenor (percent Cr_2O_3)	Metallurgical	Refractory	Chemical
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
1946	734,759	43.2	48.3	33.9	44.9
1947	833,357	41.1	47.4	35.2	44.7

Metallurgical.—Standard metallurgical chromite contains 48 percent Cr_2O_3 and has a chromium-to-iron ratio of 3:1. This high ratio is essential in the production of ferrochromium, the alloy most commonly used in adding chromium to steels, as all of the available iron enters the alloy in its manufacture. Pure chromium is important in electroplating, but the metal in the form of ferro-alloys has a wide range of uses in steels, including structural steels, tool steels, high-speed steels, bearing steels, and stainless steels. The important sources of foreign metallurgical ore are the U. S. S. R., Southern Rhodesia, Turkey, and the Union of South Africa.

Refractory.—Chromite is one of the best neutral refractories known, resisting equally well both acids and bases in the fused state. It is an excellent material for use in the basic open-hearth between the silica and magnesite bricks in side and end walls. A typical analysis [1] of chromite refractories follows: SiO_2, 9.36 percent; FeO 13.50 percent; Al_2O_3, 10.60 percent; CaO trace; MgO 21.06 percent; Cr_2O_3, 43.97 percent; and MnO 0.80 percent. The Republic of the Philippines and Cuba are the most important sources of retractory ore for United States use.

Consumption of chromite in the United States, 1943–47, by grades, in short tons

Year	Metallurgical	Refractory	Chemical	Total
1943	555, 259	282, 178	127, 163	964, 600
1944	456, 171	264, 053	128, 225	848, 449
1945	429, 644	252, 407	126, 069	808, 120
1946	376, 848	228, 641	129, 270	734, 759
1947	385, 983	311, 018	136, 356	833, 357

Chemical.—Chemical ore for United States use is imported largely from the Union of South Africa and finds a wide variety of uses in the chemical industry in making chromates and bichromates, in tanning and dyeing and paint pigments, as an oxidizing agent, and in the production of various chromium compounds. Chromium salts are used in photography and electroplating. Although obtaining its chromium from a chemical, CrO_3, known in the trade as chromic acid, electroplating is essentially a metallurgical use.

PRICES

Prices of chromite in the United States are quoted on a long-ton basis f. o. b. cars at eastern and southern port cities for imported ores and f. o. b. sellers nearest railroad for domestic ores. The quoted prices are subject to penalty if specifications are not met. According to the magazine Steel, prices for most grades of chromite declined during 1947; prices for domestic ore increased.

[1] Carnegie-Illinois Steel Corp., The Making, Shaping and Treating of Steel: P. 41.

Price quotations for various grades of chromite in 1947

[Steel]

Source	Cr_2O_3, percent	Cr:Fe ratio	Prices per long ton [1]	
			Jan. 1, 1947	Dec. 31, 1947
Indian and African	48	3:1	$41.00	$39.00
Do	48	2.8:1	39.75	37.50
Do	48		31.00	31.00
South African (Transvaal)	50		32.80	29.50
Do	48		31.00	28.50
Do	45		28.30	26.50
Do	44		27.40	25.50–26.00
Rhodesian	48	[2] 3:1	41.00	39.00
Do	48		31.00	30.00
Do	45		28.30	27.00–27.50
Domestic (Sellers nearest rail)	48	3:1	36.50	39.00

[1] Gross ton f. o. b. cars, New York, Philadelphia, Baltimore, Charleston, S. C., plus ocean freight differential for delivery to Portland, Oreg., and/or Tacoma, Wash.
[2] Lump.

Prices of ferrochromium increased during 1947. High-carbon ferrochromium sold for 15.05 cents per pound of contained Cr for packed lump alloy, contract, in the Eastern zone at the beginning of the year; this price had advanced to 18.6 cents by year's end. Low-carbon (0.06 percent) on the same basis was quoted at 23 cents in January 1947 and 26.5 cents a year later. Chromium metal (97 percent Cr minimum, 0.50 percent C maximum) advanced in price from 79.50 cents per pound of contained Cr to 93.00 cents during the year.

FOREIGN TRADE [2]

Imports of chromite in 1947 increased 46 percent over 1946 and totaled 1,106,180 short tons, containing 485,991 tons of Cr_2O_3, and were valued at $18,866,895. The Soviet Union, shipping all three grades, was the largest single supplier of chromite in 1947. The Union of South Africa was a close second, supplying the bulk of the chemical ore and smaller portions of metallurgical and refractory. The Republic of the Philippines was third in total but was the largest supplier of refractory grade. Cuba was the fourth largest supplier and the second largest with respect to refractory. The following table shows imports by grades for 1946 and 1947. In 1945, receipts of metallurgical, refractory, and chemical ore amounted to 446,901 short tons, 327,587 tons, and 140,277 tons, respectively—a total of 914,765 tons.

Imports of ferrochromium in 1947 amounted to 10,680 short tons containing 6,450 tons of Cr and were valued at $1,725,400. Exports of this material were 3,081 tons valued at $1,057,359. Exports of chrome ore and concentrates were 3,435 tons valued at $113,479; chromic acid exports totaled 1,578,772 pounds valued at $491,704.

[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.

Chromite imported for consumption in the United States, 1946–47,[1] by countries and grades

[U. S. Department of Commerce]

Country	Chemical grade			Metallurgical grade			Refractory grade			Total		
	Short tons		Value	Short tons		Value	Short tons		Value	Short tons		Value
	Gross weight	Cr_2O_3 content		Gross weight	Cr_2O_3 content		Gross weight	Cr_2O_3 content		Gross weight	Cr_2O_3 content	
1946												
Canada				8,607	4,090	$269,996				8,607	4,090	$269,996
Cuba				14,536	6,442	283,768	189,732	66,687	$2,135,493	204,268	73,129	2,419,261
India				17,268	8,500	177,964				17,268	8,500	177,964
New Caledonia [2]				21,007	11,326	399,422				21,007	11,326	399,422
Philippines, Republic of				840	286	6,000	29,625	10,183	236,510	30,465	10,469	242,510
Sierra Leone [3]				32,912	14,164	499,562				32,912	14,164	499,562
Southern Rhodesia [4]	11,217	4,935	$62,698	72,639	34,913	987,818	15,701	7,380	234,933	99,557	47,228	1,285,449
Turkey	9,015	4,328	233,430							9,015	4,328	233,430
Union of South Africa	128,885	57,001	758,458	60,225	27,872	688,101	46,230	20,958	326,037	235,340	105,831	1,772,596
U. S. S. R.				74,767	40,757	3,347,602	24,185	12,634	811,329	98,952	53,391	4,158,931
	149,117	66,264	1,054,586	302,801	148,350	6,660,233	305,473	117,842	3,744,302	757,391	332,456	11,459,121
1947												
Canada				68	34	2,316				68	34	2,316
Cuba				18,130	7,010	327,508	146,861	52,389	1,701,059	164,991	59,399	2,028,567
India	3,548	1,739	68,691	6,162	3,326	59,945				9,710	5,065	128,636
New Caledonia [2]	8,049	3,809	110,171	12,555	6,376	290,197				20,604	10,185	400,368
Philippines, Republic of				8,691	3,853	120,250	197,964	67,940	1,524,675	206,655	71,793	1,644,925
Sierra Leone [3]				7,762	3,648	152,460	10,640	5,320	180,500	18,402	8,968	332,960
Southern Rhodesia [4]	8,955	3,895	46,560	59,529	29,271	835,033	7,053	3,236	105,683	75,537	36,402	987,276
Turkey	1,120	538	28,000	59,042	27,196	1,681,454	2,240	1,120	80,000	62,402	28,854	1,789,454
Union of South Africa	141,312	65,066	1,010,322	53,775	24,696	551,301	62,990	28,684	476,440	258,077	118,446	2,038,063
U. S. S. R.	6,720	3,226	224,390	215,945	110,546	7,660,888	42,438	22,249	1,070,733	265,103	136,021	8,956,011
Yugoslavia				24,631	10,824	558,319				24,631	10,824	558,319
	169,704	78,273	1,488,134	466,290	226,780	12,239,671	470,186	180,938	5,139,090	1,106,180	485,991	18,866,895

[1] Revisions in Minerals Yearbook, 1946, p. 244, are as follows: 1945: U. S. S. R. should read 177,264 tons; grand total, 925,887 tons.
[2] Classified as French Pacific Islands.
[3] Classified as British West Africa.
[4] Includes the following quantities credited by U. S. Department of Commerce to Mozambique, which is believed to have been the country of transshipment rather than country of origin: 1946—1,369 tons (containing 657 tons chromic oxide), $16,375; 1947—4,436 tons (containing 1,907 tons chromic oxide), $17,343.

WORLD REVIEW

Cyprus.—The small output of chrome ore from Cyprus consists of concentrates from a mill at Ayios Nikolaos. Cyprus Chromite Co., Ltd.—the only operating firm—limited its 1946 operations to development, but production was resumed in 1947, although restricted somewhat by labor shortages.

World production of chromite, 1941–47, by countries, in metric tons

[Compiled by B. B. Mitchell]

Country	1941	1942	1943	1944	1945	1946	1947
North America:							
Canada	2,152	10,393	26,848	24,543	5,221	2,821	1,814
Cuba	163,175	286,470	354,152	192,131	172,626	174,350	159,209
Guatemala	697	529	374	97	442	600	600
Mexico	12	17			101		
United States	12,935	102,400	145,259	41,394	12,676	3,726	860
South America:							
Argentina	60	210	250	181	(1)	(1)	(1)
Brazil (exports)	5,944	5,776	7,813	4,721	1,490		(1)
Europe:							
Albania	[2] 20,000	[2] 5,000					
Bulgaria	(1)	[2] 6,500	[2] 7,000	(1)	(1)	(1)	(1)
Greece	16,240	24,300	15,500	18,295	2,413	8,500	[2] 8,000
Portugal			1,267	1,500	1,669	1,530	(1)
Sweden		80	224	127			
United Kingdom	848	520	294	116		(1)	(1)
Yugoslavia	(1)	[2] 100,000	[2] 65,000	(1)	(1)	(1)	(1)
Asia:							
Cyprus (exports)	4,816	2,936	7,986	469	1,070	1,158	5,283
India	50,940	50,380	33,789	40,190	31,105	45,510	[2] 23,000
Indochina, French		3,570	6,510	2,300			(1)
Iran [3]		435	1,267	12			(1)
Japan [4]	54,510	67,540	58,520	71,135	28,539	7,079	2,347
Philippines, Republic of	[5] 329,243	[2] 50,000	[2] 60,000	[2] 70,000	(1)	58,000	195,185
Turkey	150,303	130,053	165,633	139,397	146,716	103,167	102,875
U. S. S. R.	(1)	[6] 400,000	[2] 325,000	(1)	(1)	(1)	(1)
Africa:							
Egypt		312	910	150	150		266
Sierra Leone	13,907	10,726	16,306	9,851	578	[7] 33,641	[2] 18,000
Southern Rhodesia	322,123	348,314	287,453	277,051	186,318	151,433	154,242
Union of South Africa	141,884	337,620	163,232	88,909	99,090	212,253	373,094
Oceania:							
Australia:							
Queensland				1,125			(1)
New South Wales	356	365	412	246	287	(1)	(1)
New Caledonia	64,509	67,610	46,952	55,229	40,826	24,946	50,530
Total world production [2]	1,770,000	2,012,000	1,798,000	1,350,000	1,100,000	1,140,000	1,650,000

[1] Data not available; estimates by author of chapter included in total.
[2] Estimate.
[3] Fiscal year ended Mar. 20 of year following that stated.
[4] Preliminary.
[5] January to October, inclusive.
[6] Planned production.
[7] Exports.

Greece.—The status of the various Greek chrome mines was reviewed [3] during 1947.

Philippines, Republic of the.—Virtually all of the production of chromite in the Philippines is restricted to refractory-grade, commonly known as Masinloc ore, named from its location on Luzon. Consolidated Mines is the major producer in the area and is reported to be producing 20,000 tons of chromite monthly, valued at $9.50 a ton f. o. b. mines. Occurrences of metallurgical chrome near Cagayan de Misamis, Northern Mindanao, have been reported recently.[4]

Southern Rhodesia.—Southern Rhodesia is one of the most important sources of chromite for United States use; especially valuable are the large tonnages of metallurgical chromite and high-grade

[3] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 3, September 1947, p. 4.
[4] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 5, November 1947, p. 4.

refractory ore. During World War II, Southern Rhodesia supplied nearly half of the domestic requirements for metallurgical chromite. In 1947, it was the second largest source, supplying 13 percent of the total. The main factor inhibiting further use of Southern Rhodesian chromite is transportation from the mines to ports. In August 1947 it was reported that 500,000 tons of ore were stored at the railway awaiting transportation to the port of Beira; the grade of this ore was not stated.

The chromite deposits in Southern Rhodesia are divided into two important groups: (1) The massive deposits in the Selukwe and Mashaba areas near the center of the country and (2) the extensive narrow seams of high-iron material occurring along the Great Dyke. The mines in these areas are situated at distances ranging from 400 to 700 miles from Beira, Mozambique. Both districts employ underground mining, although much of the earlier production at Selukwe came from open pits.

The Great Dyke extends along almost a straight line across Southern Rhodesia in a north-northeastern direction and represents one of the most important potential chromite deposits of the world. The dike is intruded into granitic rocks, which are exposed over nearly half the total area of Southern Rhodesia. The chrome seams (at least seven) show the same synclinal structure as the dike itself and range in width from a few inches to 30 inches. The only important operating mine on the Great Dyke is the Neil, six miles northwest of Lydiate Siding, on the main line of the Rhodesian Railways, Ltd., which connects with Beira. This mine has operated continuously since 1936 and has produced about 150,000 tons of chrome ore.

Total output of chrome ore from Southern Rhodesia since operations began in 1906 totaled 4,978,199 long tons through 1946 and was valued at £11,718,680.[5] Output in 1947 totaled 151,805 long tons. The peak year was 1942, when 342,800 tons were produced.

Turkey.—Exports of chromite from Turkey during the first 9 months of 1947 totaled 134,121 metric tons, of which 44,128 tons or 33 percent were shipped to the United States. Sweden, France, and Norway were the other major recipients.

Chromite sales in Turkey are under the jurisdiction of the Eti Bank, and it is reported that sales in the United States during the third quarter of 1947 amounted to 60,000 tons from the Guleman mine, at $39.00 per ton c. i. f. New York, and 50,000 tons at $40.00 c. i. f. New York. These and other commitments assure a market for Guleman production through 1948.[6]

Shipments of Turkish chrome have decreased considerably from the peak of World War II, when approximately 100,000 tons of metallurgical chromite were received. This drop is due in part to depletion of reserves and to a shortage of mining equipment and transportation facilities within Turkey.

Union of South Africa.—Production of chromite in the Union of South Africa in 1947 was 76 percent more than in 1946. The Union is the main source of chemical-grade chromite for United States use, having supplied 141,312 short tons of this grade in 1947, or 83 percent of United States imports of chemical ore. Occurrences of chromite are restricted virtually to the province of Transvaal although small shipments have been made from Natal.

[5] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 6, December 1947, p. 6.
[6] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 6, December 1947, p. 10.

Clays

By ROBERT W. METCALF AND A. LINN [1]

GENERAL SUMMARY

HIGH industrial activity and the continued heavy demand for clay and clay products resulted in a 10-percent increase in total clay output in 1947. Substantial gains in tonnage and value were reported for all types of clay. New records were established in four classifications.

New plants and expansion of existing facilities in ceramic industries, as well as increased production of paper and rubber, aided in setting new highs in output of both kaolin and ball clay.

The insistent demand for building construction in 1947 resulted in a sizable augmented production of common clays and shales for use in heavy clay products and cement, which together consumed 73 percent of the total clay produced in the United States.

Largely increased sales for filtering and decolorizing oils and to foundries as a bonding agent for foundry sand contributed to a new record for bentonite output, the ninth year of steadily increased production.

Due to higher sales for absorbent uses, marketed production of fuller's earth in 1947 was substantially greater than in 1946 and came within 2 percent of the highest year on record (1930).

Salient statistics of the clay industry in the United States, 1946–47

	1946		1947	
	Short tons	Value	Short tons	Value
Domestic clay sold or used by producers:				
Kaolin or china clay	1,322,303	$13,553,767	1,425,106	$17,107,963
Ball clay	243,145	2,395,902	269,050	2,923,760
Fire clay, including stoneware clay	7,907,974	20,827,220	9,038,680	26,208,602
Bentonite	601,428	4,361,414	763,889	5,949,586
Fuller's earth	298,752	3,702,993	329,068	4,660,614
Miscellaneous clays	20,190,344	16,022,012	21,773,680	17,422,962
	30,563,946	60,863,308	33,599,473	74,273,487
Imports:				
Kaolin or china clay	89,233	1,440,746	82,628	1,330,001
Common blue and Gross-Almerode	22,683	270,472	25,849	342,711
Fuller's earth	194	3,639	155	3,001
Other clay	4,249	21,532	3,768	43,450
	116,359	1,736,389	112,400	1,719,163
Exports:				
Kaolin or china clay	15,878	198,679	18,686	234,707
Fire clay	97,941	657,905	110,193	780,993
Other clay (including fuller's earth)	100,598	2,283,326	138,244	3,587,489
	214,417	3,139,910	267,123	4,603,189

[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 greatly increased market for refractories and heavy clay products resulted in a new peak for fire-clay output and topped by 9 percent the wartime record established in 1942.

Price quotations on clay and clay products in 1947 generally were higher than those in effect in 1946, following the trend in prices of most other commodities.

Total foreign trade in clays in 1947 was more active than in 1946. However, imports of clay, except for "common blue and Gross-Almerode," decreased moderately in 1947, continuing the gradual decline in dependence of American consumers on foreign clays, particularly kaolin or china clay. Exports of clay, on the other hand, in 1947 were one-quarter greater than in 1946. All classifications shown increased substantially—kaolin, fire clay, and other clay, which includes the higher priced fuller's earths and bentonites and similar clays used in oil refining and rotary-drilling fluids.

CONSUMPTION AND USES

The statistics of clay consumption shown in the accompanying table are comparable with similar data published in Minerals Yearbooks covering 1946, 1945, and 1944, and those pertaining to kaolin, ball clay, bentonite, and fuller's earth are comparable for previous years also. The fire-clay and miscellaneous clay figures published beginning with 1944 include captive tonnage which was excluded in earlier years. A more detailed explanation appeared in the Clays chapter of Minerals Yearbook, 1944.

Although the quantities generally increased, the chief consuming industries in both 1947 and 1946 accounted for the same percentages of total clay sold or used: Heavy clay products, 57 percent; refractories, 17 percent; cement, 16 percent; paper, 2 percent; rotary drilling mud, 1 percent; pottery, 1 percent; and filtering and decolorizing, 1 percent. Other uses taking fairly large tonnages, although less than 1 percent of the total sold or used, were rubber and high-grade tile.

Clay sold or used by producers in the United States in 1947, 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	117,368	215,113	2,206				334,687
Stoneware, including chemical stoneware			44,904				44,904
Art pottery and flower pots	2,554	9,233	21,785			32,479	66.051
Slip for glazing	300					3,042	3,342
Total	120,222	224,346	68,895			35,521	448,984
Tile, high-grade	22,690	25,672	100.403			24,477	173,242
Kiln furniture, etc.:							
Saggers, pins, and stilts	11,603	1,000	29,377				41,980
Wads			2,912				2,912
Total	11,603	1,000	32,289				44,892
Architectural terra cotta		1,400	19,543				20,943
Paper:							
Filler	473,907						473,907
Coating	301,853						301,853
Total	775,760						775,760

Clay sold or used by producers in the United States in 1947, 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
Rubber	166, 201		17, 970			2, 011	186, 182
Linoleum	21, 140		4, 574				25, 714
Paints:							
Filler or extender	18, 866		1, 579			292	20, 737
Calcimine	500		2, 200				2, 700
Total	19, 366		3, 779			292	23, 437
Cement manufacture	41, 347		20, 819	122		5, 345, 495	5, 407, 783
Refractories:							
Fire brick and block	96, 563	10, 130	4, 120, 075				4, 226, 768
Bauxite, high-alumina brick			50, 709				50, 709
Fire-clay mortar, including clay processed for laying fire brick	38, 318		216, 465				254, 783
Clay crucibles	2, 386	202	324				2, 912
Glass refractories	500	500	8, 421				9, 421
Zinc retorts and condensers			42, 582				42, 582
Foundries and steelworks	3, 790		745, 398	205, 920	547	31, 101	986, 756
Other refractories	892		249, 836				250, 728
Total	142, 449	10, 832	5, 433, 810	205, 920	547	31, 101	5, 824, 659
Heavy clay products: Common brick, face brick, paving brick, drain tile, sewer pipe, and kindred products	7, 800		3, 246, 866			15, 868, 705	19, 123, 371
Miscellaneous:							
Rotary drilling mud			2, 313	237, 913	15, 618	184, 170	440, 014
Filtering and decolorizing oils (raw and activated earths)				247, 609	[1] 216, 895		464, 504
Other filtering and clarifying				2, 535	10, 661		13, 196
Artificial abrasives	7, 753	500	362				8, 615
Absorbent uses (oily floors, etc.)	7, 695				69, 037		76, 732
Asbestos products	2, 330						2, 330
Chemicals	19, 438		72, 275	328	198		92, 239
Enameling		1, 321					1, 321
Other filler	29, 495	2, 676	4, 025	7, 923			44, 119
Insecticides	11, 602		1, 180	5, 671	12, 940	674	32, 067
Plaster and plaster products	8, 266		2, 900				11, 166
Concrete admixture, sealing dams, etc				1, 529			1, 529
Other uses	9, 949	1, 303	6, 677	54, 339	3, 172	281, 234	356, 674
Total	96, 528	5, 800	89, 732	557, 847	328, 521	466, 078	1, 544, 506
Grand total:							
1947	1, 425, 106	269, 050	9, 038, 680	763, 889	329, 068	21, 773, 680	33, 599, 473
1946	1, 322, 303	243, 145	7, 907, 974	601, 428	298, 752	20, 190, 344	30, 563, 946

[1] Comprises following: Mineral oils, 194,721 tons; vegetable oils, 22,174 tons.

CHINA CLAY OR KAOLIN

The output of kaolin has increased steadily since 1944 and again in 1947 reached a new high—8 percent greater than in the former record year 1946. The accompanying chart clearly indicates the generally upward trend of production since 1934, owing both to an expanding demand and to better preparation of domestic clays.

Consumption of kaolin in paper manufacture in 1947 increased to 775,760 short tons or 11 percent over 1946 and accounted for over half (54 percent) of the total sales. Tonnage consumed in rubber compounding represented 12 percent of the total sales; in refractories, 10 percent; and in pottery, 8 percent. Sales for other purposes comprised 16 percent of the total and reached a wide variety of uses.

Georgia, for which State a separate break-down of the refractory and china clay or paper clay uses is shown, produced 72 percent of the kaolin mined and marketed in the United States; South Carolina, 19 percent; and Alabama, Florida, and North Carolina combined, 4 percent. Other States from which output was reported in 1947 were California, Illinois, Maryland, Pennsylvania, Utah, and Virginia.

Quotations on Georgia and South Carolina, Virginia and North Carolina kaolins, as given in E&MJ Metal and Mineral Markets, remained at the same levels as in 1946, the prices ranging from $2.50 to $3.50 per ton for sagger clays up to $30 or $40 for certain prepared specialties. Florida kaolins, however, were raised substantially in August from $11.75 to $16.75 per ton for washed and crushed material in bulk; from $14–$15 to $20.75, for washed and air-floated; and from $18–$20 to $30–$35 for air-floated enamel grade. At the beginning of 1948, Oil, Paint & Drug Reporter reported that imported china clay ex dock was quoted at $16–$35 for white lump in bulk and $45 for powdered in carlots. Powdered kaolin, ex warehouse, l. c. l., was quoted at $50 to $55 per ton. The average realization per ton, as reported to the Bureau of Mines by the producers, increased from $10.25 in 1946 to $12 in 1947.

Imports of kaolin decreased 7 percent in 1947 compared with 1946 and totaled 82,628 short tons valued at $1,330,001. Of the total receipts, 82,570 tons originated in the United Kingdom and small amounts each from Canada, Argentina, Peru, French Morocco, Czechoslovakia, and Australia. Stringencies of fuel and labor, as well as higher costs in Great Britain, have contributed to the reduction of imports of English china clay.

Kaolin sold or used by producers in the United States, 1946–47, by States

State	Sold by producer		Used by producer		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1946						
Alabama, Florida, North Carolina	61,834	$973,683			61,834	$973,683
California	(1)	(1)	(1)	(1)	18,254	152,898
Georgia	815,367	9,106,878	102,385	$564,171	917,752	9,671,049
Pennsylvania	(1)	(1)	(1)	(1)	42,186	147,262
South Carolina	(1)	(1)	(1)	(1)	270,016	2,493,031
Undistributed [2]	314,290	2,832,306	28,427	76,729	12,261	115,844
	1,191,491	12,912,867	130,812	640,900	1,322,303	13,553,767
1947						
Alabama, Florida, North Carolina	63,283	1,077,006			63,283	1,077,006
California	16,359	278,489			16,359	278,489
Georgia	922,861	12,132,303	109,152	623,738	1,032,013	12,756,041
Pennsylvania	(1)	(1)	(1)	(1)	33,491	122,653
South Carolina	(1)	(1)	(1)	(1)	271,054	2,774,545
Undistributed [2]	290,795	2,932,959	22,656	63,468	8,906	99,229
	1,293,298	16,420,757	131,808	687,206	1,425,106	17,107,963

[1] Included with "Undistributed."
[2] Includes States indicated by "(1)" and Illinois, Maryland, Utah, and Virginia.

Exports of kaolin in 1947 increased 18 percent over 1946 to 18,686 short tons valued at $234,707. The principal destination was Canada, to which country in 1947 about 88 percent of the material was shipped. Uruguay and Argentina accounted together for 7 percent of the total exports. Shipments to other South American countries and very small exports to destinations in Asia and Africa comprised the remainder.

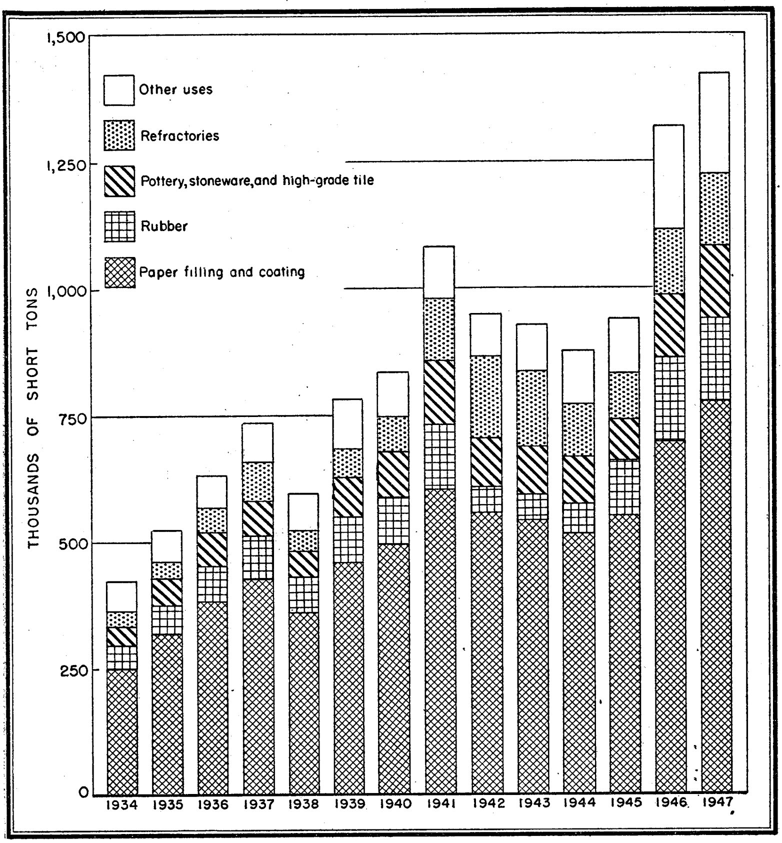

FIGURE 1.—Kaolin sold or used by domestic producers for specified uses, 1934–47.

Georgia kaolin sold or used by producers, 1943–47, 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
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
1946	798,739	9,075,123	11.36	119,013	595,926	5.01	917,752	9,671,049	10.54
1947	902,554	12,034,383	13.33	129,459	721,658	5.57	1,032,013	12,756,041	12.36

An illustrated description of the Georgia kaolin operations of the Edgar Bros. Co. was published.[2] Pottery clays and bentonites in Texas were described.[3] A study of the kaolin and other clay deposits of New Mexico has been undertaken by the New Mexico Bureau of Mines and Mineral Resources.[4] A description of endellite, found to

[2] Becker, Albert E., In Georgia, the Clay's the Thing: Excavating Eng., vol. 42, No. 2, Feb. 1948, pp. 20–23, 72.
[3] Pence, Forrest K., Ceramic Resources in Texas: Am. Ceram. Soc. Bull., vol. 27, No. 3, Mar. 15, 1948, p. 129 (abs.).
[4] Engineering and Mining Journal, vol. 149, No. 1, Jan. 1948, p. 112.

be the principal mineral of indianaite, and its occurrence in Lawrence County, Ind., were reported.[5] Halloysite deposits in Texas [6] and dickite deposits in Montana [7] were discovered.

Efforts to improve the competitive position of English china clay in the world market have been undertaken. Normally, about two-thirds of the annual production is shipped to foreign destinations; and china clay now is the most important raw material exported from United Kingdom, both in tonnage and value. As a result of a detailed survey of all phases of the English china-clay industry, increased fuel allocations were obtained, Government aid was promised in recruiting a much needed larger labor force for the industry, and discussions with the Ministry of Transport were inaugurated by the Board of Trade regarding the shipping difficulties encountered by the producers in their efforts to market their product.[8] Developments in the English china and ball clays industries over the last quarter century were reported.[9] French kaolin deposits in northwestern and southern France were described.[10] Descriptions of certain Brazilian kaolin deposits and results of detailed chemical and physical tests were reported.[11] Development of kaolin deposits in Tanganyika, Africa, said to be 30–36 percent kaolin, is planned.[12] Extensive resources of high-grade kaolin were reported in Ceylon.[13] Physical and burning properties of Indian clays,[14] including some kaolins,[15] were studied, and detailed results of tests presented.

BALL CLAY

Sales of ball clay in 1947 were 11 percent higher than in 1946 and established a new record. As in other recent years, Tennessee and Kentucky were the largest producing States, accounting together for 91 percent of the total tonnage. Tennessee contributed 54 percent of the total, Kentucky 37 percent, and Maryland, Mississippi, and New Jersey combined the other 9 percent.

The largest tonnage of ball clay by far was consumed by the pottery and stoneware industries (83 percent of the total in 1947). Ten percent was used in the manufacture of high-grade tile, 4 percent in refractories, and the remaining 3 percent in saggers, architectural terra cotta, artificial abrasives, enameling, and adhesives.

As quoted in E&MJ Metal and Mineral Markets, prices of domestic crude or shredded ball clay, which in 1946 ranged from $3 to $7, were

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[5] Callaghan, Eugene, Endellite Deposits in Gardner Ridge Mine, Lawrence County, Ind.: Am. Ceram. Soc. Bull., vol. 27, No. 3, Mar. 15, 1948, p. 125 (abs.).

[6] Schurtz, Robert F., Halloysite and Alunite Deposits near Marfa, Tex.: Am. Ceram. Soc. Bull., vol. 27, No. 3, Mar. 15, 1948, p. 129 (abs.).

[7] Dougan, Charles W., Dickite-Clay Deposits of Fergus County, Mont.: Montana Bureau of Mines and Geol., Misc. Contrib. 9, Butte, Mont., 1947, 11 pp.

[8] Chemistry and Industry, China Clay (editorial): May 15, 1948, No. 20, pp. 305–306; Mining Journal (London), Working Party's Report on China Clay Industry: Vol. 230, No. 5874, Mar. 20, 1948, p. 199; Chemical Age, vol. 58, No. 1497, Mar. 20, 1948, p. 407.

[9] Clark and Parker, English China and Ball Clays: Ceram. Age, vol. 50, No. 1, July 1947, pp. 83–85.

[10] Charrin, V., [Newly Exploited Kaolin Deposits in France]: Génie Civil, vol. 123, No. 13, July 1, 1946; Am. Ceram. Soc. Jour., vol. 31, No. 2, Feb. 1, 1948, pp. 42–43 (abs.).

[11] Barzaghi, Luciano, [Characteristics of Local Kaolin]: Anais. Assoc. Quim. Brasil, vol. 6, No. 1, 1947, pp. 50–59; Am. Ceram. Soc. Jour. vol. 31, No. 2, Feb. 1, 1948, p. 42 (abs.).

[12] South African Mining and Engineering Journal, Kaolin Development: Vol. 59, part 1, No. 2873, March 1948, p. 13: Chemical Age (London), vol. 58, No. 1497, Mar. 20, 1948, p. 410.

[13] Mining Journal (London), vol. 230, No. 5884, May 29, 1948, p. 399.

[14] Misra, Manohar L., and Henry, E. C., Nature of Some Indian Clays: Am. Ceram. Soc. Bull., vol. 27, No. 3, Mar. 15, 1948, p. 132 (abs.).

[15] Misra, Manohar L., and Hummel, F. A., Properties of Some Indian Kaolins and Whitewares Bodies Containing Them: Am. Ceram. Soc. Bull., Vol. 27, No. 3, Mar. 15, 1948, p. 132 (abs.).

raised to $5 to $12 beginning in August 1947. Air-floated and pulverized ball clay, which was quoted at $10 to $16.50 in bags in 1946, likewise did not change in price until August 1947, when the range of quotations rose to $11 to $21. The average value reported by producers to the Bureau of Mines increased from $9.85 per ton in 1946 to $10.87 in 1947.

Total imports in 1947 of crude and "wrought" common blue and ball clays, including Gross Almerode totaled 25,849 short tons, valued at $342,711, an increase of 14 percent in quantity and 27 percent in value over 1946. Virtually all of this tonnage was imported as crude or "unwrought and unmanufactured." Of the crude material, 95 percent originated in the United Kingdom, 4 percent came from Canada, and the remainder from Germany. Exports of ball clay, if any, are not separately classified.

Ball clay sold by producers in the United States, 1946–47, by States

State	1946		1947	
	Short tons	Value	Short tons	Value
Kentucky	98,918	$990,301	99,951	$1,072,203
Tennessee	131,689	1,299,393	146,168	1,588,610
Other States [1]	12,538	106,208	22,931	262,947
	243,145	2,395,902	269,050	2,923,760

[1] Maryland, Mississippi, and New Jersey.

FIRE CLAY

Stimulated by the increase in steel production and the consequent enhanced demand for refractories as well as higher construction activity, the output of fire clay in 1947 set a new record, climbing to 9,038,680 short tons. This figure was 9 percent above the former record in 1942 and 14 percent greater than in 1946.

The demand for building materials had a substantial effect on the higher output of fire clay, since sizable tonnages of low-grade fire clay are consumed in making heavy clay products especially in Ohio and, to a lesser extent, in most of the fire-clay-producing States. Total fire clay used in heavy clay products in 1947 was 25 percent more than in 1946 (nearly 650,000 tons greater). A large gain in the refractory uses of fire clay in 1947 also occurred (approximately 500,000 tons or a 10-percent increase). The manufacture of refractories consumed 60 percent of the total fire clay produced; heavy-clay products, 36 percent; and high-grade tile, chemicals, pottery, and a variety of other uses, the remainder. (See use table in section on Consumption and Uses.)

Fire clay is produced in many States. The concentration of the larger industrial plants in the East and Midwest has encouraged the development of deposits in or adjacent to those areas. Thus, in 1947, Ohio with 29 percent of the total production, ranked first in order of output, followed by Pennsylvania, 19 percent; Missouri, 13 percent; and Kentucky, 6 percent. Although smaller in point of tonnage, production in certain Western and Southwestern States in recent years has been increasing.

Quotations on fire clay do not appear in trade journals. However, according to reports from producers received in the Bureau of Mines, the average realization of fire clay sold in 1947 was $2.77 per short ton, a 5-percent increase over that reported in 1946. The average value of all fire clay, including both sales and captive tonnage, rose 10 percent to $2.90 in 1947 compared to $2.63 in 1946.

Imports of fire clays are not shown separately in official statistics. Exports of fire clay in 1947, however, increased to 110,193 short tons—13 percent greater than in 1946. Canada was the chief country of destination, receiving 87 percent of the total. Mexico, Colombia, and Chile together received another 8 percent, and the remainder represents small shipments to widely scattered destinations in Central and South America, Europe, Australia, Asia, and Africa.

Another indication of the heavy demand for fire clay was the

Fire clay, including stoneware clay [1] sold or used by producers in the United States, 1946–47, by States

State	Sold by producer		Used by producer		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1946						
Alabama	92,098	$168,496	37,649	$125,029	129,747	$293,525
Arkansas	(2)	(2)	(2)	(2)	178,246	547,509
California	220,753	438,710	100,180	205,714	320,933	644,424
Colorado	60,083	107,406	46,750	97,853	106,833	205,259
Illinois	166,437	511,896	122,328	254,736	288,765	766,632
Indiana	186,918	237,216	121,685	249,292	308,603	486,508
Kentucky	58,033	301,154	367,859	1,295,708	425,892	1,596,862
Maryland	15,243	89,877	71,591	168,204	86,834	258,081
Missouri [3]	267,893	674,777	905,439	2,248,428	1,173,332	2,923,205
New Jersey	88,969	603,297	159,010	382,469	247,979	985,766
Ohio	678,728	1,442,813	1,660,987	3,326,360	2,339,715	4,769,173
Pennsylvania	280,336	905,145	1,257,262	4,502,231	1,537,598	5,407,376
Tennessee	(2)	(2)	(2)	(2)	26,254	101,265
Texas	(2)	(2)	(2)	(2)	200,959	484,649
Utah	(2)	(2)	(2)	(2)	18,932	51,936
Washington	14,989	20,023	56,227	94,112	71,216	114,135
West Virginia	(2)	(2)	(2)	(2)	227,913	838,824
Other States [4]	83,141	333,969	787,386	2,042,305	218,223	352,091
	2,213,621	5,834,779	5,694,353	14,992,441	7,907,974	20,827,220
1947						
Alabama	104,432	166,652	39,912	108,886	144,344	275,538
Arkansas	(2)	(2)	(2)	(2)	230,241	731,324
California	225,701	614,487	261,380	454,530	487,081	1,069,017
Colorado	56,704	113,200	60,037	137,619	116,741	250,819
Illinois	200,872	690,343	190,469	398,024	391,341	1,088,367
Indiana	293,366	430,756	145,662	351,519	439,028	782,275
Kentucky	95,143	494,972	405,575	1,594,379	500,718	2,089,351
Maryland	19,992	151,452	118,386	325,218	138,378	476,670
Missouri [3]	324,774	814,811	881,197	2,900,001	1,205,971	3,714,812
New Jersey	86,672	669,136	185,705	442,268	272,377	1,111,404
Ohio	795,233	1,856,067	1,828,229	4,345,489	2,623,462	6,201,556
Pennsylvania	321,801	1,038,595	1,417,991	5,468,737	1,739,792	6,507,332
Tennessee	(2)	(2)	(2)	(2)	23,481	133,223
Texas	(2)	(2)	(2)	(2)	221,925	507,639
Utah	(2)	(2)	(2)	(2)	27,294	73,868
Washington	13,394	16,794	42,822	86,612	56,216	103,406
West Virginia	(2)	(2)	(2)	(2)	302,602	898,629
Other States [4]	139,951	353,948	783,280	2,184,107	117,688	193,372
	2,678,035	7,411,213	6,360,645	18,797,389	9,038,680	26,208,602

[1] Includes stoneware clay as follows: 1946—146,254 tons, $280,116; 1947—138,349 tons, $289,831.
[2] Included with "Other States."
[3] Includes diaspore and burley clay as follows: 1946—diaspore, 44,434 tons, $338,935; burley, 35,468 tons, $134,693; 1947—diaspore, 40,504 tons, $349,937; burley 51,330 tons, $251,449.
[4] Includes Delaware, Idaho, Iowa, Kansas, (1947 only), Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Carolina, Virginia, and States indicated by footnote 2.

advance in price of fire-clay brick. Quotations on Missouri, Kentucky, and Pennsylvania fire-clay brick, which had been raised in October 1946 to $81 per thousand for first quality and $65 for second quality, were increased in July 1947 to $87 per thousand for first quality and $70 for second quality brick. As reported in the same trade journal, E&MJ Metal and Mineral Markets, quotations on Ohio fire brick also were raised in October 1946 to $57 per thousand for first quality, and $51 for intermediate grade and second quality. In July 1947 they were increased to $64 per thousand for first quality, $56 for intermediate grade, and $51 for second grade. No other changes were reported during the remainder of the year.

BENTONITE

Output of bentonite in 1947 again rose to an all-time record, surpassing by 27 percent the previous record set in 1946, and totaled 763,889 short tons, valued at $5,949,586. The tonnage was 9 times that of 1930, the first year that separate statistics on bentonite were published. Tonnage of bentonite used for bonding foundry sand in 1947 was 25 percent greater than in 1946, and that used in rotary drilling mud increased slightly (3 percent), while that employed in filtering and decolorizing mineral oils in 1947 jumped to 247,609 short tons, an increase of 72 percent over 1946.

The foundry and petroleum industries consumed 90 percent of the total bentonite produced in 1947. Filtering and decolorizing oils

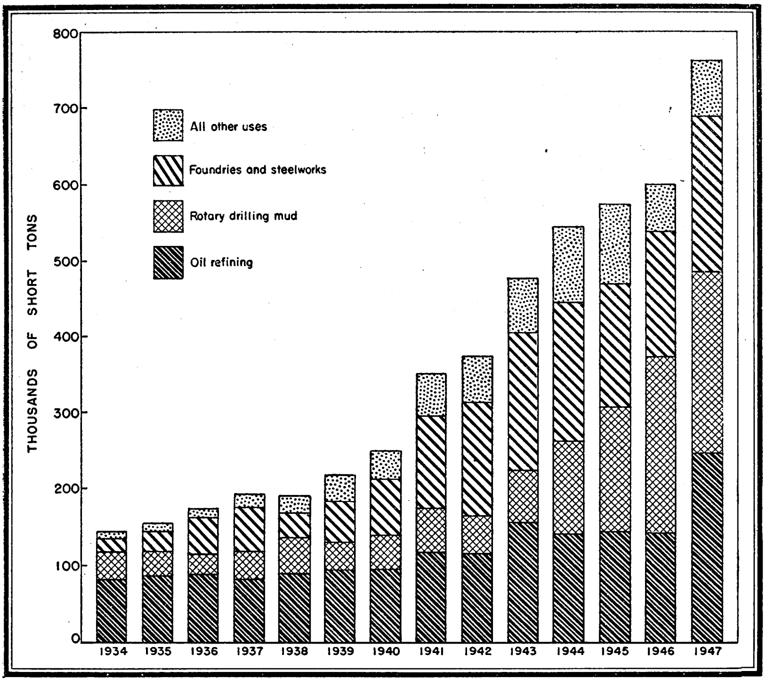

FIGURE 2.—Bentonite sold or used by domestic producers for specified uses, 1934–47.

comprised 32 percent of the total, rotary drilling mud 31 percent, and foundry sand 27 percent. The remainder (10 percent) was used for a wide variety of purposes.

In 1947 the Wyoming-South Dakota region supplied 58 percent of the bentonite sold or used—34 percent from Wyoming and 24 percent from South Dakota. Texas furnished 2 percent of the total. Most of the remainder came from Arizona and Mississippi and smaller tonnages from California, Montana, and Utah.

Bentonite sold or used by producers in the United States, 1945–47, by States

State	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
California	16, 187	$145, 424	(1)	(1)	5, 328	$55, 500
South Dakota	178, 374	1, 202, 555	186, 707	$1, 394, 378	186, 450	2, 070, 659
Texas	24, 503	247, 940	21, 576	192, 891	18, 628	146, 187
Wyoming	199, 293	1, 686, 912	212, 530	1, 988, 918	259, 084	2, 583, 255
Undistributed [2]	155, 641	487, 794	180, 615	785, 227	294, 399	1, 093, 985
	573, 998	3, 770, 625	601, 428	4, 361, 414	763, 889	5, 949, 586

[1] Included with "Undistributed."
[2] Includes Arizona, Mississippi, Montana, and Utah; in addition, Colorado in 1945–46 and California, Nevada, and Oklahoma in 1946.

Quotations on bentonite in 1947 as given in E&MJ Metal and Mineral Markets remained until July at the same levels as in 1946: Dried and crushed, in bulk, $7.50; pulverized, 200-mesh, bagged, $9.50; and pulverized, 325-mesh, bagged, $16. In July and during the balance of 1947, these prices were given as follows: Dried and crushed in bulk, $8; and 200-mesh, pulverized, bagged, $11 (quotations on 325-mesh material were not shown). The average realization per ton as reported by producers to the Bureau of Mines also increased in 1947 compared with 1946: 1947, $7.79; 1946, $7.25.

Imports of bentonite in 1947 were small, virtually all from Mexico. Exports of bentonite are not separately reported by the United States Department of Commerce but are included in the blanket classification of "Other clays or earth, n. s. p. f." However, producers reported to the Bureau of Mines that they exported nearly 41,000 tons, most of which went to European countries and to North and South American destinations. Some tonnage also was shipped to Australia, New Zealand, and Asiatic countries.

Careful compounding and the use of special chemicals to insure the desired carrying powers and consistency were stressed in a discussion of the needs and characteristics of drilling muds.[16] Bentonite clay contributes largely to their efficiency. The relation between particle size and exchange capacity of montmorillonite was studied.[17] Bentonite used as a chemical rather than solely as a filler was found to react with an organic resin to form a plastic with useful properties.[18]

[16] Arthur D. Little, Inc., Bull. 237, November 1947; American Cyanamid Co., "For Instance,"; No. 39, 1948, p. 4.
[17] Johnson, A. L., Surface Area and its Effect on Exchange Capacity of Montmorillonite: Am. Ceram. Soc. Bull., vol. 27, No. 3, Mar. 15, 1948, p. 131 (abs.).
[18] Science News Letter, Plastic from Common Clay: Vol. 51, No. 21, May 24, 1947, p. 333.

FULLER'S EARTH

Production of fuller's earth in 1947 totaled 329,068 short tons, valued at $4,660,614, or 10 percent in quantity and 26 percent in value over 1946. The tonnage produced in 1947 was only 2 percent less than in the peak year 1930 (335,644 tons). As indicated in the accompanying chart (fig. 3), output of fuller's earth has grown steadily since 1940. This increase has been due to comparatively new outlets for the product, principally absorbent uses on oily floors, and insecticides, and has counteracted decreases in tonnages reported for mineral oils or greases and vegetable oils.

Consumption of fuller's earth in mineral-oil refining, however, remains by far the largest use, comprising 59 percent of the total. The next most important market was for absorbent uses, 21 percent, followed by vegetable-oil refining, 7 percent; rotary drilling mud, 5 percent; insecticides, 4 percent; other filtering and clarifying, 3 percent; and the remainder as a binder for chemicals, foundries, and various miscellaneous uses.

Increases in output in 1947 were reported from Florida, Georgia, Illinois, Nevada, and Tennessee. The Georgia-Florida area produced 51 percent of the total tonnage; Texas furnished 31 percent of the total.

Fuller's earth sold or used by producers in the United States, 1945–47, by States

State	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Florida and Georgia	134, 401	$1, 939, 035	144, 214	$2, 100, 652	168, 557	$2, 699, 660
Illinois	43, 664	403, 084	33, 134	296, 637	37, 740	388, 955
Texas	103, 076	931, 878	110, 693	1, 157, 892	102, 901	1, 199, 726
Other States [1]	15, 227	189, 916	10, 711	147, 812	19, 870	372, 273
	296, 368	3, 463, 913	298, 752	3, 702, 993	329, 068	4, 660, 614

[1] Includes California, Mississippi (1947), Nevada, Tennessee, and Utah.

Quotations on Georgia and Florida fuller's earth in 1947 remained at the same levels as in 1946, as indicated by quotations in E & MJ Metal and Mineral Markets, and were as follows: 30- to 60-mesh, $14.50 per ton; 15- to 30-mesh, $14; 200-mesh up, $10; and 100-mesh up, $7. It is possible, however, that actual prices advanced somewhat, as the average realization as reported by producers to the Bureau of Mines increased substantially to $14.16 in 1947 compared with $12.39 in 1946.

Imports of fuller's earth are very small and in 1947 were 20 percent less than in 1946, totaling 155 short tons. Exports of fuller's earth are not separately itemized in foreign trade statistics. Reports by producers to the Bureau of Mines, however, indicated that they shipped to foreign destinations approximately 9,500 short tons, chiefly to Canada, South America, and Europe. Shipments also were made to certain Asiatic destinations.

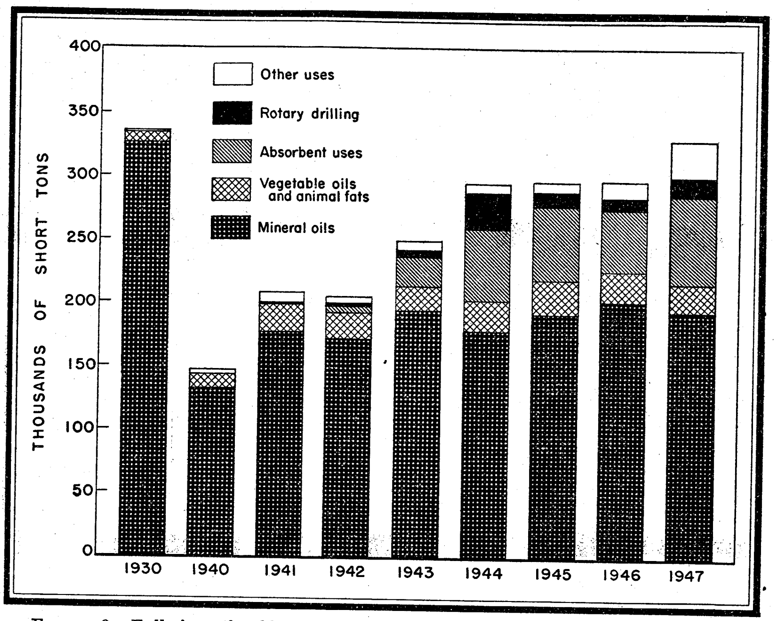

FIGURE 3.—Fuller's earth sold or used by producers for specified uses, 1930 and 1940–47.

MISCELLANEOUS CLAYS

This section on "Miscellaneous Clays" includes statistics for clay and shale used in the manufacture of heavy clay products and portland cement other than those of more or less definite composition and established use treated in the foregoing pages. The above specified products represent a very large tonnage. With these also are grouped comparatively minor tonnages of slip clay, oil-well drilling mud, pottery clay, and small tonnages for other special uses.

The continued boom in construction in 1947 resulted in a substantial increase in the production of miscellaneous clays, particularly for use in heavy clay products, which consumed in 1947 about 1,100,000 short tons more than in 1946. The percentages used for heavy clay products and for cement in 1947, however, were virtually the same as in 1946—73 percent for heavy clay products and 25 percent for cement.

Most of the clay for which data are shown in this section was captive tonnage mined by the manufacturing companies near the processing plants. It was not marketed or sold as clay but first entered trade as brick, cement, tile, or other finished products. The average value of the miscellaneous clay sold as raw or prepared clay in 1947 rose to $1.99 a short ton compared with $1.79 in 1946, although some of the special types of clay sold for much higher values. The value of the captive clay, the larger part of which is extracted by mechanized methods, was computed from individual estimates that generally are $1 or less per ton.

Virtually all States have deposits of so-called common or surface clays; and, as indicated in the accompanying tables, most of the States contribute to the national total of sold or used clays. In 1947, States producing over a million tons were, in order of output: Ohio, Illinois, Pennsylvania, California, New York, Michigan, Texas, and North Carolina.

Miscellaneous clays, including slip clay and shale, sold or used by producers in the United States, 1946–47, by States

State	Sold by producer [1]		Used by producer [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1946						
Alabama	(3)	(3)	(3)	(3)	924,215	$679,527
Arizona	-----	-----	104,825	$65,694	104,825	65,694
Arkansas	-----	-----	210,360	165,397	210,360	165,397
California	237,172	$631,785	1,087,279	745,696	1,324,451	1,377,481
Colorado	27,593	42,941	166,526	119,020	194,119	161,961
Connecticut	-----	-----	199,238	148,053	199,238	148,053
Florida	-----	-----	54,200	31,900	54,200	31,900
Georgia	(3)	(3)	(3)	(3)	723,908	551,116
Idaho	(3)	(3)	(3)	(3)	11,963	8,033
Illinois	33,771	29,759	2,001,386	1,439,948	2,035,157	1,469,707
ndiana	71,688	53,330	603,378	465,039	675,066	518,369
owa	5,556	67,578	691,138	553,192	696,694	620,770
Kansas	-----	-----	464,033	283,350	464,033	283,350
Kentucky	-----	-----	210,535	159,743	210,535	159,743
Louisiana	(3)	(3)	(3)	(3)	178,331	141,526
Maine	-----	-----	19,128	13,377	19,128	13,377
Maryland	-----	-----	306,456	182,335	306,456	182,335
Massachusetts	(3)	(3)	(3)	(3)	93,845	71,836
Michigan	(3)	(3)	(3)	(3)	1,141,848	787,861
Minnesota	(3)	(3)	(3)	(3)	48,199	40,788
Mississippi	(3)	(3)	(3)	(3)	245,209	202,378
Missouri	(3)	(3)	(3)	(3)	515,897	334,482
Montana	-----	-----	30,777	26,010	30,777	26,010
Nebraska	-----	-----	129,646	111,169	129,646	111,169
New Hampshire	-----	-----	18,108	12,381	18,108	12,381
New Jersey	(3)	(3)	(3)	(3)	234,586	255,247
New Mexico	(3)	(3)	(3)	(3)	37,787	39,240
New York	(3)	(3)	(3)	(3)	1,137,105	840,143
North Carolina	-----	-----	889,382	759,238	889,382	759,238
Ohio	26,732	8,020	1,681,371	1,336,644	1,708,103	1,344,664
Oklahoma	(3)	(3)	(3)	(3)	488,943	357,917
Oregon	(3)	(3)	(3)	(3)	111,208	77,470
Pennsylvania	11,497	17,095	1,586,730	1,371,470	1,598,227	1,388,565
South Carolina	-----	-----	342,778	292,584	342,778	292,584
Tennessee	(3)	(3)	(3)	(3)	735,370	554,750
Texas	41,020	188,168	1,105,448	848,695	1,146,468	1,036,863
Utah	-----	-----	83,763	125,942	83,763	125,942
Virginia	-----	-----	317,690	231,636	317,690	231,636
Washington	(3)	(3)	(3)	(3)	164,145	113,459
West Virginia	(3)	(3)	(3)	(3)	241,111	153,849
Wisconsin	(3)	(3)	(3)	(3)	154,913	135,207
Wyoming	-----	-----	20,305	14,619	20,305	14,619
Undistributed [4]	351,870	408,997	7,058,965	5,071,207	222,252	135,375
	806,899	1,447,673	19,383,445	14,574,339	20,190,344	16,022,012
1947						
Alabama	(3)	(3)	(3)	(3)	976,992	680,022
Arkansas	-----	-----	172,896	155,788	172,896	155,788
California	224,374	751,223	1,216,934	811,131	1,441,308	1,562,354
Colorado	42,475	73,134	217,820	154,294	260,295	227,428
Connecticut	-----	-----	184,751	134,802	184,751	134,802
Georgia	-----	-----	886,533	680,276	886,533	680,276
Illinois	31,409	36,556	1,773,494	1,422,727	1,804,903	1,459,283
Indiana	99,552	84,915	643,298	487,718	742,850	572,633
Iowa	13,862	73,736	882,703	714,928	896,565	788,664
Kansas	(3)	(3)	(3)	(3)	532,777	372,461
Kentucky	-----	-----	187,126	144,682	187,126	144,682
Louisiana	-----	-----	215,199	153,236	215,199	153,236
Maine	-----	-----	20,865	18,865	20,865	18,865
Maryland	(3)	(3)	(3)	(3)	455,180	345,004
Massachusetts	(3)	(3)	(3)	(3)	124,717	99,348
Michigan	(3)	(3)	(3)	(3)	1,161,024	842,605
Minnesota	(3)	(3)	(3)	(3)	130,207	111,662
Missouri	-----	-----	538,440	336,345	538,440	336,345
Montana	-----	-----	38,891	39,039	38,891	39,039
Nebraska	(3)	(3)	(3)	(3)	98,011	86,844
New Hampshire	-----	-----	28,605	21,456	28,605	21,456
New Jersey	-----	-----	296,402	264,049	296,402	264,049
New Mexico	(3)	(3)	(3)	(3)	54,255	41,484
New York	(3)	(3)	(3)	(3)	1,174,134	855,385
North Carolina	(3)	(3)	(3)	(3)	1,044,515	863,537
Ohio	35,903	25,217	1,903,620	1,487,556	1,939,523	1,512,773
Oklahoma	-----	-----	522,704	349,000	522,704	349,000
Oregon	(3)	(3)	(3)	(3)	135,120	78,867
Pennsylvania	28,216	37,920	1,529,113	1,189,542	1,557,329	1,227,462
Tennessee	-----	-----	761,692	534,663	761,692	534,663
Texas	(3)	(3)	(3)	(3)	1,145,325	1,085,315

See footnotes at end of table.

Miscellaneous clays, including slip clay and shale, sold or used by producers in the United States, 1946–47, by States—Continued

State	Sold by producer [1]		Used by producer [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1947						
Utah			151,802	$201,459	151,802	$201,459
Washington	(3)	(3)	(3)	(3)	185,958	137,922
West Virginia	(3)	(3)	(3)	(3)	288,078	218,526
Wisconsin	(3)	(3)	(3)	(3)	111,450	81,200
Wyoming			15,414	10,527	15,414	10,527
Undistributed [5]	424,231	$704,695	8,685,356	6,323,483	1,491,844	1,127,996
	900,022	1,787,396	20,873,658	15,635,566	21,773,680	17,422,962

[1] These totals include slip clay from Michigan, New York, and Pennsylvania: 1946—3,384 tons, $36,184; 1947—3,051 tons, $35,122. Purchases by portland cement companies of common clay and shale: 1946—438,335 tons, estimated at $328,751; 1947—431,498 tons, estimated at $365,676.

[2] Includes the following: Common clay and shale used by producers in portland-cement manufacture, 1946—4,334,575 tons, estimated at $2,167,288; 1947—4,913,997 tons, estimated at $2,476,998.

[3] Included with "Undistributed."

[4] Figures include Delaware, District of Columbia, Nevada, North Dakota, Puerto Rico, South Dakota, Vermont, and States indicated by footnote 3.

[5] These totals include Arizona, Delaware, District of Columbia, Florida, Idaho, Mississippi, Nevada, North Dakota, Puerto Rico, South Carolina, South Dakota, Vermont, Virginia, and States indicated by footnote 3.

CLAY PRODUCTS

Construction continued at a high level throughout 1947, with private building being especially active, residential nonfarm construction reaching record heights. Many long-idle plants were restored to production and new operations added. Even after the unusually large gains in output attained in 1946, substantial increases were achieved for three of the four classes of products for which comparable data are shown in the accompanying table. For 1947, it will be noted, collection of statistics for two classes of products has been discontinued, and two have been added. The value of output

Quantity and value of shipments of the principal classes of structural clay products in the United States, 1945–47 [1]

	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Unglazed brick M stand. brick	2,372,477	$39,149,000	4,643,787	$91,926,000	4,930,717	$106,079,000
Glazed brick M stand. brick	3,630	151,000	(2)	(2)	(2)	(2)
Unglazed hollow facing tile M brick equiv	98,654	2,272,000	100,966	2,711,000	301,208	13,789,000
Glazed hollow facing tile M brick equiv	92,651	3,856,000	171,866	8,052,000		
Vitrified paving brick M brick	22,557	694,000	25,376	833,000	(2)	(2)
Unglazed structural tile short tons	798,445	6,400,000	1,243,661	11,490,000	1,229,885	12,427,000
Vitrified clay sewer pipe short tons	776,417	18,332,000	1,077,584	30,288,000	1,324,793	40,302,000
Drain tile do	(2)	(2)	(2)	(2)	714,632	9,626,000
Glazed and unglazed floor and wall tile and accessories, including quarry tile M square feet	(2)	(2)	(2)	(2)	88,047	36,781,000

[1] Compiled from information furnished by the Bureau of the Census, U. S. Department of Commerce.

[2] Figure not available.

of the structural clay products for which data are given by the Bureau of the Census in 1947 totaled $219,000,000.

RESEARCH AND TECHNOLOGY

A renewed and lively interest in the improvement of methods of manufacture and better merchandizing of clay products were noteworthy in 1947. A project to increase the quality and durability of vitreous china was sponsored by the Office of Technical Services, United States Department of Commerce, and the Vitrified China Association, Inc. This program of research—said to be endorsed by 95 percent of the institutional whiteware manufacturers, the National Bureau of Standards, and the American Ceramic Society—will be undertaken by Battelle Memorial Institute, Columbus, Ohio, under the direction of an industry advisory committee.[19] A broad and comprehensive research program on the manufacture and use of brick and tile has been inaugurated by the Structural Clay Products Institute, and Arthur D. Little, Inc., Cambridge, Mass. Investigations into lightweight brick and tile, precast tile, and methods of making more uniform and durable clay products have been carried forward at the National Bureau of Standards and seven cooperating educational institutions, including the Universities of Texas, Minnesota, and Illinois, New York State College of Ceramics, North Carolina State College, Iowa State College, and Virginia Polytechnic Institute.

A series of articles covering the development and technical progress in each of the principal branches of the ceramic industry during the last quarter century was published.[20]

A description, including the historical background, of many of the processes developed for the extraction of alumina from clays and other minerals, was issued.[21] A modified Pedersen process for the extraction of alumina from clay was described.[22] The results of tests of alumina-rich clays in the Ione-Carbondale region, Amador County, Calif., were published.[23] A detailed description of laboratory and pilot-plant investigation of the lime-soda sinter process of extracting alumina from South Carolina kaolin was issued.[24] Flowsheets and cost estimates were included in the report. An investigation of the suitability of Pennsylvania high-alumina clays for the production of alumina was published.[25]

British experiments and patents for the extraction of alumina by fusion with ammonium sulfate were described.[26] Russian studies using sulfur dioxide in the recovery of alumina from kaolin also were reported in the technical press.[27]

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[19] Ceramic Age, vol. 50, No. 2, August 1947, p. 113.

[20] Ceramic Age, vol. 50, No. 1, July 1947 (25 Years of Progress Number), pp. 18–96.

[21] National Bureau of Standards, Aluminum from Clay: Tech. News Bull., vol. 31, No. 6, June 1947, pp. 66–69; Domestic Commerce, Manufacture of Aluminum from Clay Developed by Standards: Vol. 35, No. 7, July 1947, pp. 39–42.

[22] Hignett, T. P., Production of Alumina from Clay by a modified Pedersen Process: Ind. and Eng. Chem. vol. 39, 1947, pp. 1052–1060.

[23] Johnson, F. T., and Ricker, Spangler, Ione-Carbondale Clays, Amador County, Calif.: Bureau of Mines Rept. of Investigations 4213, 1948, 6 pp.

[24] Cservenyak, Frank J., Recovery of Alumina from Kaolin by the Lime-Soda Sinter Process: Bureau of Mines Rept. of Investigations 4069, 1947, 59 pp.

[25] Conley, J. E., and others, Production of Metallurgical Alumina from Pennsylvania Nodular Diaspore Clays: Bureau of Mines Bull. 465, 1947, 193 pp.

[26] Chemical Age (London), vol. 56, No. 1445, Mar. 22, 1947, pp. 340–341.

[27] Budnikov, P. P., and Rivlin, I. I. [Extraction of Alumina from Kaolin by Means of Sulfur Dioxide]: Doklady Akad. Nauk S. S. S. R., vol. 37, No. 3, 1942, pp. 121–123; Am. Ceram. Soc. Jour., vol. 31, No. 4, Apr. 1, 1948, p. 90.

Preparation of clays was described by Searle.[28] Methods of prospecting for clay were outlined.[29] The use of certain organic compounds in the manufacture of refractory insulation is claimed to result in practically no shrinkage, thus eliminating the final sawing to shape heretofore necessary.[30] Differential thermal analyses of many Missouri refractory clays were reported.[31] Bloating characteristics of southern clays of the kaolinite, illite, and montmorillonite types were studied as indications of their adaptability to the manufacture of lightweight aggregates.[32]

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[28] Searle, A. B., Grinding, Mixing, and Preparing Clays: Ceram. Age, vol. 49, No. 2, February 1947, pp. 63–65; No. 3, March 1947, pp. 113–114, 135.

[29] Miller, B. K., and Moore, George E., Jr., Prospecting for Clay in Missouri: Ceram. Age, vol. 50, No. 2, August 1947, pp. 121–123.

[30] Grim, R. E., Allaway, W. H., and Cuthbert, F. L., Reaction of Clays with Organic Cations in Producing Refractory Insulation: Am. Ceram. Soc. Jour., vol. 30, No. 5, May 1, 1947, pp. 142–145.

[31] Keller, W. D., and Wescott, James F., Differential Thermal Analyses of Some Missouri Fire Clays: Am. Ceram. Soc. Jour., vol. 31, No. 4, pp. 100–105.

[32] Klinefelter, T. A., and Hamlin, H. P., Testing of Southern Clays for Lightweight Aggregates: Am. Ceram. Soc. Bull., vol. 26, No. 4, Apr. 15, 1947, pp. 119–121.

U. S. GOVERNMENT PRINTING OFFICE: 1949

Coal—Bituminous and Lignite [1]

By W. H. YOUNG, R. L. ANDERSON, AND E. M. HALL

SURVEY OF THE BITUMINOUS-COAL AND LIGNITE INDUSTRY IN 1947

THE production of soft coal in 1947—an estimated output of 619,000,000 tons [2]—increased 16 percent over the 533,922,068 tons produced in 1946. The increased production is attributable to the heavy demand throughout the year and the fact that there were fewer and shorter strikes than in the past year. The estimated loss of production due to strikes in 1947 was 19,000,000 tons, compared to 107,000,000 tons in 1946, computed at the going rate of production immediately before the strikes. According to the Bureau of Labor Statistics, there were 415 strikes in soft-coal mines in 1947, with 490,000 workers involved and 2,190,000 man-days lost (an average of 5 days per man). The Solid Fuels Administration for War was discontinued on June 30, 1947.

Production.—There was practically no seasonal decline in production in 1947, owing to strong demand in the summer months. Throughout most of the year, production exceeded 12,000,000 tons per week, except when output was reduced because of strikes or holidays.

[1] Data for 1947 are preliminary; detailed statistics with final revisions will be released later. Data for 1946 are final.

[2] Throughout this chapter, "tons" refers to net tons of 2,000 pounds unless otherwise indicated.

Consumption.—All major classes of consumers except railroads used more coal in 1947 than in 1946. Retail-dealer deliveries were also slightly less than in 1946. The total consumption in 1947 was approximately 45,000,000 tons greater than in 1946. Table 5 shows trends in consumption.

Changes in Stocks.—The reserve supply of bituminous coal and lignite in the hands of industrial consumers and retail coal yards increased from 47,157,000 tons at the beginning of 1947 to 52,161,000 tons at the close. The days' supply of stocks increased from 32 to 33. Stocks on the upper Lake docks increased 46,390 tons from January 1 to December 31, 1947.

Mechanization.—The quantity of coal loaded mechanically at underground mines in the United States continued to advance during 1947. Mechanical loading increased from 58 percent of the total underground output in 1946 to 59 percent in 1947. Sales of underground loading equipment, in terms of capacity, were 16 percent less in 1947 than in 1946.

Mechanical Cleaning.—The total capacity of the mechanical-cleaning equipment sold for use at bituminous-coal mines in 1947 was estimated at 17,300 tons of clean coal per hour, a decrease of 4 percent from the previous year.

Trend of Employment.—The average number of men working daily at bituminous-coal and lignite mines in 1947 increased to 405,000 men from 396,434 in 1946.

Index to Capacity.—Since it is not possible for all mines to operate every working day in the year, a conservative figure of 280 days for calculating potential capacity 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 1946 was 2,494,963 tons, which (if applied to 280 days) gives an annual potential output of 699,000,000 tons compared with the actual total production of 533,922,068 tons.

Trend of Fuel Efficiency.—Since 1942 the trends in fuel efficiency have not been unidirectional. During 1947 freight service on railroads exhibited increased fuel efficiency, while passenger service registered decreased fuel efficiency. Electric public-utility power plants reported no change.

Competition with Oil and Gas.—Soon after the close of the war, increased competition between the fuels developed, with some conversion from coal to fuel oil.

Electric power utilities consumption of bituminous coal and fuel oil both increased 25 percent and the consumption of gas increased 22 percent in 1947 over 1946.

Class I railroads decreased their consumption of coal 1 percent in 1947 and their purchases of fuel oil 2 percent from 1946.

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 decreased from 164,304 in 1946 to 53,372 in 1947. Shipments of domestic oil burners, boiler-burner units, and furnace-burner units increased from 499,009 in 1946 to 1,076,565 in 1947.

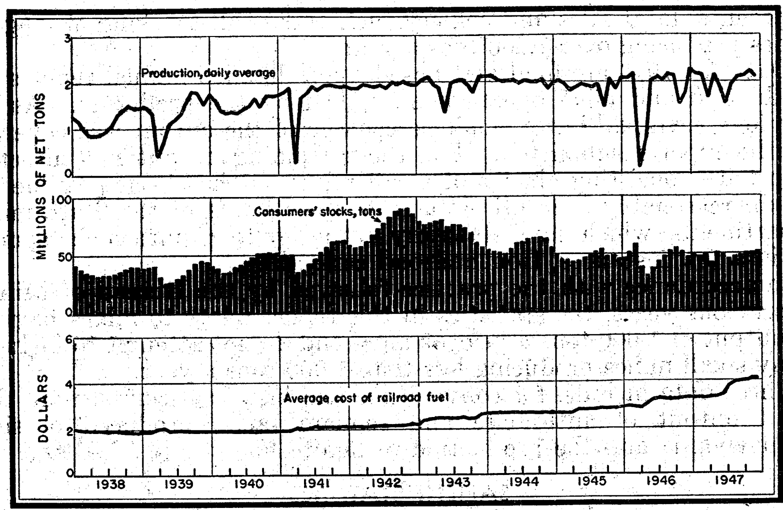

FIGURE 1.—Trends of production, stocks, and prices of bituminous coal and lignite in the United States, 1938–47.

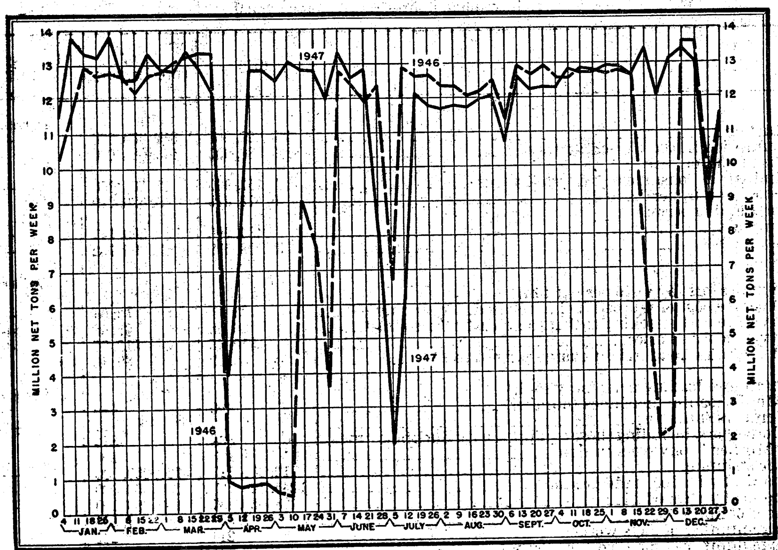

FIGURE 2.—Production of bituminous coal and lignite in the United States, by weeks, 1946–47.

SOURCES OF DATA

Bituminous-coal- and lignite-production statistics for 1947 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 1947, 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 1946 are final and 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.

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.

These data include, for convenience and historical comparison, the small output of anthracite and semianthracite produced outside Pennsylvania and the production of lignite.

SALIENT STATISTICS

TABLE 1.—Salient statistics of the bituminous-coal and lignite industry in the United States, 1946–47

[All tonnage figures represent net tons]

	1946	1947 (preliminary)	Change in 1947
			Percent
Production	533,922,068	619,000,000	+15.9
Consumption in the United States [1]	500,386,000	545,683,000	+9.1
Stocks at end of year:			
Industrial consumers and retail yards	47,157,000	52,161,000	+10.6
Stocks on upper Lake docks	5,579,829	5,626,219	+.8
Imports and exports: [2]			
Imports	434,680	290,141	−33.3
Exports	41,208,578	68,605,702	+66.5
			Dollars
Price indicators (average per net ton):			
Average cost of railroad fuel purchased, f. o. b. mines [3]	$3.11	$3.64	+0.53
Average cost of coking coal at merchant coke ovens [4]	$6.48	$7.68	+1.20
Average retail price	$10.95	$12.99	+2.04
Average railroad freight charge per net ton [5]	$2.27	$2.46	+.19
			Percent
Underground loading machinery sold: [6]			
Mobile loading machines (number)	490	485	−1.0
Scrapers (number)	3	12	+300.0
Conveyors, including those equipped with duckbills (units)	838	846	+1.0
"Mother" conveyors (units)	183	200	+9.3
Surface stripping	112,963,717	135,000,000	+19.5
Mechanically loaded underground	245,340,768	285,000,000	+16.2
Mechanically cleaned	138,669,837	160,000,000	+15.4
Number of mines [7]	7,333	7,500	+2.3
Average number of days worked [7]	214	249	+16.4
Average number of men working daily [7]	396,434	405,000	+2.2
Production per man per day [7]	6.30	6.14	−2.5
Fuel efficiency indicators:			
Pounds of coal per kilowatt-hour at electric power plants [8]	1.29	1.29	
Pounds per 1,000 gross ton-miles—railroads [9]	116	114	−1.7

[1] Represents certain classes of consumers only.
[2] U. S. Department of Commerce.
[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] Average receipts per net ton of revenue bituminous coal and lignite originated, as reported by the Interstate Commerce Commission.
[6] Young, W. H., and Anderson, R. L., Sales of Mechanical Loading and Cleaning Equipment; Coal Age, February 1948, pp. 87–89, and Min. Cong. Jour., February 1948, pp. 58–60.
[7] The figure for 1946 is based upon reports of mine operators producing over 1,000 tons. The figure for 1947 is estimated from various sources.
[8] Federal Power Commission.
[9] Interstate Commerce Commission; includes coal equivalent of fuel oil consumed.

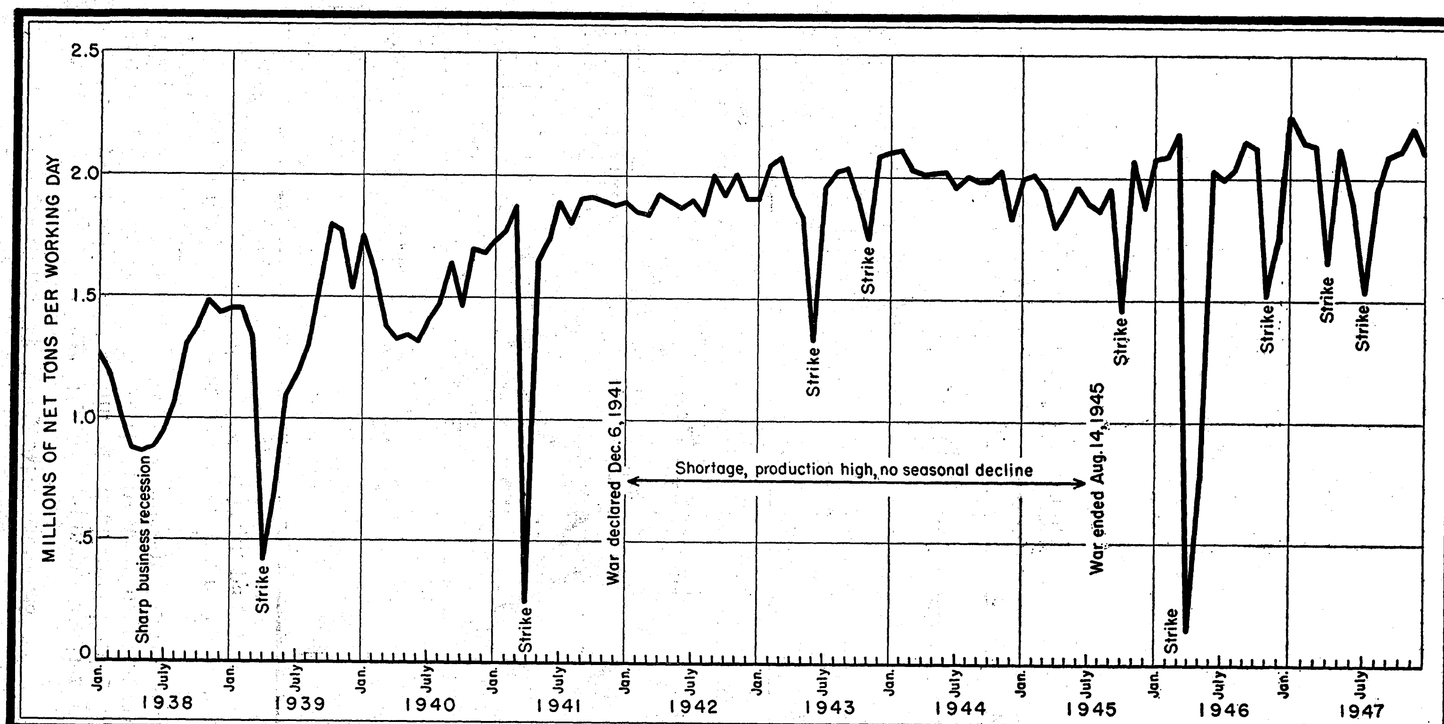

FIGURE 3.—Average production of bituminous coal and lignite in the United States per working day in each month, 1938–47.

PRODUCTION BY WEEKS AND MONTHS

The following tables summarize the preliminary statistics of weekly and monthly production of bituminous coal and lignite in 1947. 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 the method used in counting holidays, see the chapter on Coal in Mineral Resources of the United States, 1930, page 631.

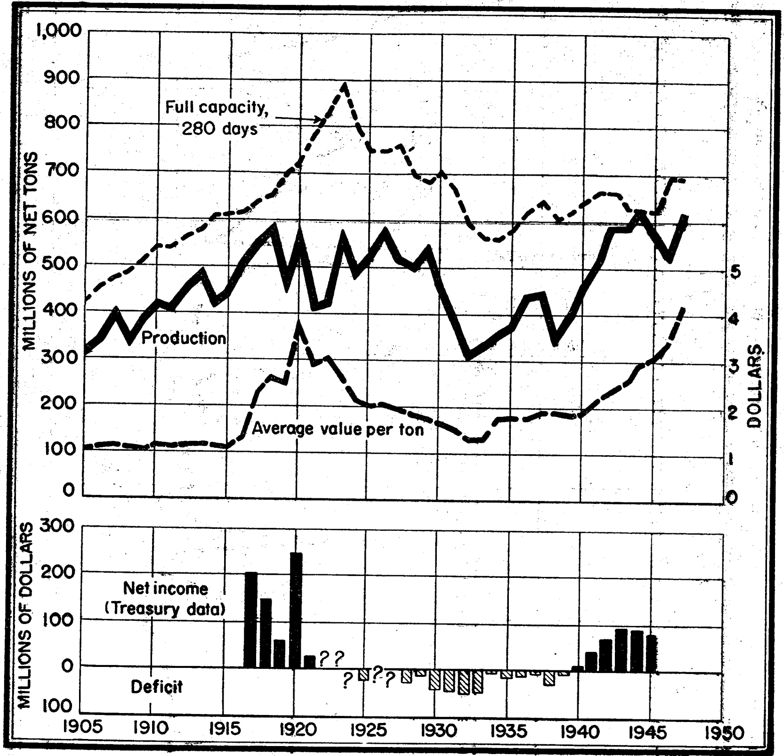

FIGURE 4.—Trends of bituminous-coal and lignite production, realization, mine capacity, and net income or deficit in the United States, 1905–47.

TABLE 2.—Estimated weekly production of bituminous coal and lignite in the United States in 1947

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. 4	[1] 6,800,000	[1] 3.1	[2] 2,255,000	July 5	1,965,000	5	393,000
11	13,785,000	6	2,298,000	12	6,140,000	6	1,023,000
18	13,347,000	6	2,225,000	19	12,156,000	6	2,026,000
25	13,232,000	6	2,205,000	26	11,798,000	6	1,966,000
Feb. 1	13,833,000	6	2,306,000	Aug. 2	11,695,000	6	1,949,000
8	12,557,000	6	2,093,000	9	11,798,000	6	1,966,000
15	12,576,000	6	2,096,000	16	11,731,000	6	1,955,000
22	13,318,000	6	2,220,000	23	11,988,000	6	1,998,000
Mar. 1	12,874,000	6	2,146,000	30	12,015,000	6	2,003,000
8	12,807,000	6	2,135,000	Sept. 6	10,733,000	5	2,147,000
15	13,396,000	6	2,233,000	13	12,604,000	6	2,101,000
22	12,918,000	6	2,153,000	20	12,235,000	6	2,039,000
29	12,182,000	6	2,030,000	27	12,296,000	6	2,049,000
Apr. 5	3,998,000	5	800,000	Oct. 4	12,254,000	6	2,042,000
12	7,172,000	6	1,195,000	11	12,839,000	6	2,140,000
19	12,828,000	6	2,138,000	18	12,737,000	6	2,123,000
26	12,825,000	6	2,138,000	25	12,726,000	6	2,121,000
May 3	12,516,000	6	2,086,000	Nov. 1	12,937,000	6	2,156,000
10	13,060,000	6	2,177,000	8	12,894,000	6	2,149,000
17	12,856,000	6	2,143,000	15	12,685,000	5.8	2,187,000
24	12,770,000	6	2,128,000	22	13,383,000	6	2,231,000
31	11,996,000	5.5	2,181,000	29	12,048,000	5	2,410,000
June 7	13,334,000	6	2,220,000	Dec. 6	13,120,000	6	2,187,000
14	12,595,000	6	2,099,000	13	13,408,000	6	2,235,000
21	12,840,000	6	2,140,000	20	13,020,000	6	2,170,000
28	8,130,000	6	1,355,000	27	8,400,000	5	1,680,000
				Jan. 3, 1948	[1] 6,850,000	[1] 3	[2] 2,192,000
				Total	619,000,000	306.4	2,020,000

[1] Figures represent output and number of working days in that part of the week included in calendar year shown. Total production for the week ended Jan. 4, 1947, was 11,502,000 net tons; week ended Jan. 3, 1948, 11,470,000 net tons.

[2] Average daily output for the entire week and not for working days in calendar year shown.

TABLE 3.—Estimated monthly production of bituminous coal and lignite, by States, in thousands of net tons, in 1947

[Figures are based principally upon the records of railroad carloadings and river shipments of coal and beehive coke, supplemented by direct reports from certain local sources. Allowance is made for commercial truck shipments, local sales, and colliery fuel, and for trucking mines producing over 1,000 tons a year]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama	1,687	1,596	1,678	1,200	1,815	1,371	982	1,556	1,552	1,825	1,604	1,706	18,572
Alaska	32	21	31	26	22	17	19	23	30	40	41	47	349
Arkansas	197	150	127	61	89	165	104	168	175	198	194	178	1,806
Colorado	814	672	632	334	357	406	218	385	510	581	607	750	6,266
Georgia and North Carolina	3	1	2	3	1	1	1	1	1	2	2	2	20
Illinois	6,757	5,938	6,406	4,253	5,764	4,496	4,132	5,195	5,597	5,854	5,508	5,850	65,750
Indiana	2,550	2,354	2,550	1,610	2,290	1,614	1,615	1,993	2,165	2,260	2,174	2,140	25,315
Iowa	185	177	176	132	138	84	132	103	134	145	178	206	1,790
Kansas	262	247	244	164	204	203	150	217	217	256	243	273	2,680
Kentucky:													
Eastern	5,538	4,574	5,095	3,440	5,526	4,442	3,494	4,900	5,257	5,770	5,150	5,214	58,400
Western	1,838	1,550	2,040	1,622	1,744	1,635	1,542	1,568	1,612	1,735	1,804	2,060	20,750
Maryland	234	205	178	131	167	164	132	170	155	140	152	150	1,978
Michigan	3	2	1	1	1	1	1	1	1	2	2	2	18
Missouri	392	370	365	246	306	305	225	326	326	385	364	410	4,020
Montana (bituminous and lignite)	420	298	286	196	242	150	182	255	274	318	309	330	3,260
New Mexico	154	135	136	96	126	113	80	105	117	118	113	133	1,426
North and South Dakota (lignite)	307	255	233	160	138	136	144	128	230	368	346	350	2,795
Ohio	3,355	2,915	3,338	2,911	3,478	3,107	2,606	3,073	3,225	3,668	3,343	3,656	38,675
Oklahoma	313	240	260	216	216	197	234	265	263	293	285	316	3,098
Pennsylvania (bituminous)	13,718	12,508	12,740	9,715	13,295	11,675	10,130	12,174	12,277	13,658	11,871	12,119	145,880
Tennessee	662	570	606	394	600	500	347	537	528	598	586	662	6,590
Texas (bituminous and lignite)	6	6	7	6	4	4	3	4	4	5	5	6	60
Utah	776	770	753	514	653	581	408	523	532	524	581	715	7,330
Virginia	1,797	1,466	1,628	1,160	1,778	1,528	1,167	1,728	1,722	1,963	1,715	1,754	19,406
Washington	118	110	112	82	75	90	52	80	86	112	104	117	1,138
West Virginia	16,005	13,611	15,111	12,069	16,876	13,842	11,446	14,882	14,751	15,697	14,627	14,823	173,740
Wyoming	894	738	717	482	557	596	335	518	638	783	778	827	7,863
Other Western States	3	3	3	1	2	1	1	1	2	3	3	2	25
Total, 1947	59,020	51,482	55,455	41,225	56,464	47,424	39,882	50,879	52,381	57,301	52,689	54,798	619,000
Days and average production:													
Number of working days	26.1	24.0	26.0	25.0	26.5	25.0	26.0	26.0	25.0	27.0	23.8	26.0	306.4
Average production per working day	2,261	2,145	2,133	1,649	2,131	1,897	1,534	1,957	2,095	2,122	2,214	2,108	2,020

AVERAGE VALUE

TABLE 4.—Average value per ton, f. o. b. mines, of bituminous coal and lignite in the United States, by States, 1946–47 [1]

State	1946			1947 (preliminary)
	Strip mines	Underground mines	Total all mines	
Alabama	$4.85	$4.81	$4.81	$5.46
Alaska	4.67	6.96	6.42	(2)
Arizona		3.79	3.79	(2)
Arkansas	4.56	6.48	5.82	(2)
Colorado	3.78	4.05	4.04	(2)
Georgia	4.70	4.70	4.70	(2)
Illinois	2.47	2.65	2.61	3.14
Indiana	2.55	2.69	2.61	3.17
Iowa	3.20	3.85	3.68	(2)
Kansas	2.66	4.13	2.78	(2)
Kentucky	2.54	3.52	3.41	4.32
Maryland	3.66	4.32	4.14	(2)
Michigan		6.45	6.45	(2)
Missouri	2.64	4.12	2.79	(2)
Montana (bituminous and lignite)	1.00	3.23	1.76	(2)
New Mexico		4.14	4.14	(2)
North and South Dakota (lignite)	1.60	2.11	1.69	(2)
Ohio	2.63	3.28	2.99	3.48
Oklahoma	3.27	4.57	3.75	(2)
Oregon		4.40	4.40	(2)
Pennsylvania	3.25	3.80	3.66	4.24
Tennessee	3.95	3.83	3.84	(2)
Texas (lignite)	.83		.83	(2)
Utah		3.58	3.58	3.94
Virginia	3.47	3.85	3.84	4.75
Washington	5.09	5.51	5.47	(2)
West Virginia	3.28	3.70	3.65	4.50
Wyoming	2.29	3.11	3.00	3.43
Total	2.87	3.59	3.44	4.14

[1] Average gross realization, selling cost not deducted.
[2] Included in total.

CONSUMPTION

TABLE 5.—Consumption of bituminous coal and lignite, by consumer class, with retail deliveries in the United States, 1938–47, in thousands of net tons

Year	Colliery fuel	Electric power utilities [1]	Bunker, foreign trade [2]	Railroads [3] (class I)	Coke plants		Steel and rolling mills	Cement mills [4]	Other industrials [5]	Retail dealer deliveries [5]	Total of classes shown
					Beehive	Oven					
1938	2,493	38,245	1,352	73,921	1,360	45,266	8,412	4,483	94,034	68,520	338,086
1939	2,565	43,979	1,477	79,072	2,298	61,216	9,808	5,274	100,514	71,570	377,773
1940	2,443	50,973	1,426	85,130	4,803	76,583	10,040	5,633	108,026	87,700	432,757
1941	2,489	61,861	1,643	97,384	10,529	82,609	10,902	6,832	122,379	97,460	494,088
1942	2,708	65,636	1,585	115,410	12,876	87,974	10,434	7,570	133,271	104,750	542,214
1943	2,702	76,403	1,647	130,283	12,441	90,019	11,238	5,851	142,816	122,764	596,164
1944	2,712	78,887	1,559	132,049	10,858	94,438	10,734	3,789	131,898	124,906	591,830
1945	2,442	71,603	1,785	125,120	8,135	87,214	10,084	4,215	127,164	121,805	559,567
1946	1,951	68,743	1,381	110,166	7,167	76,121	8,603	7,009	118,659	100,586	500,386
1947 [6]	2,489	86,003	1,689	109,296	10,142	94,522	10,048	7,872	124,459	99,163	545,683

[1] 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] Bureau of Census, U. S. Department of Commerce.
[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 1946 consumption for all uses by class I line-haul railways, plus purchases for class II and class III railways, plus purchases by all switching terminal companies combined was 113,000,421 tons of bituminous coal and lignite.
[4] Includes small amount of anthracite.
[5] Estimates based upon reports collected from a selected list of representative manufacturing plants and retail dealers.
[6] Subject to revision.

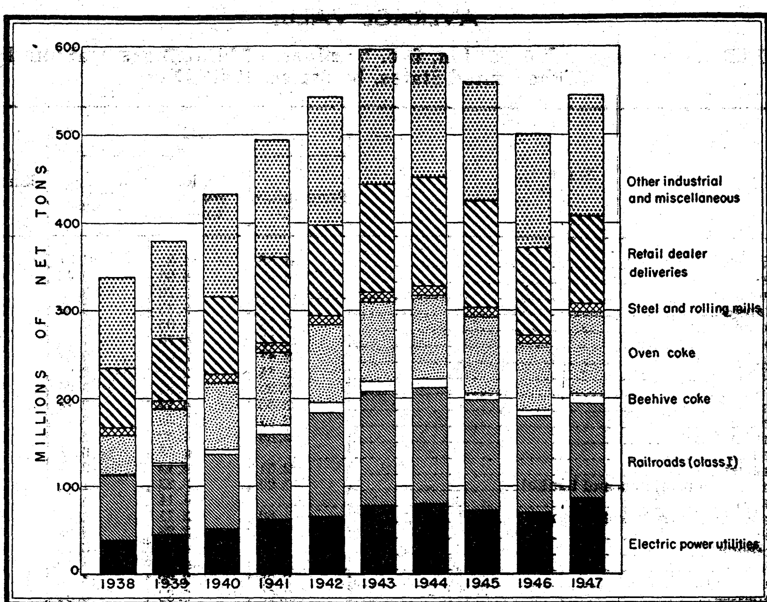

FIGURE 5.—Consumption of bituminous coal and lignite, by consumer class, with retail deliveries in the United States, 1938–47.

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	
1946	116	31.8
1947	114	32.9
Pounds per passenger-train car-mile:		
Average:		
1919–20	18.5	
1946	15.3	17.3
1947	15.9	14.1
Electric public-utility power plants:		
Pounds per kilowatt-hour:		
1919	3.20	
1946	1.29	59.7
1947	1.29	59.7
Iron and steel plants:		
Pounds coking coal per net ton of pig: [1]		
1918	3,194	
1946	2,706	15.3
1947	(2)	
Coke manufacture: Savings of heat values through recovery of gas, tar, light oils, and breeze by extension of oven coke in place of beehive, 1913–14, expressed as percent of coal used for all coke in 1947 [3]		18.5

[1] Includes only savings through higher yields of merchantable coke per ton of coal charged and lower consumption of coke per ton of iron and ferro-alloys. Excludes economies through recovery of coal-chemical materials which are covered in next item.

[2] Not available.

[3] These coal-chemical materials are used in part for boiler fuel, in part for metallurgical purposes, in part for domestic heating and cooking, and to a small extent for automotive fuel.

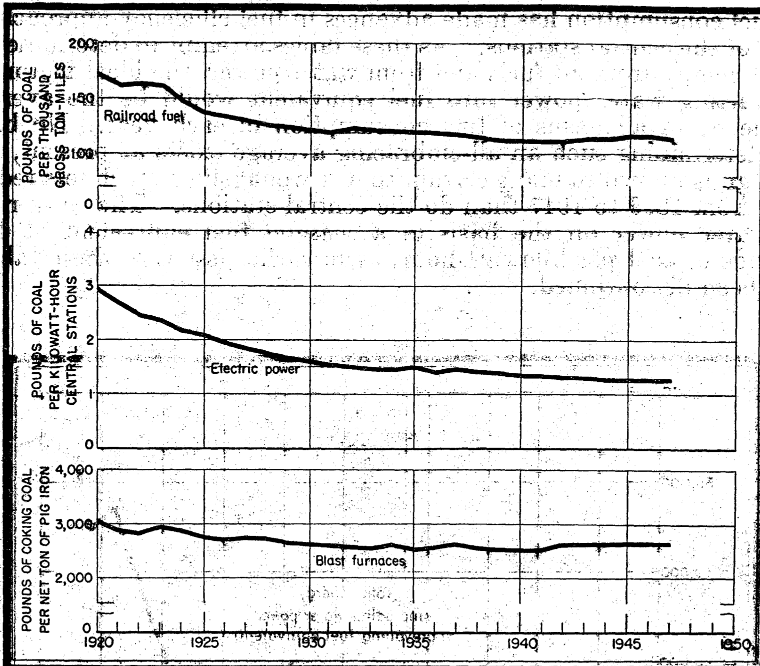

FIGURE 6.—Trends in fuel efficiency in the United States, 1920–47.

RELATIVE RATE OF GROWTH OF COAL, OIL, AND WATER POWER, 1889–1947

The total supply of available energy in the form of coal, oil, natural gas, and water power in 1947 was 35,635 trillion B. t. u.—a 10.3-percent increase over 1946.

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 1938. Details for 1889 and 1899 to 1938 are given in Minerals Yearbook, 1937, page 807, and Minerals Yearbook, 1940, page 789.

In converting water power to its equivalent of fuel required to perform the same work, the *prevailing* or average performance of all fuel-burning central electric stations for each year in question has been used. This average has declined from about 7.05 pounds of coal per kilowatt-hour in 1899 to 1.2 in 1947, which shows the influence of improving fuel efficiency. The *prevailing* fuel equivalent closely approximates 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 use of the water power generated often displaces 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. 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 1947 than do the central stations. The conversion of water power on the basis of a *constant* fuel equivalent of 4.02 pounds of coal per kilowatt-hour, as in earlier issues of these tables, has been discontinued.

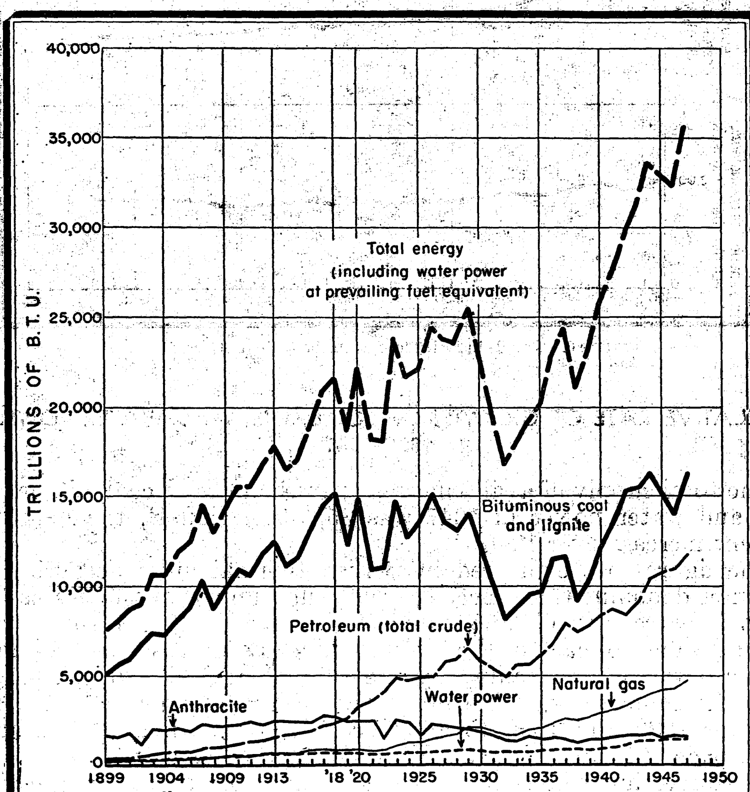

FIGURE 7.—Annual supply of energy from mineral fuels and water power in the United States, 1899–1947.

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.

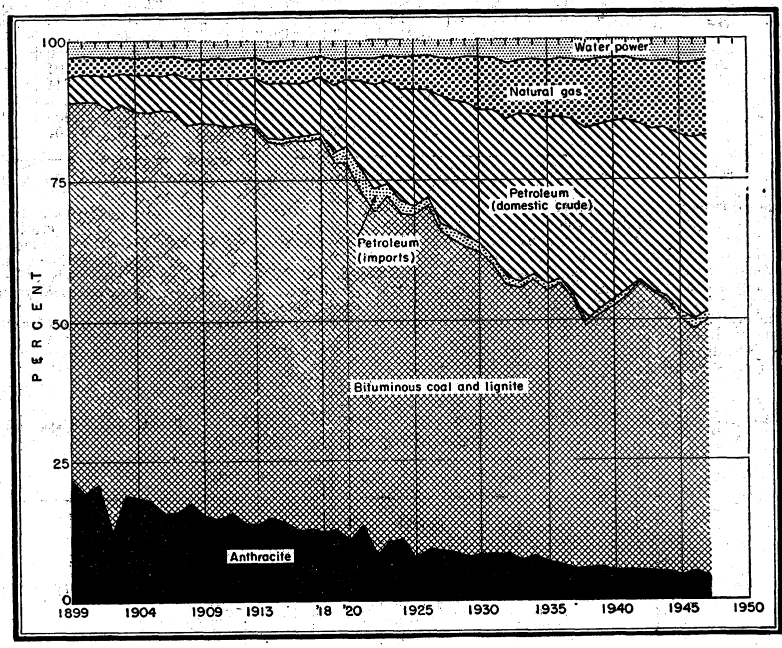

FIGURE 8.—Percentage of total British thermal units equivalent contributed by the several sources of energy in the United States, counting water power at the prevailing fuel equivalent of central stations in each year, 1899–1947.

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 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, 1938–47,[1] in trillions of B. t. u.[2]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (total crude, including that refined): Domestic production	Petroleum: Imports	Natural gas, (total production)	Total petroleum and natural gas	Total mineral fuels	Water power[3]	Grand total energy
1938	1,255	9,132	10,387	7,286	158	2,468	9,912	20,299	866	21,165
1939	1,400	10,345	11,745	7,590	199	2,663	10,452	22,197	838	23,035
1940	1,400	12,072	13,472	8,119	256	2,860	11,235	24,707	880	25,587
1941	1,533	13,471	15,004	8,413	304	3,024	11,741	26,745	934	27,679
1942	1,641	15,267	16,908	8,320	74	3,282	11,676	28,584	1,136	29,720
1943	1,650	15,463	17,113	9,034	83	3,671	12,788	29,901	1,304	31,205
1944	1,733	16,233	17,966	10,067	269	3,989	14,325	32,291	[4] 1,344	[4] 33,635
1945	1,494	15,134	16,628	10,282	444	4,213	14,939	31,567	1,442	33,009
1946 [5]	1,646	13,989	15,635	10,404	535	4,333	15,272	30,907	1,406	32,313
1947 [5]	1,550	16,218	17,768	11,137	596	4,730	16,463	34,231	1,404	35,635

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 807, and Minerals Yearbook, 1940, p. 789.
[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 and of 40 percent for public utilities.
[3] Fuel equivalent calculated by assuming the average central-station practice for each of the years for which data are available.
[4] Revised figure.
[5] Subject to revision.

TABLE 8.—Index numbers for relative rate of growth of coal, oil, and water power in the United States, 1938–47[1]

[Figures are expressed as percentage of 1918 rate]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (total crude): Domestic production	Petroleum: Imports	Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power[2]	Grand total
1938	47	60	58	341	70	318	316	97	124	98
1939	52	68	66	355	88	344	333	106	120	106
1940	52	80	75	380	113	369	358	118	126	118
1941	57	89	84	394	135	390	374	127	133	128
1942	61	101	95	390	33	423	372	136	162	137
1943	61	102	96	423	37	474	408	142	186	144
1944	64	107	101	471	119	515	457	154	[3] 192	155
1945	56	100	93	481	196	544	476	150	206	152
1946 [4]	61	92	88	487	237	559	487	147	201	149
1947 [4]	58	107	99	521	264	610	525	163	200	164

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 809, and Minerals Yearbook, 1940, p. 789.
[2] At prevailing central station equivalent.
[3] Revised.
[4] Subject to revision.

TABLE 9.—Percentage of total British thermal unit equivalent contributed by the several mineral fuels and water power in the United States, 1938–47 [1]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (total crude) Domestic production	Petroleum (total crude) Imports	Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power (fuel equivalent)	Grand total, including water power
1938	5.9	43.2	49.1	34.4	0.7	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	48.3	[2] 53.4	29.9	.8	11.9	42.6	[2] 96.0	[2] 4.0	100.0
1945	4.5	45.9	50.4	31.1	1.3	12.8	45.2	95.6	4.4	100.0
1946 [3]	5.1	43.3	48.4	32.2	1.7	13.4	47.3	95.7	4.3	100.0
1947 [3]	4.4	45.5	49.9	31.2	1.7	13.3	46.2	96.1	3.9	100.0

[1] Percentages based upon figures in table 7. Comparable data for earlier years in Minerals Yearbook, 1937, p. 810, and Minerals Yearbook, 1940, p. 790.
[2] Revised figure.
[3] Subject to revision.

STOCKS HELD BY CONSUMERS

TABLE 10.—Stocks of bituminous coal and lignite in hands of commercial consumers and in retail dealers' yards in the United States, 1946–47

Date	Total stocks (net tons)	Days' supply at current rate of consumption on date of stock taking: Coke ovens	Steel plants	Other industrials	Electric utilities	Retail yards	Railroads	Cement mills	Total
1946									
Jan. 1	45,665,000	20	20	32	78	8	25	43	27
Feb. 1	46,528,000	33	35	32	78	5	27	39	28
Mar. 1	51,158,000	48	29	37	84	6	32	39	31
Apr. 1	58,531,000	36	38	48	95	12	39	42	42
May 1	38,741,000	22	24	44	70	18	27	24	36
June 1	31,643,000	22	26	41	67	15	24	21	34
July 1	37,777,000	17	32	43	68	17	27	25	33
Aug. 1	43,611,000	16	30	54	68	15	27	29	34
Sept. 1	47,900,000	21	34	57	68	14	28	35	36
Oct. 1	52,367,000	23	35	58	70	12	30	41	37
Nov. 1	54,924,000	26	32	55	72	11	30	47	36
Dec. 1	52,429,000	27	33	52	68	9	26	46	35
Dec. 31	47,157,000	24	28	45	60	10	23	41	32
1947									
Jan. 1	47,157,000	24	28	45	60	10	23	41	32
Feb. 1	49,688,000	23	30	45	57	8	24	41	29
Mar. 1	47,867,000	26	31	39	57	5	23	41	27
Apr. 1	49,033,000	29	38	42	63	6	25	44	31
May 1	42,419,000	21	37	33	62	10	25	42	30
June 1	50,218,000	25	45	51	73	15	28	59	38
July 1	49,778,000	28	50	39	77	16	30	52	37
Aug. 1	45,366,000	19	47	47	71	19	26	46	36
Sept. 1	47,157,000	21	48	55	65	12	24	41	37
Oct. 1	48,370,000	24	44	44	64	9	22	41	33
Nov. 1	50,276,000	27	40	39	64	9	22	46	32
Dec. 1	50,455,000	30	34	44	65	8	20	45	33
Dec. 31	52,161,000	34	32	52	62	6	22	46	33

FINAL BITUMINOUS-COAL AND LIGNITE STATISTICS FOR 1946

Tables 11 to 52 give the final detailed statistics of bituminous-coal- and lignite-mine operations in 1946. The subjects covered include production, number and size of mines, employment, value, mechanization, exports, and world production.

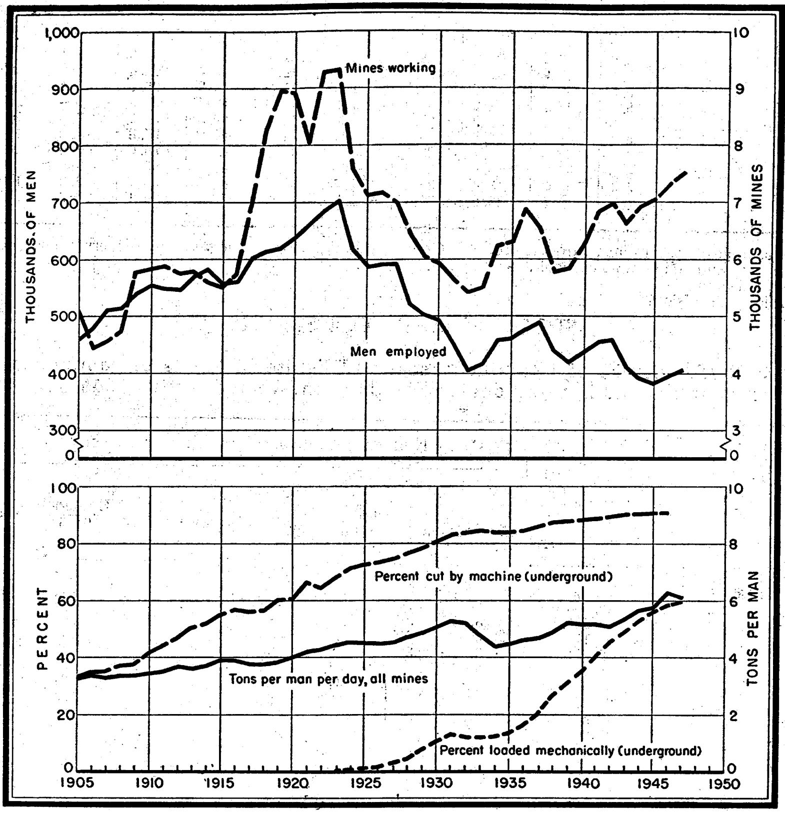

FIGURE 9.—Trends of employment, mechanization, and output per man at bituminous-coal and lignite mines in the United States, 1905–47.

SALIENT TRENDS

TABLE 11.—Salient trends in bituminous-coal and lignite-mining industry in the United States, 1939–46

	1939	1940	1941	1942	1943	1944	1945	1946
Production:								
Loaded at mine for shipment by rail ____net tons__	331, 189, 620	380, 387, 674	425, 184, 319	482, 814, 042	495, 863, 581	527, 135, 489	490, 471, 988	475, 257, 057
Loaded at mine for shipment by water ____do____	22, 229, 364	29, 493, 058	30, 240, 489	34, 018, 025	30, 188, 093	31, 518, 334	27, 547, 679	
Shipped by truck or wagon ____do____	29, 533, 824	35, 540, 476	40, 055, 638	45, 154, 432	42, 432, 667	40, 123, 023	41, 477, 428	42, 730, 884
Taken by locomotive tenders at tipple ____do____	826, 556	939, 058	1, 099, 582	920, 213	779, 154	807, 679	694, 555	731, 748
Shipped by conveyor or tram to point of consumption net tons__	4, 317, 465	5, 887, 994	6, 067, 697	7, 121, 116	7, 476, 717	7, 206, 392	6, 416, 327	5, 700, 870
Used by mine employees ____do____	1, 901, 408	2, 035, 201	1, 872, 026	2, 180, 077	2, 549, 775	2, 545, 343	2, 660, 039	2, 464, 300
Used at mines for power and heat ____do____	2, 565, 276	2, 442, 989	2, 488, 950	2, 708, 312	2, 701, 828	2, 713, 073	2, 442, 398	1, 950, 645
Made into beehive coke at mines ____do____	2, 089, 475	4, 045, 050	7, 140, 544	7, 776, 720	8, 185, 254	7, 526, 907	5, 906, 913	5, 086, 564
Total production ____do____	[1] 394, 855, 325	460, 771, 500	514, 149, 245	582, 692, 937	590, 177, 069	619, 576, 240	577, 617, 327	533, 922, 068
Number of active mines of commercial size:								
Class 1 (200,000 tons or more) ____number__	577	636	730	811	855	828	753	706
Class 2 (100,000 to 200,000 tons) ____do____	404	432	437	484	464	559	591	560
Class 3 (50,000 to 100,000 tons) ____do____	387	371	402	445	481	540	629	637
Class 4 (10,000 to 50,000 tons) ____do____	1, 065	1, 157	1, 305	1, 492	1, 544	1, 776	1, 920	2, 016
Class 5 (1,000 to 10,000 tons) ____do____	3, 387	3, 728	3, 948	3, 740	3, 276	3, 225	3, 140	3, 414
Total number over 1,000 tons ____do____	5, 820	6, 324	6, 822	6, 972	6, 620	6, 928	7, 033	7, 333
Average number of men employed at mines active:								
Underground ____men__	353, 476	365, 013	376, 765	374, 654	326, 763	301, 461	290, 001	[2] 296, 030
Surface:								
In strip pits ____do____	8, 791	8, 983	10, 861	12, 893	16, 643	21, 035	23, 261	[2] 25, 408
All others ____do____	59, 521	65, 079	69, 355	74, 444	72, 601	70, 851	69, 838	[2] 74, 996
Total ____do____	421, 788	439, 075	456, 981	461, 991	416, 007	393, 347	383, 100	[2] 396, 434
Average number of days mines operated ____days__	178	202	216	246	264	278	261	214
Capacity of active mines with existing labor force:								
Per year of 308 days ____net tons__	683, 000, 000	703, 000, 000	733, 000, 000	730, 000, 000	689, 000, 000	686, 000, 000	682, 000, 000	768, 000, 000
Per year of 280 days ____do____	621, 000, 000	639, 000, 000	666, 000, 000	663, 000, 000	626, 000, 000	624, 000, 000	620, 000, 000	699, 000, 000
Per year of 261 days ____do____	579, 000, 000	595, 000, 000	621, 000, 000	618, 000, 000	583, 000, 000	582, 000, 000	578, 000, 000	651, 000, 000
Output per man per day ____do____	5. 25	5. 19	5. 20	5. 12	5. 38	5. 67	5. 78	6. 30
Output per man per year ____do____	936	1, 049	1, 125	1, 261	1, 419	1, 575	1, 508	1, 347
Underground output cut by machine ____do____	313, 969, 394	369, 227, 277	408, 510, 296	462, 344, 719	461, 051, 743	469, 458, 349	424, 726, 432	382, 133, 540
Percent of underground output cut by machine ____	87. 9	88. 4	89. 0	89. 7	90. 3	90. 5	90. 8	90. 8
Underground output mechanically loaded ____net tons__	110, 711, 970	147, 870, 252	186, 667, 250	232, 902, 920	249, 805, 214	274, 189, 132	262, 512, 729	245, 340, 768
Percent of underground output mechanically loaded ____	31. 0	35. 4	40. 7	45. 2	48. 9	52. 9	56. 1	58. 4
Quantity mined by stripping ____net tons__	37, 722, 583	43, 167, 336	55, 071, 609	67, 202, 663	79, 685, 175	100, 898, 376	109, 986, 865	112, 963, 717
Percent mined by stripping ____	9. 6	9. 4	10. 7	11. 5	13. 5	16. 3	19. 0	21. 1
Quantity cleaned by wet and pneumatic processes [3] ____net tons__	79, 429, 426	102, 269, 753	117, 539, 522	142, 187, 346	145, 575, 849	158, 727, 129	147, 885, 936	138, 669, 837
Percent cleaned by wet and pneumatic processes [3] ____	20. 1	22. 2	22. 9	24. 4	24. 7	25. 6	25. 6	26. 0

[1] Includes 202,337 tons of coal reported as net changes in stocks at mines, Jan. 1, 1939, to Jan. 1, 1940.
[2] Average number of men working daily.
[3] Includes central washeries operated by consumers.

TABLE 12.—Coal produced in the United States, by States, 1936–46, with production of maximum year and cumulative production from earliest record to end of 1946, in thousands of net tons

State	Maximum production		Production by years											Total production from earliest record to end of 1946
	Year	Quantity	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	
Alabama	1926	21,001	12,229	12,440	11,062	12,047	15,324	15,464	19,301	17,160	18,752	18,236	16,183	771,495
Arkansas	1907	2,670	1,623	1,511	1,197	1,152	1,454	1,574	1,985	1,718	1,972	1,854	1,631	86,881
Colorado	1917	12,483	6,812	7,187	5,663	5,923	6,589	6,949	8,086	8,324	8,168	7,621	5,914	454,496
Georgia	1903	416	(1)	(1)	(1)	(1)	(1)	(1)	31	14	24	43	114	(1)
Illinois	1918	89,291	50,927	51,602	41,912	46,783	50,610	54,703	65,071	72,631	76,792	73,011	63,469	2,950,873
Indiana	1918	30,679	17,822	17,765	14,759	16,943	18,869	22,484	25,388	25,065	27,962	25,183	21,697	919,440
Iowa	1917	8,966	3,961	3,637	3,103	2,948	3,231	2,939	2,948	2,771	2,141	2,046	1,788	332,654
Kansas	1918	7,562	2,944	2,893	2,654	2,675	3,579	4,008	4,230	3,437	3,369	3,228	2,493	258,737
Kentucky	1944	71,356	47,522	47,086	38,545	42,557	49,141	53,710	62,231	63,211	71,356	69,593	66,553	1,726,866
Maryland	1907	5,533	1,704	1,549	1,281	1,443	1,503	1,701	2,001	1,933	1,870	1,763	2,003	255,445
Michigan	1907	2,036	626	562	494	457	410	311	231	169	140	126	80	46,334
Missouri	1917	5,671	3,985	4,091	3,436	3,273	3,097	3,145	3,520	4,310	4,779	3,983	3,733	245,562
Montana (bituminous and lignite)	1944	4,844	2,988	2,965	2,732	2,804	2,867	3,254	3,829	4,833	4,844	4,467	3,723	148,421
New Mexico	1918	4,023	1,597	1,715	1,239	1,230	1,111	1,251	1,669	1,851	1,744	1,484	1,280	117,629
North Carolina	1922	79	------	------	------	------	------	------	------	------	------	------	------	(1)
North Dakota (lignite)	1946	2,555	2,215	2,251	2,050	2,072	2,218	2,309	2,537	2,500	2,366	2,522	2,555	58,952
Ohio	1920	45,878	24,110	25,178	18,591	20,289	22,772	29,319	32,764	32,255	33,877	32,737	32,314	1,590,465
Oklahoma	1920	4,849	1,540	1,600	1,245	1,188	1,646	1,771	2,387	2,838	3,209	2,909	2,647	148,870
Pennsylvania (bituminous)	1918	178,551	109,887	111,002	77,705	92,584	116,603	130,240	144,073	141,050	146,052	132,965	125,497	6,994,955
Tennessee	1942	8,158	5,108	5,213	4,472	5,185	6,008	7,045	8,158	7,179	7,266	6,271	5,618	307,399
Texas (bituminous and lignite)	1913	2,429	843	910	879	826	621	353	304	153	[2] 109	[2] 80	[2] 56	60,744
Utah	1944	7,119	3,247	3,810	2,947	3,285	3,576	4,077	5,517	6,666	7,119	6,679	5,994	177,464
Virginia	1943	20,280	11,662	13,795	12,283	13,531	15,348	18,441	20,136	20,280	19,514	17,235	15,527	501,369
Washington	1918	4,082	1,812	2,002	1,567	1,690	1,650	1,841	1,953	1,528	1,524	1,357	991	139,212
West Virginia	1944	164,704	117,926	118,646	93,288	108,362	126,438	140,250	155,882	158,804	164,704	152,035	144,020	4,494,114
Wyoming	1945	9,847	5,781	5,918	5,204	5,373	5,808	6,646	8,133	9,155	9,540	9,847	7,635	342,997
Other States	------	------	217	203	237	235	299	364	328	342	383	342	407	64,621
Total bituminous and lignite	1944	619,576	439,088	445,531	348,545	394,855	460,772	514,149	582,693	590,177	619,576	577,617	533,922	23,195,995
Pennsylvania anthracite	1917	99,612	54,580	51,856	46,099	51,487	51,485	56,368	60,328	60,644	63,701	54,934	60,507	4,741,911
Grand total	------	------	493,668	497,387	394,644	446,342	512,257	570,517	643,021	650,821	683,277	632,551	594,429	27,937,906

[1] Included with "Other States."
[2] Lignite only.

TABLE 18.—Growth of bituminous-coal and lignite-mining industry in the United States, 1890–1946

Year	Production (net tons)	Value: Total [1]	Value: Average per ton [1]	Men employed	Number of mines	Average number of days worked	Capacity at 280 days (millions of tons)
1890	111,302,322	$110,420,801	$0.99	192,204	(2)	226	137
1891	117,901,238	117,188,400	.99	205,803	(2)	223	148
1892	126,856,567	125,124,381	.99	212,893	(2)	219	162
1893	128,385,231	122,751,618	.96	230,365	(2)	204	174
1894	118,820,405	107,653,501	.91	244,603	(2)	171	196
1895	135,118,193	115,779,771	.86	239,962	2,555	194	196
1896	137,640,276	114,891,515	.83	244,171	2,599	192	202
1897	147,617,519	119,595,224	.81	247,817	2,454	196	213
1898	166,593,623	132,608,713	.80	255,717	2,862	211	221
1899	193,323,187	167,952,104	.87	271,027	3,245	234	230
1900	212,316,112	220,930,313	1.04	304,375	(2)	234	255
1901	225,828,149	236,422,049	1.05	340,235	(2)	225	281
1902	260,216,844	290,858,483	1.12	370,056	(2)	230	316
1903	282,749,348	351,687,933	1.24	415,777	(2)	225	350
1904	278,659,689	305,397,001	1.10	437,832	4,650	202	386
1905	315,062,785	334,658,294	1.06	460,629	5,060	211	417
1906	342,874,867	381,162,115	1.11	478,425	4,430	213	451
1907	394,759,112	451,214,842	1.14	513,258	4,550	234	473
1908	332,573,944	374,135,268	1.12	516,264	4,730	193	482
1909	379,744,257	405,486,777	1.07	543,152	5,775	209	510
1910	417,111,142	469,281,719	1.12	555,533	5,818	217	538
1911	405,907,059	451,375,819	1.11	549,775	5,887	211	538
1912	450,104,982	517,983,445	1.15	548,632	5,747	223	566
1913	478,435,297	565,234,952	1.18	571,882	5,776	232	577
1914	422,703,970	493,309,244	1.17	583,506	5,592	195	608
1915	442,624,426	502,037,688	1.13	557,456	5,502	203	610
1916	502,519,682	665,116,077	1.32	561,102	5,726	230	613
1917	551,790,563	1,249,272,837	2.26	603,143	6,939	243	636
1918	579,385,820	1,491,809,940	2.58	615,305	8,319	249	650
1919	465,860,058	1,160,616,013	2.49	621,998	8,994	195	669
1920	568,666,683	2,129,933,000	3.75	639,547	8,921	220	725
1921	415,921,950	1,199,983,600	2.89	663,754	8,038	149	781
1922	422,268,099	1,274,820,000	3.02	687,958	9,299	142	832
1923	564,564,662	1,514,621,000	2.68	704,793	9,331	179	885
1924	483,686,538	1,062,626,000	2.20	619,604	7,586	171	792
1925	520,052,741	1,060,402,000	2.04	588,493	7,144	195	748
1926	573,366,985	1,183,412,000	2.06	593,647	7,177	215	747
1927	517,763,352	1,029,657,000	1.99	593,918	7,011	191	759
1928	500,744,970	933,774,000	1.86	522,150	6,450	203	691
1929	534,988,593	952,781,000	1.78	502,993	6,057	219	679
1930	467,526,299	795,483,000	1.70	493,202	5,891	187	700
1931	382,089,396	588,895,000	1.54	450,213	5,642	160	669
1932	309,709,872	406,677,000	1.31	406,380	5,427	146	594
1933	333,630,533	445,788,000	1.34	418,703	5,555	167	559
1934	359,368,022	628,383,000	1.75	458,011	6,258	178	565
1935	372,373,122	658,063,000	1.77	462,403	6,315	179	582
1936	439,087,903	770,955,000	1.76	477,204	6,875	199	618
1937	445,531,449	864,042,000	1.94	491,864	6,548	193	646
1938	348,544,764	678,653,000	1.95	441,333	5,777	162	602
1939	394,855,325	728,348,366	1.84	421,788	5,820	178	621
1940	460,771,500	879,327,227	1.91	439,075	6,324	202	639
1941	514,149,245	1,125,362,836	2.19	456,981	6,822	216	666
1942	582,692,937	1,373,990,608	2.36	461,991	6,972	246	663
1943	590,177,069	1,584,644,477	2.69	416,007	6,620	264	626
1944	619,576,240	1,810,900,542	2.92	393,347	6,928	278	624
1945	577,617,327	1,768,204,320	3.06	383,100	7,033	261	620
1946	533,922,068	1,835,539,476	3.44	[3] 396,434	7,333	214	699

[1] Figures on value and value per ton for 1890–1936, inclusive, and 1939 exclude selling expense. Figures for other years include selling expense.
[2] Data not available.
[3] Average number of men working daily.

TABLE 13.—Growth of bituminous-coal and lignite-mining industry in the United States, 1890–1946—Continued

Year	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[4]	Mechanically loaded	Mechanically cleaned[5]	Mined by stripping
1890	(2)	(2)	2.56	579	(2)	(2)	(2)	(2)
1891	(2)	(2)	2.57	573	5.3	(2)	(2)	(2)
1892	(2)	(2)	2.72	596	(2)	(2)	(2)	(2)
1893	(2)	(2)	2.73	557	(2)	(2)	(2)	(2)
1894	(2)	(2)	2.84	486	(2)	(2)	(2)	(2)
1895	(2)	(2)	2.90	563	(2)	(2)	(2)	(2)
1896	(2)	(2)	2.94	564	11.9	(2)	(2)	(2)
1897	(2)	(2)	3.04	596	15.3	(2)	(2)	(2)
1898	(2)	(2)	3.09	651	19.5	(2)	(2)	(2)
1899	8	46	3.05	713	22.7	(2)	(2)	(2)
1900	5	43	2.98	697	24.9	(2)	(2)	(2)
1901	2	35	2.94	664	25.6	(2)	(2)	(2)
1902	7	44	3.06	703	26.8	(2)	(2)	(2)
1903	3	28	3.02	680	27.6	(2)	(2)	(2)
1904	8	44	3.15	637	28.2	(2)	(2)	(2)
1905	2	23	3.24	684	32.8	(2)	(2)	(2)
1906	28	63	3.36	717	34.7	(2)	2.7	(2)
1907	1	14	3.29	769	35.1	(2)	2.9	(2)
1908	11	38	3.34	644	37.0	(2)	3.6	(2)
1909	1	29	3.34	699	37.5	(2)	3.8	(2)
1910	35	89	3.46	751	41.7	(2)	3.8	(2)
1911	2	27	3.50	738	43.9	(2)	(2)	(2)
1912	10	35	3.68	820	46.8	(2)	3.9	(2)
1913	4	36	3.61	837	50.7	(2)	4.6	(2)
1914	19	80	3.71	724	51.8	(2)	4.8	0.3
1915	4	61	3.91	794	55.3	(2)	4.7	.6
1916	4	26	3.90	896	56.9	(2)	4.6	.8
1917	4	17	3.77	915	56.1	(2)	4.6	1.0
1918	1	7	3.78	942	56.7	(2)	3.8	1.4
1919	25	37	3.84	749	60.0	(2)	3.6	1.2
1920	6	22	4.00	881	60.7	(2)	3.3	1.5
1921	3	23	4.20	627	66.4	(2)	3.4	1.2
1922	78	117	4.28	609	64.8	(2)	(2)	2.4
1923	2	20	4.47	801	68.3	0.3	3.8	2.1
1924	7	73	4.56	781	71.5	.7	(2)	2.8
1925	2	30	4.52	884	72.9	1.2	(2)	3.2
1926	1	24	4.50	966	73.8	1.8	(2)	3.0
1927	45	153	4.55	872	74.9	3.3	5.3	3.6
1928	8	83	4.73	959	76.9	4.5	5.7	4.0
1929	(6)	11	4.85	1,064	78.4	7.4	6.9	3.8
1930	2	43	5.06	948	81.0	10.5	8.3	4.3
1931	3	35	5.30	849	83.2	13.1	9.5	5.0
1932	19	120	5.22	762	84.1	12.3	9.8	6.3
1933	9	30	4.78	797	84.7	12.0	10.4	5.5
1934	3	15	4.40	785	84.1	12.2	11.1	5.8
1935	(2)	(2)	4.50	805	84.2	13.5	12.2	6.4
1936	2	21	4.62	920	84.8	16.3	13.9	6.4
1937	(2)	(2)	4.69	906	(2)	20.2	14.6	7.1
1938	1	13	4.89	790	87.5	26.7	18.2	8.7
1939	25	36	5.25	936	87.9	31.0	20.1	9.6
1940	1	8	5.19	1,049	88.4	35.4	22.2	9.4
1941	20	27	5.20	1,125	89.0	40.7	22.9	10.7
1942	1	7	5.12	1,261	89.7	45.2	24.4	11.5
1943	(2)	(2)	5.38	1,419	90.3	48.9	24.7	13.5
1944	(2)	(2)	5.67	1,575	90.5	52.9	25.6	16.3
1945	(2)	(2)	5.78	1,508	90.8	56.1	25.6	19.0
1946	(2)	(2)	6.30	1,347	90.8	58.4	26.0	21.1

[2] Data not available.
[4] Percentages for 1890 to 1913, inclusive, are of total production, as a separation of strip-mine and underground production is not available for those years.
[5] For 1906 to 1926, inclusive, these percentages are exclusive of coal cleaned at central washeries operated by consumers; after 1926, when data became available on the tonnage cleaned by consumer-operated plants, the percentages include the total tons cleaned at the mines and at consumer-operated washeries.
[6] One-half day or less.

SUMMARY BY STATES AND DISTRICTS

TABLE 14.—Number of mines, production, value, employment, days active, man-days, and output per day at bituminous-coal and lignite mines in the United States, by States, in 1946

[Exclusive of mines producing less than 1,000 tons]

State	Number of active mines	Disposition of coal produced (net tons)								Average value per ton[2]	Average number of men working daily				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	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[1]	Total quantity		Underground	Surface: In strip pits	Surface: All others	Total			
Alabama	397	13,210,938	992,205	1,424,349	57,856	360,320	75,479	62,151	16,183,298	$4.81	15,812	904	3,416	20,132	213	4,289,350	3.77
Alaska	5	308,195	----------	51,614	716	----------	----------	6,284	366,809	6.42	184	20	76	280	282	79,022	4.64
Arizona	2	----------	----------	6,379	----------	----------	35	----------	6,414	3.79	16	----------	2	18	156	2,804	2.29
Arkansas	61	1,426,382	104,066	95,070	10	----------	3,218	2,728	1,631,474	5.82	1,505	321	418	2,244	180	404,179	4.04
Colorado	171	4,077,677	280,100	1,272,907	8,613	47,024	36,175	[1] 191,012	5,913,508	4.04	4,823	54	1,374	6,251	183	1,142,001	5.18
Georgia	3	109,978	----------	3,000	----------	----------	380	405	113,763	4.70	57	40	26	123	253	31,167	3.65
Illinois	299	54,466,129	1,716,287	6,202,157	3,061	119,430	291,839	669,682	63,468,585	2.61	22,395	1,878	8,197	32,470	217	7,032,257	9.03
Indiana	118	18,841,418	568,957	1,734,654	----------	429,549	33,632	88,737	21,696,947	2.61	5,029	1,976	2,585	9,590	207	1,980,545	10.96
Iowa	118	724,352	189,855	857,978	----------	----------	12,657	3,291	1,788,133	3.68	1,695	202	370	2,267	173	393,254	4.55
Kansas	54	2,222,482	34,241	177,657	1,730	44,812	6,175	6,288	2,493,385	2.78	518	507	435	1,460	209	305,433	8.16
Kentucky	1,637	51,657,212	7,885,938	6,368,801	54,576	75,198	320,954	[1] 190,298	66,552,977	3.41	46,186	1,314	9,394	56,894	212	12,048,667	5.52
Maryland	103	1,194,584	394,329	404,049	762	100	5,998	2,723	2,002,545	4.14	1,400	338	416	2,154	184	396,881	5.05
Michigan	3	29,539	----------	42,168	----------	----------	1,728	6,555	79,990	6.45	128	----------	22	150	184	27,596	2.90
Missouri	78	2,929,342	17,579	777,774	----------	----------	6,103	2,017	3,732,815	2.79	870	527	504	1,901	204	387,131	9.64
Montana:																	
Bituminous	29	3,552,780	24,884	90,936	----------	----------	8,298	6,015	3,682,913	1.75	686	98	369	1,153	205	236,797	15.55
Lignite	8	----------	----------	40,013	----------	----------	----------	----------	40,013	2.63	27	4	8	39	175	6,837	5.85
Total, Montana	37	3,552,780	24,884	130,949	----------	----------	8,298	6,015	3,722,926	1.76	713	102	377	1,192	204	243,634	15.28

See footnotes at end of table.

TABLE 14.—Number of mines, production, value, employment, days active, man-days, and output per day at bituminous-coal and lignite mines in the United States, by States, in 1946—Continued

[Exclusive of mines producing less than 1,000 tons]

State	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	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 mine [1]	Total quantity	Average value per ton [2]	Average number of men working daily: 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
New Mexico	26	1,123,197	18,472	97,301			8,532	32,777	1,280,279	$4.14	993		276	1,269	218	276,495	4.63
North Dakota (lignite)	47	2,097,317		373,631	18		67,963	15,753	2,554,682	1.68	156	255	263	674	241	162,388	15.73
Ohio	567	25,326,829	1,286,207	5,507,937	421	112,623	53,479	26,766	32,314,262	2.99	12,263	2,924	4,331	19,518	207	4,038,075	8.00
Oklahoma	67	2,339,040	147,585	146,690			3,324	10,741	2,647,380	3.75	1,049	428	463	1,940	209	405,268	6.53
Oregon	2		7,900	9,218			35		17,153	4.40	72		13	85	249	21,164	.81
Pennsylvania	1,994	87,812,344	17,398,447	12,010,662	209,490	2,753,995	536,565	[1] 4,775,353	125,496,856	3.66	74,459	9,324	16,693	100,476	207	20,836,340	6.02
South Dakota (lignite)	3		1,680	15,266					16,946	2.15		14		14	169	2,364	7.17
Tennessee	113	4,829,983	430,144	244,014	36,193		60,365	17,653	5,618,352	3.84	5,603	75	1,056	6,734	197	1,323,950	4.24
Texas (lignite)	1	55,604			374				55,978	.83		10	15	25	248	6,200	9.03
Utah	48	5,629,156	64,092	254,381			16,882	[1] 29,502	5,994,013	3.58	2,726		988	3,714	230	853,503	7.02
Virginia	156	14,069,273	687,918	362,231			114,393	[1] 293,080	15,526,895	3.84	11,569	245	2,392	14,206	228	3,243,708	4.79
Washington	46	605,280	52,945	299,508	9,804		10,609	12,981	991,127	5.47	926	69	378	1,373	211	289,418	3.42
West Virginia	1,126	125,211,886	11,746,946	3,713,902	348,124	1,757,819	755,638	[1] 485,777	144,020,092	3.65	81,608	3,693	19,450	104,751	225	23,524,248	6.12
Wyoming	51	7,336,297	19,066	146,637			33,844	98,640	7,634,484	3.00	3,275	188	1,066	4,529	215	972,644	7.85
Grand total	7,333	431,187,214	44,069,843	42,730,884	731,748	5,700,870	2,464,300	7,037,209	533,922,068	3.44	296,030	25,408	74,996	396,434	214	84,719,686	6.30

[1] Includes coal made into beehive coke at mines in following States in 1946: Colorado, 105,297 tons; Kentucky, 133,500; Pennsylvania, 4,345,361; Utah, 12,075; Virginia, 271,243; and West Virginia, 219,088—a grand total of 5,086,564 tons.

[2] 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.)

PRODUCTION BY WEEKS AND MONTHS

TABLE 15.—Bituminous-coal and lignite production (final figures) in the United States in 1946, with estimates by weeks

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. 5	[1] 8,574,000	[1] 4.1	[2] 2,018,000	July 6	6,692,000	5	1,338,000
Jan. 12	11,707,000	6	1,951,000	July 13	12,918,000	6	2,153,000
Jan. 19	12,970,000	6	2,162,000	July 20	12,636,000	6	2,106,000
Jan. 26	12,675,000	6	2,113,000	July 27	12,654,000	6	2,109,000
Feb. 2	12,783,000	6	2,131,000	Aug. 3	12,362,000	6	2,060,000
Feb. 9	12,642,000	6	2,107,000	Aug. 10	12,360,000	6	2,060,000
Feb. 16	12,196,000	6	2,033,000	Aug. 17	12,053,000	6	2,009,000
Feb. 23	12,700,000	6	2,117,000	Aug. 24	12,207,000	6	2,035,000
Mar. 2	12,774,000	6	2,129,000	Aug. 31	12,567,000	6	2,095,000
Mar. 9	13,093,000	6	2,182,000	Sept. 7	11,388,000	5.1	2,233,000
Mar. 16	13,260,000	6	2,210,000	Sept. 14	12,936,000	6	2,156,000
Mar. 23	13,353,000	6	2,226,000	Sept. 21	12,676,000	6	2,113,000
Mar. 30	13,336,000	6	2,223,000	Sept. 28	12,929,000	6	2,155,000
Apr. 6	935,000	5	187,000	Oct. 5	12,587,000	6	2,098,000
Apr. 13	726,000	6	121,000	Oct. 12	12,558,000	6	2,093,000
Apr. 20	786,000	6	131,000	Oct. 19	12,834,000	6	2,139,000
Apr. 27	837,000	6	140,000	Oct. 26	12,796,000	6	2,133,000
May 4	551,000	6	92,000	Nov. 2	12,699,000	6	2,117,000
May 11	470,000	6	78,000	Nov. 9	12,770,000	6	2,128,000
May 18	9,015,000	6	1,503,000	Nov. 16	12,675,000	5.7	2,224,000
May 25	7,702,000	6	1,284,000	Nov. 23	6,539,000	6	1,090,000
June 1	3,607,000	5	721,000	Nov. 30	2,045,000	5	409,000
June 8	12,795,000	6	2,133,000	Dec. 7	2,303,000	6	384,000
June 15	12,402,000	6	2,067,000	Dec. 14	13,662,000	6	2,277,000
June 22	11,910,000	6	1,985,000	Dec. 21	13,667,000	6	2,278,000
June 29	12,365,000	6	2,061,000	Dec. 28	9,543,000	5	1,909,000
				Jan. 4, 1947	[1] 4,702,000	[1] 2	[2] 2,255,000
				Total	533,922,000	305.9	1,745,000

[1] Figures represent output and number of working days in that part of week included in the calendar year shown. Total production for the week ended Jan. 5, 1946, was 10,291,000 net tons; week ended Jan. 4, 1947, 11,502,000 net tons.
[2] Average daily production for entire week and not for working days in calendar year shown.

TABLE 16.—Bituminous-coal and lignite production (final figures) in the United States in 1946, with estimates by months

Month	1946			Month	1946		
	Production (net tons)	Number of working days	Average production per working day (net tons)		Production (net tons)	Number of working days	Average production per working day (net tons)
January	54,602,000	26.1	2,092,000	August	54,901,000	27	2,033,000
February	50,424,000	24	2,101,000	September	52,154,000	24.1	2,164,000
March	57,037,000	26	2,194,000	October	57,669,000	27	2,136,000
April	3,543,000	25	142,000	November	37,609,000	24.7	1,523,000
May	19,803,000	26	762,000	December	43,877,000	25	1,755,000
June	50,755,000	25	2,030,000				
July	51,548,000	26	1,983,000	Total	533,922,000	305.9	1,745,000

TABLE 17.—Coal production in the United States, in 1946, 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 twelve 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	1,518	1,402	1,918	133	593	1,697	1,695	1,700	1,566	1,726	1,050	1,185	16,183
Alaska	28	27	27	28	25	23	26	30	38	44	38	33	367
Arkansas	180	154	165	49	51	114	143	160	150	180	133	152	1,631
Colorado	782	662	690	20	243	382	352	450	560	695	465	613	5,914
Georgia	10	7	10	3	3	13	10	12	13	13	10	10	114
Illinois	6,807	6,278	6,970	1,225	2,580	5,893	5,570	6,228	5,935	6,758	4,068	5,157	63,469
Indiana	2,367	2,102	2,377	117	878	1,994	2,088	1,874	2,152	2,508	1,417	1,823	21,697
Iowa	201	186	179	65	106	150	135	153	146	154	147	166	1,788
Kansas	252	240	272	78	138	192	221	238	240	240	180	202	2,493
Kentucky:													
Eastern	4,744	4,750	5,280	200	1,760	4,758	4,990	5,464	4,935	5,506	3,197	3,758	49,342
Western	1,831	1,675	1,882	84	586	1,552	1,700	1,645	1,626	1,724	1,363	1,543	17,211
Total, Kentucky	6,575	6,425	7,162	284	2,346	6,310	6,690	7,109	6,561	7,230	4,560	5,301	66,553
Maryland	205	184	235	8	114	211	216	202	155	182	134	157	2,003
Michigan	8	8	11	2	4	10	10	9	7	5	3	3	80
Missouri	378	359	406	117	208	286	330	358	360	360	270	301	3,733
Montana:													
Bituminous	399	353	330	161	223	284	270	267	332	391	305	368	3,683
Lignite	5	4	4	2	2	3	2	3	4	4	3	4	40
Total, Montana	404	357	334	163	225	287	272	270	336	395	308	372	3,723
New Mexico	136	110	136	6	65	123	113	123	120	135	93	120	1,280
North Dakota (lignite)	300	228	170	108	123	130	127	137	223	335	332	342	2,555
Ohio	3,295	2,892	3,380	266	1,280	3,177	3,108	3,123	2,933	3,694	2,386	2,780	32,314
Oklahoma	285	245	264	119	122	185	232	257	213	262	213	250	2,647
Pennsylvania (bituminous)	12,678	11,669	13,556	232	2,477	12,029	12,836	13,573	12,677	14,235	9,178	10,357	125,497
South Dakota (lignite)	2	2	1	1	1	1	1	1	1	2	2	2	17
Tennessee	592	560	657	26	102	582	579	599	531	595	357	438	5,618
Texas (lignite)	7	5	6	3	4	4	4	4	4	4	5	6	56
Utah	630	590	639	14	248	473	548	567	590	628	442	625	5,994
Virginia	1,571	1,511	1,678	30	672	1,624	1,513	1,686	1,469	1,649	982	1,142	15,527
Washington	121	110	118	6	22	94	86	91	85	106	75	77	991
West Virginia	14,309	13,295	14,836	415	6,818	14,335	14,044	15,226	14,358	14,649	10,122	11,613	144,020
Wyoming	958	813	837	24	354	435	598	720	730	883	636	647	7,635
Other States [1]	3	3	3	1	1	1	1	1	1	2	3	3	23
Total bituminous coal and lignite	54,602	50,424	57,037	3,543	19,803	50,755	51,548	54,901	52,154	57,669	37,609	43,877	533,922
Pennsylvania anthracite [2]	4,968	4,774	5,476	5,069	5,453	3,625	5,248	5,428	5,033	5,393	4,975	5,065	60,507
Grand total, 1946	59,570	55,198	62,513	8,612	25,256	54,380	56,796	60,329	57,187	63,062	42,584	48,942	594,429

[1] Includes Arizona and Oregon.

[2] Includes Sullivan County.

NUMBER AND SIZE OF MINES

TABLE 18.—Number and production of bituminous-coal and lignite mines in the United States, classified by size of output in each State, in 1946

[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	5	1.3	3,026,287	605,257	18.7	17	4.3	5,547,657	326,333	34.3	25	6.3	3,365,901	134,636	20.8
Alaska											2	40.0	261,961	130,981	71.4
Arizona															
Arkansas											2	3.3	242,914	121,457	14.9
Colorado						4	2.3	1,085,788	271,447	18.4	15	8.8	1,933,527	128,902	32.7
Georgia															
Illinois	52	17.4	48,139,431	925,758	75.9	20	6.7	7,199,016	359,951	11.3	23	7.7	3,445,451	149,802	5.4
Indiana	19	16.1	14,466,229	761,380	66.7	11	9.3	3,952,468	359,315	18.2	12	10.2	1,568,247	130,687	7.2
Iowa											2	1.7	374,195	187,098	20.9
Kansas	1	1.9	507,603	507,603	20.4	3	5.6	971,390	323,797	39.0	4	7.4	621,237	155,309	24.9
Kentucky	20	1.2	14,551,006	727,550	21.9	64	3.9	20,030,386	312,975	30.1	100	6.1	14,525,666	145,257	21.8
Maryland						1	1.0	214,130	214,130	10.7	3	2.9	426,911	142,304	21.3
Michigan															
Missouri	1	1.3	947,196	947,196	25.4	5	6.4	1,770,834	354,167	47.4	2	2.5	255,963	127,982	6.8
Montana (bituminous)	1	3.5	2,452,753	2,452,753	66.6	3	10.3	851,692	283,897	23.1	1	3.5	104,713	104,713	2.9
Montana, North Dakota, South Dakota, and Texas (lignite)	1	1.7	500,131	500,131	18.7	5	8.5	1,667,473	333,495	62.5					
New Mexico						3	11.5	894,616	298,205	69.9	1	3.9	115,564	115,564	9.0
Ohio	17	3.0	13,798,901	811,700	42.7	20	3.5	5,806,859	290,343	18.0	37	6.5	5,270,512	142,446	16.3
Oklahoma						3	4.5	809,618	269,873	30.6	7	10.4	1,000,206	142,887	37.8
Oregon															
Pennsylvania	56	2.8	47,599,163	849,985	37.9	85	4.3	25,916,010	304,894	20.7	122	6.1	16,955,703	138,981	13.5
Tennessee						8	7.1	2,050,381	256,298	36.5	11	9.7	1,544,760	140,433	27.5
Utah	3	6.3	2,484,461	828,154	41.5	7	14.6	2,313,789	330,541	38.6	5	10.4	731,537	146,307	12.2
Virginia	7	4.5	5,588,485	798,355	36.0	16	10.3	5,123,242	320,203	33.0	13	8.3	1,940,328	149,256	12.5
Washington											3	6.5	336,939	112,313	34.0
West Virginia	60	5.3	45,558,891	759,315	31.6	177	15.7	56,265,141	317,882	39.1	164	14.6	23,090,002	140,793	16.0
Wyoming	6	11.8	4,381,699	730,283	57.4	5	9.8	1,673,574	334,715	21.9	6	11.8	876,598	146,100	11.5
Total, 1946	249	3.4	204,002,236	819,286	38.2	457	6.2	144,144,064	315,414	27.0	560	7.6	78,988,835	141,051	14.8

TABLE 18.—Number and production of bituminous-coal and lignite mines in the United States, classified by size of output in each State, in 1946—Continued

[Exclusive of mines producing less than 1,000 tons]

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	22	5.5	1,648,960	74,953	10.2	74	18.6	1,768,583	23,900	10.9	254	64.0	825,910	3,252	5.1	397	16,183,298	40,764
Alaska	1	20.0	51,614	51,614	14.1	2	40.0	53,234	26,617	14.5	-	-	-	-	-	5	366,809	73,362
Arizona	-	-	-	-	-	-	-	-	-	-	2	100.0	6,414	3,207	100.0	2	6,414	3,207
Arkansas	12	19.7	774,529	64,544	47.5	20	32.8	529,946	26,497	32.5	27	44.2	84,085	3,114	5.1	61	1,631,474	26,745
Colorado	21	12.3	1,523,230	72,535	25.8	46	26.9	1,091,204	23,722	18.4	85	49.7	279,759	3,291	4.7	171	5,913,508	34,582
Georgia	1	33.4	88,965	88,965	78.2	1	33.3	21,798	21,798	19.2	1	33.3	3,000	3,000	2.6	3	113,763	37,921
Illinois	26	8.7	1,852,775	71,261	2.9	94	31.4	2,452,392	26,089	3.9	84	28.1	379,520	4,518	.6	299	63,468,585	212,270
Indiana	12	10.2	841,600	70,133	3.9	28	23.7	727,197	25,971	3.4	36	30.5	141,206	3,922	.6	118	21,696,947	183,872
Iowa	4	3.4	296,325	74,081	16.6	40	33.9	791,179	19,779	44.2	72	61.0	326,434	4,534	18.3	118	1,788,133	15,154
Kansas	1	1.8	58,163	58,163	2.3	10	18.5	202,380	20,238	8.1	35	64.8	132,612	3,789	5.3	54	2,493,385	46,174
Kentucky	79	4.8	5,761,432	72,930	8.6	374	22.9	7,830,924	20,938	11.8	1,000	61.1	3,853,563	3,854	5.8	1,637	66,552,977	40,655
Maryland	9	8.7	582,009	64,668	29.1	26	25.3	546,246	21,009	27.3	64	62.1	233,249	3,645	11.6	103	2,002,545	19,442
Michigan	1	33.3	51,445	51,445	64.3	2	66.7	28,545	14,273	35.7	-	-	-	-	-	3	79,990	26,663
Missouri	2	2.6	121,685	60,843	3.3	18	23.1	433,380	24,077	11.6	50	64.1	203,757	4,075	5.5	78	3,732,815	47,857
Montana (bituminous)	1	3.4	80,302	80,302	2.2	4	13.8	118,918	29,730	3.2	19	65.5	74,535	3,923	2.0	29	3,682,913	126,997
Montana, North Dakota, South Dakota, and Texas (lignite)	3	5.1	201,645	67,215	7.6	10	16.9	178,292	17,829	6.7	40	67.8	120,078	3,002	4.5	59	2,667,619	45,214
New Mexico	1	3.8	85,772	85,772	6.7	6	23.1	123,077	20,513	9.6	15	57.7	61,250	4,083	4.8	26	1,280,279	49,242
Ohio	36	6.4	2,564,857	71,246	7.9	154	27.2	3,745,634	24,322	11.6	303	53.4	1,127,499	3,721	3.5	567	32,314,262	56,992
Oklahoma	5	7.5	370,394	74,079	14.0	17	25.4	337,759	19,868	12.7	35	52.2	129,403	3,697	4.9	67	2,647,380	39,513
Oregon	-	-	-	-	-	1	50.0	16,089	16,089	93.8	1	50.0	1,064	1,064	6.2	2	17,153	8,577
Pennsylvania	206	10.3	14,789,709	71,795	11.8	696	34.9	16,473,036	23,668	13.1	829	41.6	3,763,235	4,539	3.0	1,994	125,496,856	62,937
Tennessee	15	13.3	1,134,459	75,631	20.2	30	26.5	702,761	23,425	12.5	49	43.4	185,991	3,796	3.3	113	5,618,352	49,720
Utah	1	2.1	74,484	74,484	1.2	15	31.2	330,629	22,042	5.5	17	35.4	59,113	3,477	1.0	48	5,994,013	124,875
Virginia	26	16.7	1,922,275	73,934	12.4	35	22.4	711,199	20,320	4.6	59	37.8	241,366	4,091	1.5	156	15,526,895	99,531
Washington	2	4.4	164,967	82,484	16.6	15	32.6	372,571	24,838	37.6	26	56.5	116,650	4,487	11.8	46	991,127	21,546
West Virginia	144	12.8	10,638,880	73,881	7.4	288	25.6	7,217,368	25,060	5.0	293	26.0	1,249,810	4,266	.9	1,126	144,020,092	127,904
Wyoming	6	11.7	464,984	77,497	6.1	10	19.6	193,678	19,368	2.5	18	35.3	43,951	2,442	.6	51	7,634,484	149,696
Total, 1946	637	8.7	46,145,460	72,442	8.6	2,016	27.5	46,998,019	23,313	8.8	3,414	46.6	13,643,454	3,996	2.6	7,333	533,922,068	72,811

BITUMINOUS COAL AND LIGNITE LOADED FOR SHIPMENT BY INDIVIDUAL RAILROADS AND WATERWAYS

TABLE 19.—Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in net tons, in 1946 [1]

Route	State	Net tons: By State	Net tons: Total for route
RAILROADS			
Alabama Central	Alabama	127,654	127,654
Alabama Great Southern	do	247,298	247,298
Alaska	Alaska	308,195	308,195
Algiers, Winslow & Western	Indiana	2,470,617	2,470,617
Alton	Illinois	865,577	865,577
Artemus-Jellico	Kentucky	393,019	393,019
Atchison, Topeka & Santa Fe	Colorado	229,470	1,997,669
	Illinois	658,250	
	Kansas	326,468	
	New Mexico	783,481	
Baltimore & Ohio	Illinois	210,780	42,220,589
	Indiana	626,014	
	Maryland	91,759	
	Ohio	4,260,261	
	Pennsylvania	11,467,082	
	West Virginia	25,564,693	
Bessemer & Lake Erie	Pennsylvania	3,361,842	3,361,842
Bevier & Southern	Missouri	419,393	419,393
Brimstone	Tennessee	37,778	37,778
Buffalo Creek & Gauley	West Virginia	810,795	810,795
Cambria & Indiana	Pennsylvania	3,344,739	3,344,739
Campbell's Creek	West Virginia	821,121	821,121
Carbon County	Utah	1,015,629	1,015,629
Central of Georgia	Alabama	777,237	887,215
	Georgia	109,978	
Chesapeake & Ohio	Kentucky	12,439,297	60,389,551
	Ohio	1,355,710	
	West Virginia	46,594,544	
Cheswick & Harmar	Pennsylvania	711,062	711,062
Chicago, Burlington & Quincy	Colorado	170,138	11,284,213
	Illinois	9,340,126	
	Iowa	247,179	
	Missouri	29,434	
	Wyoming	1,497,336	
Chicago & Eastern Illinois	Illinois	2,508,925	3,519,395
	Indiana	1,010,470	
Chicago & Illinois Midland	Illinois	5,629,451	5,629,451
Chicago, Indianapolis & Louisville	Indiana	676,015	676,015
Chicago, Milwaukee, St. Paul & Pacific	do	4,989,276	5,921,848
	Iowa	184,177	
	Missouri	1,261	
	Montana (bituminous)	704,366	
	North Dakota (lignite)	41,031	
	Washington	1,737	
Chicago & North Western	Illinois	2,922,136	2,922,136
Chicago, Rock Island & Pacific	Arkansas	44,872	1,108,659
	Illinois	515,980	
	Iowa	150,419	
	Missouri	210,377	
	Oklahoma	187,011	
Cleveland, Cincinnati, Chicago & St. Louis	Illinois	4,789,751	7,327,334
	Indiana	2,537,583	
Clinchfield	Kentucky	80,314	2,654,853
	Virginia	2,574,539	
Colorado & Southeastern	Colorado	87,725	87,725
Colorado & Southern	do	328,067	328,067
Colorado & Wyoming	do	414,331	414,331
Conemaugh & Black Lick	Pennsylvania	50,526	50,526
Cumberland & Pennsylvania	Maryland	572,123	572,123
Dardanelle & Russellville Ry. Co.	Arkansas	25,643	25,643
Denver & Intermountain	Colorado	99,849	99,849
Denver & Rio Grande Western	do	1,300,711	4,247,160
	New Mexico	18,472	
	Utah	2,927,977	
Denver & Salt Lake	Colorado	929,703	929,703
Detroit, Toledo & Ironton	Ohio	16,045	16,045
East Broad Top Railroad & Coal Co.	Pennsylvania	320,955	320,955

See footnote at end of table.

TABLE 19.—Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in net tons, in 1946 [1]—Continued

Route	State	Net tons: By State	Net tons: Total for route
RAILROADS—continued			
Erie	Ohio	88,913	733,688
	Pennsylvania	644,775	
Evansville & Ohio Valley	Indiana	17,433	17,433
Evansville Suburban & Newburgh	do	237,504	237,504
Fort Dodge, Des Moines & Southern	Iowa	51,274	51,274
Fort Smith & Van Buren	Oklahoma	60,595	60,595
Galesburg & Great Eastern	Illinois	656,263	656,263
Great Northern	Montana (bituminous)	108,118	749,822
	North Dakota (lignite)	577,864	
	Washington	63,840	
Gulf, Mobile & Ohio	Alabama	249,193	1,470,063
	Illinois	1,220,870	
Harriman & Northeastern	Tennessee	67,145	67,145
Huntingdon & Broad Top Mountain Railroad & Coal Co.	Pennsylvania	867,254	867,254
Illinois Central	Alabama	180,376	22,063,924
	Illinois	12,585,834	
	Indiana	162,322	
	Kentucky	9,135,392	
Illinois Terminal	Illinois	512,629	512,629
Interstate	Kentucky	187,605	2,497,515
	Virginia	2,309,910	
Iowa Southern Utilities Co	Iowa	43,894	43,894
Johnstown & Stony Creek	Pennsylvania	232,107	232,107
Joplin-Pittsburg	Kansas	323,704	323,704
Kanawha Central	West Virginia	107,079	107,079
Kansas City Southern	Arkansas	138,345	1,107,234
	Missouri	946,451	
	Oklahoma	22,438	
Kansas, Oklahoma & Gulf	do	10,775	10,775
Kelley's Creek & Northwestern	West Virginia	1,087,599	1,087,599
Kentucky & Tennessee	Kentucky	670,304	670,304
Lake Erie, Franklin & Clarion	Pennsylvania	370,250	370,250
Laramie, North Park & Western	Colorado	22,731	22,731
Ligonier Valley	Pennsylvania	116,757	116,757
Litchfield & Madison	Illinois	723,276	723,276
Louisville & Nashville	Alabama	3,351,687	33,945,364
	Illinois	87,210	
	Kentucky	29,521,666	
	Tennessee	822,584	
	Virginia	162,217	
Mary Lee	Alabama	536,032	536,032
Midland Valley	Arkansas	243,361	494,366
	Oklahoma	251,005	
Minneapolis & St. Louis	Illinois	1,919,691	1,972,186
	Iowa	52,495	
Minneapolis, St. Paul & Sault Ste. Marie	North Dakota (lignite)	511,593	511,593
Missouri-Illinois	Illinois	18,349	18,349
Missouri-Kansas-Texas	Kansas	192,135	517,105
	Missouri	236,387	
	Oklahoma	88,583	
Missouri Pacific	Arkansas	863,406	8,413,587
	Illinois	6,286,551	
	Kansas	777,761	
	Missouri	244,730	
	Oklahoma	241,139	
Monongahela	Pennsylvania	3,708,748	12,628,855
	West Virginia	8,920,107	
Montana, Wyoming & Southern	Montana (bituminous)	314,532	314,532
Montour	Pennsylvania	6,089,622	6,089,622
Nashville, Chattanooga & St. Louis	Alabama	2,195	732,913
	Tennessee	730,718	
New Haven and Dunbar	Pennsylvania	8,747	8,747
New York Central (includes coal shipped over Kanawha and Michigan, Kelley's Creek, Toledo, and Ohio Central, and Zanesville & Western).	Ohio	7,033,047	14,129,539
	Pennsylvania	5,366,401	
	West Virginia	1,730,091	
Nicholas, Fayette & Greenbrier	West Virginia	1,617,206	1,617,206
Norfolk & Western	Kentucky	5,684,388	42,940,316
	Virginia	8,778,189	
	West Virginia	28,477,739	
North East Oklahoma	Kansas	3,100	3,100

See footnote at end of table.

TABLE 19.—Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in net tons, in 1946 [1]—Continued

Route	State	Net tons: By State	Net tons: Total for route
RAILROADS—continued			
Northern Pacific	Montana (bituminous)	2,450,648	3,904,207
	North Dakota (lignite)	968,509	
	Washington	485,050	
Oklahoma City-Ada-Atoka	Oklahoma	216,791	216,791
Pacific Coast	Washington	63,793	63,793
Pennsylvania (includes Pittsburgh, Cincinnati, Chicago, and St. Louis).	Illinois	181,693	54,102,947
	Indiana	4,971,845	
	Ohio	7,373,172	
	Pennsylvania	40,881,995	
	West Virginia	694,242	
Peoria Terminal	Illinois	332,726	332,726
Pere Marquette	Michigan	29,539	29,539
Pittsburgh County	Oklahoma	2,914	2,914
Pittsburgh & Lake Erie	Pennsylvania	1,705,053	1,705,053
Pittsburgh & Shawmut	do	2,381,400	2,381,400
Pittsburgh, Shawmut & Northern	do	306,965	306,965
Pittsburgh, Chartiers & Youghiogheny	do	77,066	77,066
Pittsburgh & West Virginia	Ohio	677,287	1,859,858
	Pennsylvania	1,031,191	
	West Virginia	151,380	
Preston	do	93,208	93,208
Rio Grande Southern	Colorado	8,622	8,622
Rockdale, Sandow & Southern	Texas (lignite)	55,604	55,604
St. Louis & O'Fallon	Illinois	373,211	373,211
St. Louis-San Francisco	Alabama	1,780,257	4,457,523
	Arkansas	214,821	
	Kansas	633,555	
	Missouri	423,516	
	Oklahoma	1,405,374	
Seaboard Air Line	Alabama	88,999	88,999
Southern	do	3,008,191	8,988,888
	Illinois	149,762	
	Indiana	1,711,296	
	Kentucky	1,079,251	
	Tennessee	2,274,845	
	Virginia	765,543	
Southern Pacific	New Mexico	339,716	347,616
	Oregon	7,900	
Springfield Terminal	Illinois	717,351	717,351
Tennessee	Tennessee	979,292	979,292
Tennessee Central	do	317,202	317,202
Tennessee Coal, Iron & Railroad Co	Alabama	2,572,987	2,572,987
Thomas & Sayreton	do	365,324	365,324
Union	Pennsylvania	220,501	220,501
Union Pacific	Colorado	766,430	6,676,334
	Utah	8,072	
	Washington	43,805	
	Wyoming	5,858,027	
Unity	Pennsylvania	533,770	533,770
Utah	Utah	1,741,570	1,741,570
Virginian	Virginia	166,793	11,713,425
	West Virginia	11,546,632	
Wabash	Illinois	2,445,324	3,065,465
	Iowa	184,769	
	Missouri	435,372	
West Virginia Northern	West Virginia	832,281	832,281
Western Allegheny	Pennsylvania	448,219	448,219
Western Maryland	Maryland	925,031	6,020,416
	Pennsylvania	335,282	
	West Virginia	4,760,103	
Wheeling and Lake Erie	Ohio	5,729,313	5,729,313
Winifrede	West Virginia	183,562	183,562
Woodward Iron Co	Alabama	859,006	859,006
Youngstown & Suburban	Ohio	2,571	2,571
Total railroad shipments		450,615,524	450,615,524

See footnote at end of table.

TABLE 19.—Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in net tons, in 1946 [1]—Continued

Route	State	Net tons: By State	Net tons: Total for route
WATERWAYS			
Allegheny River	Pennsylvania	880,022	880,022
Black Warrior River	Alabama	56,707	56,707
Emory River	Tennessee	3,142	3,142
Illinois River	Illinois	530,700	530,700
Kanawha River	West Virginia	1,501,335	1,501,335
Monongahela River	Pennsylvania	19,743,932	20,575,402
	West Virginia	831,470	
Ohio River	Kentucky	351,914	1,066,804
	Ohio	76,717	
	Pennsylvania	4,528	
	West Virginia	633,645	
Tennessee River	Tennessee	27,421	27,421
Total waterway shipments		24,641,533	24,641,533
Total loaded at mines for shipment by railroads and waterways.		475,257,057	475,257,057
Shipped by truck or wagon		42,730,884	42,730,884
Taken by locomotive tender at tipple		731,748	731,748
Shipped by conveyor or tram to point of consumption.		5,700,870	5,700,870
Coal used by employees		2,464,300	2,464,300
Used at mine for power and heat		1,950,645	1,950,645
Made into beehive coke at mine		5,086,564	5,086,564
Total production, 1946		533,922,068	533,922,068

[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 one year an operator may report coal loaded on subsidiary railroad and in another year same operator may report coal loaded on parent railroad system.

METHODS OF RECOVERY

TABLE 20.—Bituminous coal and lignite mined by different methods in the United States, by States, in 1946

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 total underground	Net tons	Percent of total underground	Net tons	Percent of total underground		Net tons	Percent of grand total	
Alabama	155,750	1.1	3,234,667	22.5	10,977,735	76.4	14,368,152	1,815,146	11.2	16,183,298
Alaska	----	----	280,173	100.0	----	----	280,173	86,636	23.6	366,809
Arizona	----	----	6,414	100.0	----	----	6,414	----	----	6,414
Arkansas	42,705	4.0	73,020	6.8	952,507	89.2	1,068,232	563,242	34.5	1,631,474
Colorado	774,586	13.5	191,126	3.3	4,792,773	83.2	5,758,485	155,023	2.6	5,913,508
Georgia	----	----	24,798	100.0	----	----	24,798	88,965	78.2	113,763
Illinois	204,764	.4	1,886,365	3.9	46,215,638	95.7	48,306,767	15,161,818	23.9	63,468,585
Indiana	49,667	.5	150,546	1.5	9,670,379	98.0	9,870,592	11,826,355	54.5	21,696,947
Iowa	60,109	5.2	521,434	45.1	575,757	49.7	1,157,300	630,833	35.3	1,788,133
Kansas	49,583	23.5	35,071	16.7	126,010	59.8	210,664	2,282,721	91.6	2,493,385
Kentucky	487,741	.8	8,758,479	14.8	49,952,393	84.4	59,198,613	7,354,364	11.1	66,552,977
Maryland	825,392	57.1	----	----	619,423	42.9	1,444,815	557,730	27.9	2,002,545
Michigan	----	----	----	----	79,990	100.0	79,990	----	----	79,990
Missouri	28,373	7.3	24,007	6.1	339,514	86.6	391,894	3,340,921	89.5	3,732,815
Montana (bituminous)	----	----	10,324	.8	1,219,836	99.2	1,230,160	2,452,753	66.6	3,682,913
Montana (lignite)	----	----	38,934	100.0	----	----	38,934	1,079	2.7	40,013
New Mexico	71,868	5.6	187,070	14.6	1,021,341	79.8	1,280,279	----	----	1,280,279
North Dakota (lignite)	----	----	33,875	7.9	393,231	92.1	427,106	2,127,576	83.3	2,554,682
Ohio	87,104	.5	30,015	.2	17,990,204	99.3	18,107,323	14,206,939	44.0	32,314,262
Oklahoma	3,098	.3	64,276	6.6	907,512	93.1	974,886	1,672,494	63.2	2,647,380
Oregon	1,064	6.2	200	1.2	15,889	92.6	17,153	----	----	17,153
Pennsylvania	8,909,306	9.5	2,582,813	2,8	82,317,930	87.7	93,810,049	31,686,807	25.2	125,496,856
South Dakota (lignite)	----	----	----	----	----	----	----	16,946	100.0	16,946
Tennessee	281,037	5.2	566,001	10.4	4,575,107	84.4	5,422,145	196,207	3.5	5,618,352
Texas (lignite)	----	----	----	----	----	----	----	55,978	100.0	55,978
Utah	6,708	.1	259,242	4.3	5,728,063	95.6	5,994,013	----	----	5,994,013
Virginia	133,592	.9	1,010,925	6.8	13,726,562	92.3	14,871,079	655,816	4.2	15,526,895
Washington	91,084	10,2	387,390	43.3	415,097	46.5	893,571	97,556	9,8	991,127
West Virginia	2,909,768	2.2	3,053,093	2.4	123,120,104	95.4	129,082,965	14,937,127	10.4	144,020,092
Wyoming	104,089	1.6	137,165	2.0	6,400,545	96.4	6,641,799	992,685	13.0	7,634,484
Total, 1946	15,277,388	3.6	23,547,423	5.6	382,133,540	90.8	420,958,351	112,963,717	21.1	533,922,068

TABLE 21.—Number of coal-cutting machines in bituminous-coal and lignite mines, average output per machine, and percentage of total product of underground mines cut by machines in the United States, by States, 1945–46

State	1945					1946				
	Number of coal-cutting machines in use			Average output per machine (net tons)	Percent of total product of underground mines cut by machine	Number of coal-cutting machines in use			Average output per machine (net tons)	Percent of total product of underground mines cut by machine
	Permissible	Other	Total			Permissible	Other	Total		
Alabama	291	350	641	19, 482	76. 4	259	365	624	17, 593	76. 4
Arkansas	26	52	78	13, 532	89. 3	21	55	76	12, 533	89. 2
Colorado	202	313	515	12, 039	81. 9	192	325	517	9, 270	83. 2
Illinois	289	512	801	66, 614	95. 1	272	551	823	56, 157	95. 7
Indiana	95	144	239	47, 866	97. 6	62	154	216	44, 770	98. 0
Iowa	33	46	79	11, 568	59. 9	35	21	56	10, 281	49. 7
Kansas	8	12	20	9, 984	73. 1	8	11	19	6, 632	59. 8
Kentucky	572	1, 178	1, 750	31, 071	86. 4	552	1, 299	1, 851	26, 987	84. 4
Maryland	21	27	48	12, 186	37. 9	19	30	49	12, 641	42. 9
Michigan		18	18	6, 984	100. 0		19	19	4, 210	100. 0
Missouri	28	30	58	6, 888	81. 5	20	40	60	5, 659	86. 6
Montana (bituminous)	7	50	57	32, 631	99. 5	12	45	57	21, 401	99. 2
New Mexico	41	36	77	14, 549	75. 6	52	12	64	15, 958	79. 8
North Dakota (lignite)	13	3	16	38, 971	94. 1	2	5	7	56, 176	92. 1
Ohio	262	523	785	24, 316	99. 1	267	527	794	22, 658	99. 3
Oklahoma	70	58	128	9, 162	91. 6	37	48	85	10, 677	93. 1
Oregon	2		2	8, 150	98. 8	2		2	7, 945	92. 6
Pennsylvania	2, 304	1, 096	3, 400	26, 885	86. 8	2, 386	1, 018	3, 404	24, 183	87. 7
Tennessee	23	221	244	19, 078	76. 8	16	255	271	16, 882	84. 4
Utah	165	59	224	29, 460	98. 8	166	65	231	24, 797	95. 6
Virginia	123	245	368	42, 764	93. 0	95	285	380	36, 123	92. 3
Washington	58		58	9, 894	47. 6	57		57	7, 282	46. 5
West Virginia	1, 187	2, 270	3, 457	38, 184	95. 8	1, 351	2, 266	3, 617	34, 039	95. 4
Wyoming	15	312	327	26, 700	97. 1	25	321	346	18, 499	96. 4
Total	5, 835	7, 555	13, 390	31, 720	90. 8	5, 908	7, 717	13, 625	28, 046	90. 8

TABLE 22.—Stripping operations of all types in the bituminous-coal and lignite fields of the United States, by States and counties, in 1946 [1]

State and county	Number of strip pits	Number of power shovels and dragline excavators				Mined by stripping (net tons)	Average number of men working daily			Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	Diesel	Gasoline		In strip pits	All others	Total			
Alabama:												
Bibb	4	------	------	1	2	111,170	83	17	100	84	8,426	13.19
Blount and Marion	4	4	------	3	------	73,511	69	14	83	221	18,335	4.01
Jefferson	7	1	------	6	5	442,672	210	51	261	194	50,614	8.75
St. Clair	4	------	------	4	2	199,725	135	22	157	153	24,023	8.31
Tuscaloosa	4	------	------	6	------	189,209	60	17	77	221	16,981	11.14
Walker	20	1	2	23	3	798,859	347	118	465	156	72,554	11.01
Total, Alabama	43	6	2	43	12	1,815,146	904	239	1,143	167	190,933	9.51
Alaska	2	------	------	2	------	86,636	20	6	26	291	7,554	11.47
Arkansas:												
Franklin	2	2	------	------	1	19,627	20	5	25	129	3,225	6.09
Johnson	4	------	1	4	1	169,143	49	35	84	207	17,418	9.71
Pope	1	------	------	1	------	44,405	42	10	52	97	5,020	8.85
Scott	2	1	------	4	------	153,345	49	34	83	181	15,011	10.22
Sebastian	11	2	------	11	9	176,722	161	55	216	107	23,198	7.62
Total, Arkansas	20	5	1	20	11	563,242	321	139	460	139	63,872	8.82
Colorado:												
Jackson	2	------	------	------	2	35,564	16	3	19	214	4,073	8.73
Routt	2	------	1	------	1	119,459	38	16	54	181	9,754	12.25
Total, Colorado	4	------	1	------	3	155,023	54	19	73	189	13,827	11.21
Georgia: Walker	1	------	------	2	------	88,965	40	13	53	273	14,472	6.15
Illinois:												
Brown	1	------	------	------	------	1,570	2	------	2	132	264	5.95
Bureau, La Salle, and Schuyler	4	------	3	5	------	297,216	56	64	120	209	25,073	11.85
Fulton	10	------	23	7	3	5,600,965	555	663	1,218	222	270,615	20.70
Grundy	3	------	12	2	4	1,408,256	263	236	499	255	127,300	11.06
Henry	1	------	3	------	------	412,575	47	105	152	256	38,978	10.58
Jackson	1	------	4	------	------	493,527	77	30	107	242	25,893	19.06
Knox	1	------	3	1	------	656,263	52	51	103	253	26,104	25.14
Livingston	1	------	------	------	2	6,189	4	1	5	154	770	8.04
Perry	3	------	10	1	1	2,493,105	246	395	641	234	149,924	16.63

See footnote at end of table.

TABLE 22.—Stripping operations of all types in the bituminous-coal and lignite fields of the United States, by States and counties, in 1946 [1]—Continued

State and county	Number of strip pits	Number of power shovels and dragline excavators				Mined by stripping (net tons)	Average number of men working daily			Average number of days mines were active	Number of man days worked	Average tons per man per day
		Steam	Electric	Diesel	Gasoline		In strip pits	All others	Total			
Illinois—Continued												
Randolph	1		1	1		929,306	57	54	111	245	27,195	34.17
St. Clair	3		4	3	3	1,018,784	99	75	174	272	47,407	21.49
Saline	3		4	7		687,847	155	124	279	234	65,417	10.51
Vermillion	2			1	1	48,306	21	2	23	136	3,137	15.40
Will	2		2	1		213,746	47	29	76	187	14,190	15.06
Williamson	10		5	4	5	894,163	197	109	306	126	38,548	23.20
Total, Illinois	46		74	33	19	15,161,818	1,878	1,938	3,816	226	860,815	17.61
Indiana:												
Clay	14	2	10	20	11	1,864,143	418	278	696	196	136,137	13.69
Daviess and Fountain	2			1	3	97,656	27	10	37	223	8,237	11.86
Greene	4	1	2	2	3	617,266	70	57	127	176	22,387	27.57
Knox	1		2	2		685,522	74	75	149	248	36,910	18.57
Owen	2			1	3	14,731	9	2	11	134	1,469	10.03
Pike	8	1	14	6	6	3,436,060	478	403	881	224	197,609	17.40
Spencer	3			3	3	208,551	54	33	87	180	15,702	13.28
Sullivan	4		11	4		1,525,375	250	244	494	210	103,773	14.70
Vermillion	2		3	1	1	198,773	89	72	161	121	19,427	10.23
Vigo	5		2	2	4	558,382	106	48	154	173	26,671	20.94
Warrick	5		9	8	1	2,617,296	401	273	674	236	158,772	16.48
Total, Indiana	50	4	53	50	35	11,826,355	1,976	1,495	3,471	209	727,154	16.26
Iowa:												
Davis	1			2	1	4,730	10	2	12	204	2,442	1.94
Mahaska	10	2	1	8	9	236,295	93	49	142	219	31,156	7.58
Marion	8			4	9	291,623	70	32	102	209	21,340	13.67
Van Buren and Wapello	4			3	6	98,185	29	14	43	217	9,339	10.51
Total, Iowa	23	2	1	17	25	630,833	202	97	299	215	64,277	9.81
Kansas:												
Bourbon	4	1	2		1	162,838	45	30	75	174	13,080	12.45
Cherokee	10	2	6	2	5	877,219	147	149	296	221	65,323	13.43
Crawford	10	7	12		5	1,230,366	290	148	438	207	90,503	13.59
Labette, Linn, and Osage	6				1	12,298	25	9	34	124	4,228	2.91
Total, Kansas	30	10	20	2	12	2,282,721	507	336	843	205	173,134	13.18

Kentucky:												
Boyd	5			9	1	404, 306	76	25	101	259	26, 198	15. 43
Butler and Daviess	3				2	13, 020	14	3	17	134	2, 290	7. 90
Clay	2			4		51, 750	53	11	64	163	10, 445	4. 95
Elliott, Pulaski, Rockcastle, and Whitley	6	2			1	29, 928	39	8	47	108	5, 094	5. 88
Hancock	2			2	2	36, 246	25	10	35	98	3, 240	11. 19
Hopkins	17	1	11	20	20	4, 588, 543	616	345	961	236	226, 632	20. 25
Laurel	4			5		159, 126	54	12	66	200	13, 228	12. 03
Letcher	3			4		37, 967	32	7	39	80	3, 129	12. 13
Muhlenberg	5	2	1	11	4	816, 350	170	60	230	197	47, 105	17. 33
Ohio	3			6	3	346, 093	67	54	121	161	19, 458	17. 79
Perry and Pike	4		1	13		761, 114	122	33	155	231	35, 851	21. 23
Webster	2			1	3	104, 921	46	12	58	181	5, 836	17. 98
Total, Kentucky	56	5	13	75	36	7, 354, 364	1, 314	589	1, 903	209	398, 502	18. 46
Maryland:												
Allegany	15			9	10	351, 196	256	79	335	112	37, 508	9. 36
Garrett	8	1		6	5	206, 534	82	32	114	170	19, 422	10. 63
Total, Maryland	23	1		15	15	557, 730	338	111	449	127	56, 930	9. 80
Missouri:												
Barton	4		4		2	166, 857	48	28	71	178	12, 626	13. 22
Bates	2	2	4	1		1, 006, 322	99	100	199	253	50, 279	19. 96
Boone	1			2		45, 586	12	2	14	268	3, 748	12. 16
Callaway and Johnson	3			4	2	209, 860	53	39	92	304	27, 927	7. 51
Dade	3				1	8, 102	8	3	11	270	2, 970	2. 73
Henry	4		7	1	1	677, 091	92	47	139	254	35, 263	19. 20
Jasper	1	1				3, 426	4	1	5	205	1, 025	3. 34
Macon	1		2	1	1	464, 207	86	59	145	241	34, 888	13. 31
Monroe	2				1	6, 152	10	1	11	259	2, 854	2. 16
Randolph	2		2			430, 421	33	53	86	281	24, 155	17. 82
Vernon	6	1	5	2	1	325, 897	82	35	117	229	26, 762	12. 18
Total, Missouri	29	4	24	11	9	3, 340, 921	527	363	890	250	222, 497	15. 02
Montana:												
McCone (lignite)	1				1	1, 079	4		4	64	256	4. 21
Rosebud (bituminous)	1		7	1		2, 452, 753	98	51	149	298	44, 411	55. 23
Total, Montana	2		7	1	1	2, 453, 832	102	51	153	292	44, 667	54. 94
North Dakota: Lignite	28	4	14	7	20	2, 127, 576	255	210	465	232	107, 668	19. 76
Ohio:												
Athens	7	1		13	2	388, 486	96	70	166	150	24, 892	15. 61
Belmont	14			21	11	1, 217, 073	220	117	337	199	67, 095	18. 14
Carroll	3			10	1	297, 175	54	18	72	296	21, 330	13. 93
Columbiana	15			20	6	558, 972	135	49	184	229	42, 131	13. 27
Coshocton	8	1		5	7	133, 315	61	28	89	142	12, 621	10. 56

See footnote at end of table

TABLE 22.—Stripping operations of all types in the bituminous-coal and lignite fields of the United States, by States and counties, in 1946 [1]—Continued

State and county	Number of strip pits	Number of power shovels and dragline excavators				Mined by stripping (net tons)	Average number of men working daily			Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	Diesel	Gasoline		In strip pits	All others	Total			
Ohio—Continued												
Guernsey, Portage, and Wayne	5	----	----	11	----	277,233	87	24	111	166	18,395	15.07
Harrison	14	----	13	31	4	4,641,609	648	513	1,161	236	274,255	16.92
Hocking	7	----	----	11	6	367,648	94	35	129	195	25,217	14.58
Holmes	1	----	----	2	2	105,957	14	20	34	276	9,384	11.29
Jackson	10	----	----	4	7	65,576	38	10	48	161	7,728	8.49
Jefferson	24	2	3	33	12	2,511,293	420	204	624	202	126,103	19.91
Mahoning	4	1	----	3	1	143,516	43	10	53	202	10,714	13.40
Meigs	2	----	----	----	2	26,807	14	4	18	99	1,774	15.11
Morgan	3	----	----	----	6	41,122	33	17	50	67	3,348	12.28
Muskingum	7	1	2	4	4	792,395	122	26	148	200	29,575	26.79
Noble	4	----	----	5	3	287,675	48	17	65	184	11,937	24.10
Perry	32	----	2	41	10	1,078,214	419	152	571	140	79,823	13.51
Stark	9	2	----	3	14	242,389	75	29	104	216	22,481	10.7[illegible]
Tuscarawas	19	4	2	17	16	889,151	197	87	284	255	72,440	12.27
Vinton	9	----	----	11	4	141,333	106	26	132	141	18,66[illegible]	7.57
Total, Ohio	197	12	22	245	118	14,206,939	2,924	1,456	4,380	201	879,910	16.15
Oklahoma:												
Coal	3	----	1	4	1	228,674	59	40	99	230	22,739	10.06
Craig	4	1	----	2	1	10,784	13	4	17	192	3,266	3.30
Haskell	3	1	----	----	3	36,108	34	16	50	102	5,086	7.10
Latimer, Pittsburg, and Tulsa	3	1	2	3	2	161,029	57	31	88	211	18,574	8.67
Muskogee	2	2	----	1	----	152,198	54	15	69	270	18,624	8.17
Okmulgee	1	----	----	1	2	176,356	28	12	40	313	12,532	14.07
Rogers	3	5	4	1	----	494,520	107	63	170	287	48,721	10.15
Wagoner	3	----	5	1	1	412,825	76	80	156	192	30,028	13.75
Total, Oklahoma	22	10	12	13	10	1,672,494	428	261	689	232	159,570	10.48
Pennsylvania:												
Allegheny	59	2	----	78	43	4,549,726	991	392	1,383	189	261,801	17.38
Armstrong	25	----	----	42	12	1,400,418	394	141	535	176	93,942	14.91
Beaver	8	1	----	11	7	138,967	75	21	96	134	12,843	10.82
Bedford	3	1	----	9	----	229,629	82	36	118	177	20,860	11.01
Blair and Lycoming	3	----	----	4	2	95,771	36	14	50	174	8,722	10.98
Butler	30	4	----	28	23	1,060,885	379	111	490	169	82,990	12.78
Cambria	40	1	----	52	1	1,319,345	474	155	629	135	85,176	15.49
Centre	21	2	----	23	18	912,382	314	90	404	197	79,430	11.49

Clarion	26	-	-	46	9	2,049,036	536	206	742	206	152,662	13.42
Clearfield	102	12	-	125	31	3,875,309	1,537	435	1,972	178	350,551	11.05
Clinton	3	1	-	3	2	185,553	65	14	79	149	11,748	15.79
Elk	9	1	-	8	1	139,069	98	19	117	109	12,696	10.95
Fayette	59	3	-	23	53	1,738,134	592	152	744	143	106,080	16.39
Greene	12	-	-	4	14	534,386	183	47	230	158	36,344	14.70
Huntingdon	6	-	-	9	4	374,783	158	29	187	184	34,374	10.90
Indiana	35	-	2	70	12	2,233,319	601	203	804	190	152,629	14.63
Jefferson	38	2	-	43	9	1,279,709	446	126	572	174	99,764	12.83
Lawrence	6	-	-	4	7	112,338	41	14	55	179	9,820	11.44
McKean	2	-	-	3	-	40,938	15	7	22	164	3,600	11.37
Mercer	7	-	-	13	1	322,521	102	28	130	184	23,942	13.47
Somerset	37	-	4	44	18	1,645,961	473	174	647	148	95,919	17.16
Tioga	3	-	-	2	1	26,081	19	6	25	122	3,056	8.53
Venango	3	-	-	5	1	101,134	34	14	48	133	6,389	15.83
Washington	31	5	4	49	18	4,913,735	856	386	1,242	216	268,834	18.28
Westmoreland	72	4	-	56	30	2,407,678	823	247	1,070	129	138,103	17.43
Total, Pennsylvania	640	39	10	754	317	31,686,807	9,324	3,067	12,391	174	2,152,275	14.72
South Dakota: Lignite	3	-	-	3	-	16,946	14	-	14	169	2,364	7.17
Tennessee:												
Anderson, Campbell, and Morgan	5	-	1	3	3	121,681	45	20	65	166	10,814	11.25
Bledsoe and Grundy	2	-	1	5	-	74,526	30	10	40	219	8,740	8.53
Total, Tennessee	7	-	2	8	3	196,207	75	30	105	186	19,554	10.03
Texas: Lignite	1	2	-	1	-	55,978	10	15	25	248	6,200	9.03
Virginia:												
Buchanan	2	-	-	3	1	248,391	67	13	80	171	13,651	18.20
Russell	2	-	-	5	-	92,578	37	6	43	163	7,020	13.19
Wise	11	2	-	8	4	314,847	141	31	172	141	24,236	12.99
Total, Virginia	15	2	-	16	5	655,816	245	50	295	152	44,907	14.60
Washington:												
King	4	-	-	2	4	41,683	28	9	37	133	4,922	8.47
Kittitas and Thurston	4	-	2	-	5	55,873	41	24	65	156	10,125	5.52
Total, Washington	8	-	2	2	9	97,556	69	33	102	148	15,047	6.48
West Virginia:												
Barbour	18	-	-	17	7	912,014	259	106	365	160	58,420	15.61
Boone and Kanawha	3	-	1	3	1	175,526	41	16	57	175	9,963	17.62
Braxton, Lewis, and Webster	3	-	-	4	1	83,246	55	16	71	90	6,402	13.00
Brooke	9	-	-	13	9	868,597	184	58	242	209	50,553	17.18
Fayette	16	-	-	26	9	1,208,366	369	115	484	176	85,066	14.21
Gilmer	2	-	-	3	-	50,877	25	9	34	165	5,606	9.08
Grant	1	-	-	2	1	103,834	30	10	40	269	10,750	9.66
Greenbrier	6	1	-	8	6	347,385	141	33	174	156	27,123	12.81

See footnote at end of table.

TABLE 22.—Stripping operations of all types in the bituminous-coal and lignite fields of the United States, by States and counties, in 1946 [1]—Continued

State and county	Number of strip pits	Number of power shovels and dragline excavators				Mined by stripping (net tons)	Average number of men working daily			Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	Diesel	Gasoline		In strip pits	All others	Total			
West Virginia—Continued												
Hancock and Marshall	3	1		3	3	137,871	40	11	51	193	9,832	14.02
Harrison	61			126	17	6,445,411	1,321	554	1,875	173	323,934	19.90
Marion	3			3		131,724	45	18	63	117	7,372	17.87
McDowell	2			1		48,157	25	5	30	105	3,164	15.22
Mineral	5			4	4	342,196	84	27	111	190	21,139	16.19
Mingo	3			5	1	272,985	63	37	100	218	21,790	12.53
Monongalia	11			17	8	662,213	189	61	250	154	38,600	17.16
Nicholas	4			8	1	314,158	75	25	100	243	24,264	12.95
Preston	4	2		7	1	637,847	131	74	205	257	52,660	12.11
Raleigh	6			3	7	145,107	76	16	92	115	10,547	13.76
Randolph	9			18	2	669,948	184	87	271	152	41,087	16.31
Taylor	9			15		601,066	149	44	193	135	26,053	23.07
Tucker	5			6	6	740,671	184	55	239	239	57,040	12.99
Upshur	3			2	3	37,928	23	8	31	96	2,987	12.70
Total, West Virginia	186	4	1	294	87	14,937,127	3,693	1,385	5,078	176	894,352	16.70
Wyoming:												
Campbell	2		2		2	188,837	22	36	58	225	13,066	14.45
Carbon	3	1		3	2	307,517	74	37	111	177	19,641	15.66
Converse	2				1	11,380	5	1	6	228	1,370	8.31
Sheridan	2			2	1	484,951	87	34	121	229	27,744	17.48
Total, Wyoming	9	1	2	5	6	992,685	188	108	296	209	61,821	16.06
Total, United States, 1946	1,445	111	261	1,619	753	112,963,717	25,408	12,011	37,419	192	7,182,302	15.73

[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.

POWER DRILLING

TABLE 23.—Summary of operations of underground bituminous-coal and lignite mines where shot holes were power-drilled in the United States, by States, in 1946

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	Electric drills	Compressed air drills	Total	
Alabama	68	838	189	10,233,263	363,503	10,596,766	12,066,657
Alaska	3	12	27	115,550	164,623	280,173	280,173
Arkansas	21	26	38	275,238	67,214	342,452	926,805
Colorado	89	447	66	3,891,164	14,392	3,905,556	5,111,920
Illinois	130	1,142	34	42,685,775	5,744	42,691,519	46,011,494
Indiana	28	247	1	9,207,331	----------	9,207,331	9,231,488
Iowa	16	49	--------	351,973	----------	351,973	449,078
Kentucky	307	1,339	177	37,400,410	636,868	38,037,278	42,920,418
Maryland	6	35	7	370,531	----------	370,531	692,109
Michigan	3	8	1	62,956	----------	62,956	79,990
Missouri	10	9	2	139,801	----------	139,801	176,582
Montana:							
Bituminous	15	53	3	1,187,355	----------	1,187,356	1,192,299
Lignite	5	14	--------	35,270	----------	35,270	35,270
New Mexico	6	35	6	964,268	----------	964,268	1,017,130
North Dakota (lignite)	7	13	3	90,015	309,979	399,994	399,994
Ohio	76	471	6	13,411,150	2,251	13,413,401	14,669,728
Oklahoma	6	34	--------	499,206	----------	499,206	583,471
Oregon	1	--------	5	----------	16,089	16,089	16,089
Pennsylvania	292	2,121	583	51,217,950	552,825	51,770,775	74,286,538
Tennessee	39	198	55	3,195,990	79,990	3,275,980	4,194,138
Utah	39	295	28	5,902,353	----------	5,902,353	5,936,283
Virginia	53	246	74	6,756,947	----------	6,756,947	10,483,594
Washington	22	78	160	252,422	526,213	778,635	830,546
West Virginia	433	2,811	411	81,001,224	139,047	81,140,271	111,357,543
Wyoming	27	447	8	6,586,702	20,386	6,607,088	6,607,088
Total, 1946	1,702	10,968	1,884	275,834,844	2,899,124	278,733,968	349,556,425

MECHANICAL LOADING

Bituminous coal and lignite mechanically loaded in underground mines amounted to 245,340,768 tons in 1946, or 58 percent of the total underground output.

Mechanical loading equipment used in underground bituminous-coal and lignite mines is divided into two types: Devices that practically eliminate hand shoveling (known as mobile loaders, scrapers, and self-loading conveyors) and those that greatly reduce the labor in hand shoveling (known as hand-loaded face conveyors and pit-car loaders). Devices in the first category are designated as "machines" and those in the second category as "conveyors."

Sales of Mechanical Loading Equipment in 1947.—The estimated capacity of mechanical loading equipment sold for underground use in all coal mines was 16 percent less in 1947 than in 1946. Table 24 shows the sales reported to bituminous-coal and lignite operators, by type of equipment, and the number of manufacturers reporting for 1940–47.

Sales of conveyors to bituminous-coal and lignite mines in 1947 totaled 846 units. The figures for 1942–47 exclude duckbills, which were included in all previous years. Therefore, these sales are not comparable with those for 1941 or earlier years.

The number of mobile loaders, scrapers, and conveyors shipped into various States in 1947 and the number of units in actual use in 1946 are shown in table 26.

Statistics on Mechanical Loading in Bituminous-Coal and Lignite Mines.—More than three-fourths of the underground mechanically loaded tonnage was handled by mobile loaders in 1946. Table 27 shows the tons and percent handled by each type of equipment in 1945 and 1946.

During 1946, in underground bituminous-coal and lignite mines, 3,200 mobile loaders handled 186,974,813 tons, an average of 58,430 tons per mobile loader per year. Self-loading conveyors averaged 12,938 tons, scrapers 12,223, hand-loaded face conveyors 10,706, and pit-car loaders 6,692 per year per unit for the same period.

Mechanical Loading by States.—West Virginia has been the leading producer of mechanically loaded coal since 1939. During 1946 West Virginia produced 77,699,870 tons of mechanically loaded coal, followed by Pennsylvania with 42,836,165, Illinois with 42,353,054, Kentucky with 24,369,466, and Ohio with 12,578,225 tons. These five States produced more than 81 percent of the total output of underground mechanically loaded bituminous coal in the United States in 1946.

TABLE 24.—Units of mechanical loading equipment sold to bituminous-coal and lignite mines for underground use in the United States, as reported by manufacturers, 1940–47

Type of equipment	1940	1941	1942	1943	1944	1945	1946	1947	Change 1947 from 1946 (percent)
Mobile loaders	233	367	352	234	282	349	490	485	−1.0
Scrapers [1]	36	8	15	13	20	6	3	12	+300.0
Conveyors [2]	1,573	1,800	1,167	798	580	738	838	846	+1.0
Pit-car loaders	3	10	2	1		(3)	(3)	(3)	
Total, all types	1,845	2,185	1,536	1,046	882	1,093	1,331	1,343	+.9
Number of manufacturers reporting	32	32	28	24	22	25	24	23	

[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 1940–41, inclusive, but the figures for 1942–47, inclusive, do not include loading heads separately.
[3] Canvass of sales of pit-car loaders discontinued in 1945.

TABLE 25.—Units of mechanical loading equipment in use in underground bituminous-coal and lignite mines in the United States, 1941–46

Type of equipment	1941	1942	1943	1944	1945	1946	Change 1946 from 1945 (percent)
Mobile loaders	1,985	2,301	2,525	2,737	2,950	3,200	+8.5
Scrapers	109	93	83	87	87	75	−13.8
Pit-car loaders	607	481	321	241	142	93	−34.5
Conveyors equipped with duckbills or other self-loading heads	788	1,062	1,226	1,331	1,383	1,521	+10.0
Hand-loaded conveyors	2,807	3,041	3,191	3,236	3,385	3,470	+2.5
Total, all types	6,296	6,978	7,346	7,632	7,947	8,359	+5.2

Detailed data, by States, on the number of mines and machines and the production of mechanically loaded coal compared with the total production at mines using mechanical loading devices are given in table 28. Comparative changes in underground mechanical loading in 1945–46, by States, are shown in table 29.

Table 30 shows bituminous-coal and lignite tonnage mined by stripping compared with underground hand-loaded and machine-loaded tonnage, also productivity at strip and underground mines, by States, for 1946.

TABLE 26.—Comparison of mechanical loading equipment and "mother" conveyors in actual use in bituminous-coal and lignite mines in the United States in 1946 with sales reported in 1947, by States

State	Mechanical loading equipment						"Mother" conveyors [2]
	Mobile loaders		Scrapers		Conveyors [1]		
	In use in 1946	Sales in 1947	In use in 1946	Sales in 1947	In use in 1946	Sales in 1947	Sales in 1947
Alabama	112	24	37	-------	384	63	5
Arkansas	-------	-------	-------	-------	63	2	1
Colorado	30	1	1	-------	283	11	1
Illinois	582	24	-------	-------	30	5	6
Indiana	146	10	-------	-------	-------	-------	8
Iowa	4	3	-------	-------	22	-------	1
Kentucky	289	71	1	3	621	113	31
Maryland	1	1	-------	-------	43	3	-------
Michigan	-------	-------	-------	-------	5	-------	-------
Montana	47	-------	-------	-------	8	-------	-------
New Mexico	16	2	6	-------	1	1	-------
North Dakota	6	1	-------	-------	-------	-------	-------
Ohio	162	28	-------	-------	166	30	23
Oklahoma	4	-------	-------	-------	55	-------	-------
Oregon	-------	-------	-------	-------	2	-------	-------
Pennsylvania	693	93	17	5	893	168	26
Tennessee	11	8	-------	-------	168	26	5
Utah	80	10	-------	-------	117	17	-------
Virginia	83	26	-------	-------	158	43	3
Washington	1	-------	5	-------	95	-------	-------
West Virginia	903	182	-------	4	1,564	360	90
Wyoming	30	1	8	-------	313	4	-------
Total	3,200	485	75	12	4,991	846	200

[1] Includes hand-loaded conveyors and conveyors equipped with duckbills or other self-loading heads.
[2] Includes all haulage conveyors with capacity over 500 feet except main slope conveyors. Data on number in use in 1946 are not available.

TABLE 27.—Bituminous coal and lignite mechanically loaded underground in the United States, by types of loading equipment, 1945–46

Type of equipment	1945		1946	
	Net tons	Percent of total	Net tons	Percent of total
Mobile loaders:				
Loading direct into mine cars	145,811,787	55.6	132,662,797	54.1
Loading onto conveyors	7,934,178	3.0	8,379,074	3.4
Loading into rubber-tired trucks	44,922,497	17.1	45,932,942	18.7
Scrapers	1,251,868	.5	916,759	.4
Pit-car loaders	985,817	.4	622,363	.3
Conveyors equipped with duckbills or other self-loading heads	21,505,950	8.2	19,678,478	8.0
Hand-loaded conveyors	40,100,632	15.2	37,148,355	15.1
Grand total loaded mechanically	262,512,729	100.0	245,340,768	100.0

TABLE 28.—Mechanical loading underground in bituminous-coal and lignite mines in the United States, by States, in 1946

State	Number of mines				Number of loading devices					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 equip'd with duckbills or other self-loading heads	Pit-car loaders	Hand-loaded conveyors (number of) units)	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	20	16	14	50	112	37	38		346	5,255,066	2,885,063	8,140,129	4,115,084	2,545,271	4,269,721	10,930,076
Arkansas		17		17					63		715,818	715,818		735,584		735,584
Colorado	40	15	5	60	30	1	202	1	81	2,990,267	898,002	3,888,269	3,557,732	423,793	187,237	4,168,762
Illinois	71	1	7	79	582		30	64		41,875,095	477,959	42,353,054	39,516,807	84,018	3,730,690	43,331,515
Indiana	19		1	20	146			2		8,889,172	25,000	8,914,172	8,800,756		113,416	8,914,172
Iowa	3		1	4	4		21		1	253,809	1,850	255,659	299,815		3,850	303,665
Kentucky	99	34	20	153	289	1	223		398	20,086,034	4,283,432	24,369,466	22,476,291	4,665,526	7,069,212	34,211,029
Maryland		3	1	4	1		3		40	27,703	283,643	311,346		363,603	190,230	553,833
Michigan		1		1					5		34,411	34,411		51,445		51,445
Montana (bituminous and lignite)	9	1	1	11	47		6	6	2	1,142,015	15,244	1,157,259	1,117,015	20,535	32,244	1,169,794
New Mexico	5			5	16	6	1			809,933		809,933	1,014,124			1,014,124
North Dakota (lignite)	2			2	6					354,379		354,379	390,386			390,386
Ohio	29	4	3	36	162		143		23	12,356,640	221,585	12,578,225	13,081,396	75,743	464,971	13,622,110
Oklahoma		7	1	8	4				55	130,000	440,602	570,602		431,956	179,942	611,898
Oregon		1		1					2		16,089	16,089		16,089		16,089
Pennsylvania	103	68	31	202	693	17	96		797	36,369,029	6,467,136	42,836,165	47,170,895	7,880,036	8,429,318	63,480,249
Tennessee	13	9	8	30	11		40		128	824,988	1,534,400	2,359,388	1,318,000	1,594,684	754,282	3,666,966
Utah	18	5	3	26	80		99		18	5,432,296	98,460	5,530,756	5,291,821	70,881	396,162	5,758,864
Virginia	19	11	7	37	83		36		122	4,295,140	1,638,479	5,933,619	4,975,934	2,067,436	2,954,350	9,997,720
Washington	1	4	5	10	1	5	4		91	59,415	413,582	472,997	19,415	122,485	369,920	511,820
West Virginia	183	114	84	381	903		313	19	1,251	60,288,895	17,410,975	77,699,870	61,984,763	17,468,472	24,516,481	103,969,716
Wyoming	20	2	3	25	30	8	266	1	47	6,130,174	408,988	6,539,162	6,043,029	151,661	363,207	6,557,897
Total:																
1946	654	313	195	1,162	3,200	75	1,521	93	3,470	207,570,050	37,770,718	245,340,768	221,173,263	38,769,218	54,025,233	313,967,714
1945	592	328	196	1,116	2,950	87	1,383	142	3,385	221,426,280	41,086,449	262,512,729	235,653,793	45,579,058	60,527,040	341,759,891
Percent change, 1946 from 1945	+10.5	−4.6	−0.5	+4.1	+8.5	−13.8	+10.0	−34.5	+2.5	−6.3	−8.1	−6.5	−6.1	−14.9	−10.7	−8.1

[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.

TABLE 29.—Comparative changes in underground mechanical loading of bituminous coal and lignite by principal types of loading devices in the United States, by States, 1945–46

State	Net tons						Handled by each class (percent)				Underground output mechanically loaded (percent)	
	1945			1946			1945		1946			
	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]	1945	1946
Alabama	5,270,582	4,053,933	9,324,515	5,255,066	2,885,063	8,140,129	56.5	43.5	64.6	35.4	57.0	56.7
Arkansas		773,472	773,472		715,818	715,818		100.0		100.0	65.4	67.0
Colorado	3,488,332	809,687	4,298,019	2,990,267	398,002	3,388,269	81.2	18.8	88.3	11.7	56.8	58.8
Illinois	48,410,628	586,431	48,997,059	41,875,095	477,959	42,353,054	98.8	1.2	98.9	1.1	87.3	87.7
Indiana	10,541,050	36,177	10,577,227	8,889,172	25,000	8,914,172	99.7	.3	99.7	.3	90.3	90.3
Iowa	248,141		248,141	253,809	1,850	255,659	100.0		99.3	.7	16.3	22.1
Kentucky	20,429,297	4,344,086	24,773,383	20,086,034	4,283,432	24,369,466	82.5	17.5	82.4	17.6	39.4	41.2
Maryland	33,567	176,024	209,591	27,703	283,643	311,346	16.0	84.0	8.9	91.1	13.6	21.5
Michigan		53,656	53,656		34,411	34,411		100.0		100.0	42.7	43.0
Montana (bituminous and lignite)	1,774,152	20,000	1,794,152	1,142,015	15,244	1,157,259	98.9	1.1	98.7	1.3	98.9	91.2
New Mexico	761,484	3,861	765,345	809,933		809,933	99.5	.5	100.0		51.6	63.3
North Dakota (lignite)	543,351		543,351	354,379		354,379	100.0		100.0		82.0	83.0
Ohio	12,555,496	381,583	12,937,079	12,356,640	221,585	12,578,225	97.1	2.9	98.2	1.8	67.2	69.5
Oklahoma	125,000	723,908	848,908	130,000	440,602	570,602	14.7	85.3	22.8	77.2	66.3	58.5
Oregon		16,500	16,500		16,089	16,089		100.0		100.0	100.0	93.8
Pennsylvania	37,181,093	7,373,828	44,554,921	36,369,029	6,467,136	42,836,165	83.5	16.5	84.9	15.1	42.3	45.7
Tennessee	936,816	1,693,723	2,630,539	824,988	1,534,400	2,359,388	35.6	64.4	35.0	65.0	43.4	43.5
Utah	5,742,076	217,596	5,959,672	5,432,296	98,460	5,530,756	96.3	3.7	98.2	1.8	89.2	92.3
Virginia	4,104,531	1,198,432	5,302,963	4,295,140	1,638,479	5,933,619	77.4	22.6	72.4	27.6	31.3	39.9
Washington	103,393	599,237	702,630	59,415	413,582	472,997	14.7	85.3	12.6	87.4	58.3	52.9
West Virginia	60,838,348	17,519,919	78,358,267	60,288,895	17,410,975	77,699,870	77.6	22.4	77.6	22.4	56.9	60.2
Wyoming	8,338,943	504,396	8,843,339	6,130,174	408,988	6,539,162	94.3	5.7	93.7	6.3	98.3	98.5
Total	221,426,280	41,086,449	262,512,729	207,570,050	37,770,718	245,340,768	84.3	15.7	84.6	15.4	56.1	58.4

[1] Includes mobile loaders, scrapers, and conveyors equipped with duckbills or other self-loading heads.
[2] Includes hand-loaded conveyors and pit-car loaders.

TABLE 30.—Bituminous-coal and lignite production, by methods of mining and loading and average output per man per day, by methods of mining in the United States, by States, in 1946

State	Mined by stripping		Mined underground				Total	
	Net tons	Average tons per man per day	Hand-loaded (net tons)	Mechanically loaded (net tons)	Total (net tons)	Average tons per man per day	Net tons	Average tons per man per day
Alabama	1,815,146	9.51	6,228,023	8,140,129	14,368,152	3.51	16,183,298	3.77
Alaska	86,636	11.47	280,173		280,173	3.92	366,809	4.64
Arizona			6,414		6,414	2.29	6,414	2.29
Arkansas	563,242	8.82	352,414	715,818	1,068,232	3.14	1,631,474	4.04
Colorado	155,023	11.21	2,370,216	3,388,269	5,758,485	5.10	5,913,508	5.18
Georgia	88,965	6.15	24,798		24,798	1.49	113,763	3.65
Illinois	15,161,818	17.61	5,953,713	42,353,054	48,306,767	7.83	63,468,585	9.03
Indiana	11,826,355	16.26	956,420	8,914,172	9,870,592	7.88	21,696,947	10.96
Iowa	630,833	9.81	901,641	255,659	1,157,300	3.52	1,788,133	4.55
Kansas	2,282,721	13.18	210,664		210,664	1.59	2,493,385	8.16
Kentucky	7,354,364	18.46	34,829,147	24,369,466	59,198,613	5.08	66,552,977	5.52
Maryland	557,730	9.80	1,133,469	311,346	1,444,815	4.25	2,002,545	5.05
Michigan			45,579	34,411	79,990	2.90	79,990	2.90
Missouri	3,340,921	15.02	391,894		391,894	2.38	3,732,815	9.64
Montana (bituminous)	2,452,753	55.23	80,923	1,149,237	1,230,160	6.39	3,682,913	15.55
Montana (lignite)	1,079	4.21	30,912	8,022	38,934	5.92	40,013	5.85
New Mexico			470,346	809,933	1,280,279	4.63	1,280,279	4.63
North Dakota (lignite)	2,127,576	19.76	72,727	354,379	427,106	7.81	2,554,682	15.73
Ohio	14,206,939	16.15	5,529,098	12,578,225	18,107,323	5.73	32,314,262	8.00
Oklahoma	1,672,494	10.48	404,284	570,602	974,886	3.97	2,647,380	6.53
Oregon			1,064	16,089	17,153	.81	17,153	.81
Pennsylvania	31,686,807	14.72	50,973,884	42,836,165	93,810,049	5.02	125,496,856	6.02
South Dakota (lignite)	16,946	7.17					16,946	7.17
Tennessee	196,207	10.03	3,062,757	2,359,388	5,422,145	4.16	5,618,352	4.24
Texas (lignite)	55,978	9.03					55,978	9.03
Utah			463,257	5,530,756	5,994,013	7.02	5,994,013	7.02
Virginia	655,816	14.60	8,937,460	5,933,619	14,871,079	4.65	15,526,895	4.79
Washington	97,556	6.48	420,574	472,997	893,571	3.26	991,127	3.42
West Virginia	14,937,127	16.70	51,383,095	77,699,870	129,082,965	5.70	144,020,092	6.12
Wyoming	992,685	16.06	102,637	6,539,162	6,641,799	7.29	7,634,484	7.85
Total, 1946	112,963,717	15.73	175,617,583	245,340,768	420,958,351	5.43	533,922,068	6.30

MECHANICAL CLEANING

The quantity of bituminous coal mechanically cleaned increased from about 28,000,000 tons or 5 percent of the total output in 1927 to more than 138,000,000 tons or 26 percent in 1946. (See table 13.)

Tables 31, 32, 35, and 36 include mechanical cleaning data on all coal mined in the United States except Pennsylvania anthracite. Tables 33 and 34 are on the same basis but do not include consumer-operated plants. There are no mechanical cleaning plants at lignite mines.

Mechanical cleaning by wet methods includes jigs, concentrating tables, classifiers, launders, dense-media processes, and any combinations of these five methods. Tables 32 and 33 show separate data on coal cleaned by classifiers, launders, and dense-media processes for the first time. Similar tables previously published have shown these three types of cleaning grouped under the caption "Launders and upward-current classifiers."

Pneumatic methods of coal cleaning include air tables, air flow, air sand, and any combination of these three methods.

Consumer-operated plants include plants owned by steel companies that receive coal from various mines (but usually from affiliated companies), clean it, and then consume it directly at the plant.

Table 31 compares bituminous coal cleaned in 1943–46, by method of cleaning. Both wet and pneumatic methods decreased in 1946 from 1945.

Mechanical Cleaning, by Types of Equipment.—The tonnage of bituminous coal cleaned by wet-washing methods was 122,058,639 tons in 1946—a decrease of 6 percent from 1945. The quantity cleaned by pneumatic methods was 16,611,198 tons—a decrease of 5 percent.

Table 32 compares the number of cleaning plants and the net tons of cleaned coal, by types of equipment, for 1945 and 1946. During 1946, 416 wet-washing and 88 pneumatic cleaning plants were in operation. Fifty-nine tipples used both wet and dry methods at the same plant; deducting these duplications gives a net total of 445 plants that cleaned coal in 1946, an increase of 6 plants over 1945.

TABLE 31.—Bituminous coal mechanically cleaned by wet and pneumatic methods, in the United States, in net tons of clean coal, 1943–46

Method of cleaning	1943	1944	1945	1946	Change 1946 from 1945 (percent)
By wet methods:					
At mines	114, 407, 591	128, 390, 547	121, 418, 585	115, 120, 292	−5.2
At consumer-operated cleaning plants	9, 967, 184	10, 272, 142	9, 051, 154	6, 938, 347	−23.3
Total wet methods	124, 374, 775	138, 662, 689	130, 469, 739	122, 058, 639	−6.4
By pneumatic methods	21, 201, 074	20, 064, 440	17, 416, 197	16, 611, 198	−4.6
Grand total	145, 575, 849	158, 727, 129	147, 885, 936	138, 669, 837	−6.2

TABLE 32.—Bituminous coal cleaned in the United States, by types of equipment in actual operation, 1945–46

[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)	
	1945	1946	1945	1946	1945	1946
Wet methods:						
Jigs	219	226	68,608,875	64,702,238	46.4	46.7
Concentrating tables	13	10	2,594,085	1,447,200	1.8	1.0
Classifiers	72	68	14,203,306	13,883,068	9.6	10.0
Launders	19	18	18,980,003	16,020,328	12.8	11.6
Dense-media	55	59	12,874,598	14,172,428	8.7	10.2
Jigs and concentrating tables	16	14	4,754,311	3,776,190	3.2	2.7
Other combinations of methods 1, 2, 3, 4, and 5	18	21	8,454,561	8,057,167	5.7	5.8
Total wet methods	412	416	130,469,739	122,058,639	88.2	88.0
Pneumatic methods	83	88	17,416,197	16,611,198	11.8	12.0
Grand total	[1] 495	[1] 504	147,885,936	138,669,837	100.0	100.0

[1] Number of plants using both wet and pneumatic methods: 1945—56; 1946—59.

TABLE 33.—Total production of all coal at bituminous mines in the United States having cleaning plants, in net tons, 1945–46

[Does not include any estimate for mines that may ship to consumer-operated plants]

Type of equipment	1945	1946	Change 1946 from 1945 (percent)
Wet methods:			
Jigs	104,445,160	98,228,966	−6.0
Concentrating tables	2,018,364	884,813	−56.2
Classifiers	31,704,616	29,727,885	−6.2
Launders	16,803,513	14,978,052	−10.9
Dense-media	31,059,519	29,329,451	−5.6
Jigs and concentrating tables	5,039,409	4,137,840	−17.9
Other combinations of methods	12,394,420	12,566,806	+1.4
Total wet methods	203,465,001	189,853,813	−6.7
Pneumatic methods	47,386,413	52,939,443	+11.7
Grand total	250,851,414	242,793,256	−3.2
Less duplications [1]	36,593,344	42,519,334	+16.2
Net total	214,258,070	200,273,922	−6.5
United States, total production [2]	577,617,327	533,922,068	−7.6
Percent produced at mines having cleaning plants	37.1	37.5	

[1] Mines using both wet and pneumatic methods.
[2] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania. There are no mechanical cleaning plants at lignite mines.

TABLE 34.—Method of mining at bituminous-coal mines in the United States served by cleaning plants, 1943–46

[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				Change 1946 from 1945 (percent)
	1943	1944	1945	1946	
Mined from strip pits	30,326,426	32,444,227	35,910,050	33,221,819	−7.5
Mechanically loaded underground	125,313,683	137,926,900	129,733,226	125,521,189	−3.2
Hand-loaded underground	67,258,305	62,564,653	48,614,794	41,530,914	−14.6
Total	222,898,414	232,935,780	214,258,070	200,273,922	−6.5

Mines served by cleaning plants, exclusive of those that ship to washeries operated by steel companies, produced 200,273,922 tons, or 38 percent of the total bituminous output in 1946. In this same group of mines, 131,731,490 tons were mechanically cleaned; therefore, 66 percent of the coal produced at mines with cleaning plants in 1946 was cleaned at the mine. The remainder of the output from these mines (34 percent) presumably represents the larger sizes commonly picked by hand. (See tables 34 and 36.)

Relation Between Raw Coal, Clean Coal, and Refuse.—For every 100 tons of raw coal cleaned during 1946 at the mines, 84.5 tons of clean merchantable coal, on an average, were obtained, and 15.5 tons of refuse were discarded. Table 36 shows total production of mines with cleaning plants and results of cleaning operations, by States.

TABLE 35.—Bituminous coal mechanically cleaned by wet and pneumatic methods in the United States, by States, 1945–46

[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)	
	1945	1946	1945	1946	1945	1946
Alabama	53	51	13,831,185	11,608,231	75.8	71.7
Alaska	2	2	158,800	164,623	53.4	44.9
Arkansas	3	3	71,951	98,177	3.9	6.0
Colorado	7	10	1,135,679	901,069	15.0	15.2
Illinois	55	57	30,710,862	28,164,779	42.1	44.4
Indiana	20	19	11,135,525	10,669,696	44.2	49.2
Kansas	5	5	1,588,125	1,273,764	49.2	51.1
Kentucky	20	23	8,043,420	8,270,196	11.6	12.4
Michigan	1	1	11,949	7,554	9.5	9.4
Missouri	11	10	2,960,031	2,991,932	74.3	80.2
Montana	2	2	302,978	171,882	6.8	4.6
New Mexico	3	3	303,470	395,347	20.5	30.9
Ohio	10	11	6,292,400	6,467,864	19.2	20.0
Oklahoma	3	1	239,169	90,000	8.2	3.4
Oregon	1	1	13,072	14,961	79.2	87.2
Pennsylvania [1]	65	[2] 61	32,880,671	[2] 29,807,425	24.7	23.8
Tennessee	3	3	114,695	125,276	1.8	2.2
Utah	3	3	1,682,138	1,636,201	25.2	27.3
Virginia	20	18	3,623,548	3,401,629	21.0	21.9
Washington	20	21	1,114,360	816,465	82.1	82.4
West Virginia [3]	132	140	31,671,908	31,592,766	20.3	21.9
Total	[4] 439	[5] 445	147,885,936	138,669,837	25.6	26.0

[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] For purpose of concealment includes one plant in Maryland.

[3] Includes some coal mined in West Virginia and cleaned in Ohio and Pennsylvania.

[4] Represents 56 plants using both wet and pneumatic methods of cleaning and 383 plants using only 1 cleaning method.

[5] Represents 59 plants using both wet and pneumatic methods of cleaning and 386 plants using only 1 cleaning method.

Methods of Mining at Mines Served by Cleaning Plants.—Underground mechanical loading appears to be closely related to mechanical cleaning. Underground coal loaded mechanically in 1946 totaled 245,340,768 tons, of which 125,521,189 tons (51 percent) passed through tipples with mechanical cleaning devices. Production of coal from strip mines in 1946 was 112,963,717 tons, of which 33,221,819 tons (29 percent) came from strip mines having mechanical cleaning tipples. Hand-loaded underground coal production in 1946 totaled 175,617,583 tons, of which 24 percent passed through tipples equipped with cleaning plants. (See tables 30 and 34.)

TABLE 36.—Result of operations at bituminous-coal-cleaning plants in the United States, by States, in net tons, in 1946

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)[1]	Total production from mines that moved coal to cleaning plants
Alabama	15,083,017	11,608,231	3,474,786	23.0	12,506,070
Alaska	245,139	164,623	80,516	32.8	164,623
Arkansas	121,054	98,177	22,877	18.9	339,414
Colorado	70,971	64,778	6,193	8.7	617,798
Illinois	33,444,031	28,164,779	5,279,252	15.8	42,374,504
Indiana	12,964,763	10,669,696	2,295,067	17.7	14,619,687
Kansas	1,611,453	1,273,764	337,689	21.0	1,273,764
Kentucky	10,451,929	8,270,196	2,181,733	20.9	11,858,482
Michigan	9,443	7,554	1,889	20.0	51,445
Missouri	3,781,186	2,991,932	789,254	20.9	3,101,033
Montana	180,000	171,882	8,118	4.5	298,119
New Mexico	427,963	395,347	32,616	7.6	894,616
Ohio	8,346,770	6,467,864	1,878,906	22.5	9,681,543
Oklahoma	100,000	90,000	10,000	10.0	243,321
Oregon	20,571	14,961	5,610	27.3	16,089
Pennsylvania [2]	26,877,382	23,705,369	3,172,013	11.8	31,301,927
Tennessee	138,403	125,276	13,127	9.5	550,630
Utah	1,673,470	1,636,201	37,269	2.2	2,034,492
Virginia	3,702,273	3,401,629	300,644	8.1	8,198,309
Washington	1,032,401	816,465	215,936	20.9	893,056
West Virginia [3]	35,691,911	31,592,766	4,099,145	11.5	59,255,000
Total at mines only [4]	155,974,130	131,731,490	24,242,640	15.5	200,273,922
Consumer plants [5]	7,659,200	6,938,347	720,853	9.4	------------
Grand total, 1946	163,633,330	138,669,837	24,963,493	15.3	------------

[1] In Alabama (for example) for every 100 tons of raw coal cleaned in 1946, an average of 23 tons of refuse was discarded, and 77 tons of clean marketable coal was obtained.
[2] Includes some coal that was mined in Pennsylvania and cleaned in Ohio; also includes tonnage from 1 plant in Maryland.
[3] Includes some coal that was 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.

MECHANICAL CRUSHING

TABLE 37.—Mechanical crushing of bituminous coal at mines in the United States, by States, 1944–45 [1]

[Includes mines with an average daily production of over 50 tons and all mines with rail or river connections, regardless of size. Excludes lignite and Virginia semianthracite]

States	Number of mines crushing coal		Coal crushed (net tons)		Percentage of production crushed at mines where crushing is done		Percentage of total production crushed	
	1944	1945	1944	1945	1944	1945	1944	1945
Alabama	29	33	5,887,097	5,656,080	58.6	57.1	31.4	31.0
Alaska	1	1	68,407	57,498	100.0	100.0	19.6	19.3
Arkansas	3	3	81,987	96,599	65.6	60.1	4.2	5.2
Colorado	26	28	990,479	682,628	27.5	20.3	12.1	9.0
Illinois	79	75	9,481,075	8,658,456	19.5	20.1	12.3	11.9
Indiana	25	23	1,592,688	3,006,820	16.8	30.2	5.7	11.9
Iowa	29	29	313,383	334,285	24.4	28.0	14.6	16.3
Kansas	9	8	910,577	711,114	51.5	44.6	27.0	22.0
Kentucky	87	96	5,408,896	6,852,714	22.0	27.2	7.6	9.8
Maryland	7	4	41,830	35,509	18.0	17.4	2.2	2.0
Michigan	1	1	6,988	2,989	7.0	3.2	5.0	2.4
Missouri	11	10	919,927	1,475,379	37.6	51.2	19.3	37.0
Montana	4	4	242,336	154,500	15.6	12.7	5.1	3.5
New Mexico	3	4	83,172	230,815	14.6	25.8	4.8	15.6
Ohio	53	52	3,041,510	4,877,996	39.6	42.2	9.0	14.9
Oklahoma	3	7	200,653	451,075	48.8	35.9	6.3	15.5
Oregon	------	1	------------	14,000	------	84.8	------	84.8
Pennsylvania	239	239	21,678,376	20,572,127	43.2	48.6	14.8	15.5
Tennessee	11	10	447,263	261,405	27.6	28.5	6.2	4.2
Utah	11	13	2,188,090	2,860,528	54.9	58.3	30.7	42.8
Virginia	23	21	1,748,893	1,682,423	23.1	27.0	9.0	9.8
Washington	11	13	105,102	128,300	10.2	14.3	6.9	9.5
West Virginia	137	143	9,966,224	10,752,888	23.8	24.1	6.1	7.1
Wyoming	12	12	1,055,611	1,380,770	19.1	22.4	11.1	14.0
Total	814	830	66,460,564	70,936,898	29.6	32.4	10.8	12.3

[1] Young, W. H., and Anderson, R. L., Mechanical Crushing of Bituminous Coal and Treatment for Allaying Dust: Mechanization, March 1946, pp. 79–91, and April 1947, pp. 89–91.

MECHANICAL TREATMENT

TABLE 38.—Summary data on treatment of bituminous coal for allaying dust at mines in the United States, 1940–45 [1]

[Includes mines with an average daily production of over 50 tons and all mines with rail or river connections regardless of sizes. Excludes lignite and Virginia semianthracite]

	1940	1941	1942	1943	1944	1945
Grand total production—bituminous coal and lignite	460,771,500	514,149,245	582,692,937	590,177,069	619,576,240	577,617,327
Total production at mines where coal was treated (net tons)	161,089,959	197,476,343	202,973,885	153,863,052	172,955,108	166,935,955
Net tons treated with:						
Calcium chloride	2,633,291	3,957,459	10,132,809	15,049,176	7,276,702	5,115,090
Oil	25,767,651	29,258,462	11,302,020	1,720,176	13,188,883	18,875,674
Calcium chloride and oil	4,428,113	2,482,899	6,544,658	1,947,219	4,744,580	4,647,872
All other materials	2,807,728	3,844,476	7,148,064	7,966,484	5,562,565	4,910,602
Total	35,636,783	39,543,296	35,127,551	26,683,055	30,772,730	33,549,238
Percent of total production treated	7.7	7.7	6.0	4.5	5.0	5.8
Percent of production treated at mines where treating is done	22.1	20.0	17.3	17.3	17.8	20.1
Percent of tonnage treated with:						
Calcium chloride	7.4	10.0	28.8	56.4	23.6	15.2
Oil	72.3	74.0	32.2	6.4	42.9	56.3
Calcium chloride and oil	12.4	6.3	18.6	7.3	15.4	13.9
All other materials	7.9	9.7	20.4	29.9	18.1	14.6
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number of mines treating with:						
Calcium chloride	51	67	167	212	145	105
Oil	486	564	334	67	192	296
Calcium chloride and oil	22	15	73	28	47	43
All other materials	62	58	117	101	83	67
Total [2]	614	668	603	393	434	487

[1] Young, W. H., and Anderson, R. L., Mechanical Crushing of Bituminous Coal and Treatment for Allaying Dust: Mechanization, March 1946, pp. 79–91, and April 1947, pp. 89–91.
[2] Because some mines use more than 1 method of treatment, this total is not the sum of the above items.

HAULAGE

TABLE 39.—Animals and locomotives used in underground bituminous-coal mines [1]

[Includes mines with an average daily production of over 50 tons and all mines with rail or river connections, regardless of size. Excludes lignite and Virginia semianthracite]

State	Animals				Locomotives							
	1924	1936	1940	1944	1924		1936		1940		1944	
					Electric	Other types	Electric	Other types	Electric	Other types	Electric	Other types
Alabama	1,711	431	300	368	342	43	375	5	416	8	513	
Alaska	(2)				(2)	(2)			5		4	
Arkansas	212	194	95	39	3		5	6	28	7	30	1
Colorado	1,542	625	481	379	136	4	140	8	166	21	229	3
Illinois	4,093	1,718	1,232	776	1,487	14	1,295	44	1,278	37	1,422	19
Indiana	1,391	219	149	143	466	2	311	3	259	10	295	1
Iowa	696	485	297	193	60	2	55		46		26	
Kansas	334	67	61	27	45	1	7	2	8	1	6	
Kentucky	2,244	864	531	675	1,424	13	1,574	43	1,550	20	1,736	6
Maryland	220	160	113	141	75	3	44	7	58	2	61	1
Michigan	95	12	12	2	39		43		30		12	
Missouri	215	162	128	71	11		11	4	4	1	6	
Montana	198	46	23	10	54		48	1	71		80	
New Mexico	436	109	43	32	76	1	52	4	48	4	68	
Ohio	2,070	738	393	264	686	2	512	1	465	15	554	2
Oklahoma	394	114	42	27	17		12	3	7	1	22	
Pennsylvania	7,099	3,356	2,597	2,236	3,592	80	3,273	72	2,893	59	3,578	49
Tennessee	556	66	48	72	197	19	181	10	219	4	216	1
Utah	362	135	49	37	76		116	5	119	2	196	1
Virginia	400	24	26	25	496		503	1	577		590	1
Washington	108	43	42	31	48	8	70	3	61	1	63	
West Virginia	5,110	1,716	1,228	1,195	3,845	95	3,767	76	3,987	44	4,339	21
Wyoming	418	85	47	11	98	1	157		178		204	
Other States [3]	28	22	19	8	8		2					
Total	29,932	11,391	7,956	6,762	13,281	288	12,553	298	12,473	237	14,250	106

[1] Young, W. H., and Anderson, R. L., Bituminous Haulage Marked by Locomotive and Conveyor Rise: Coal Age, January 1947, pp. 78–82.
[2] Data not available.
[3] Includes Georgia, Idaho, North Carolina, and Texas.

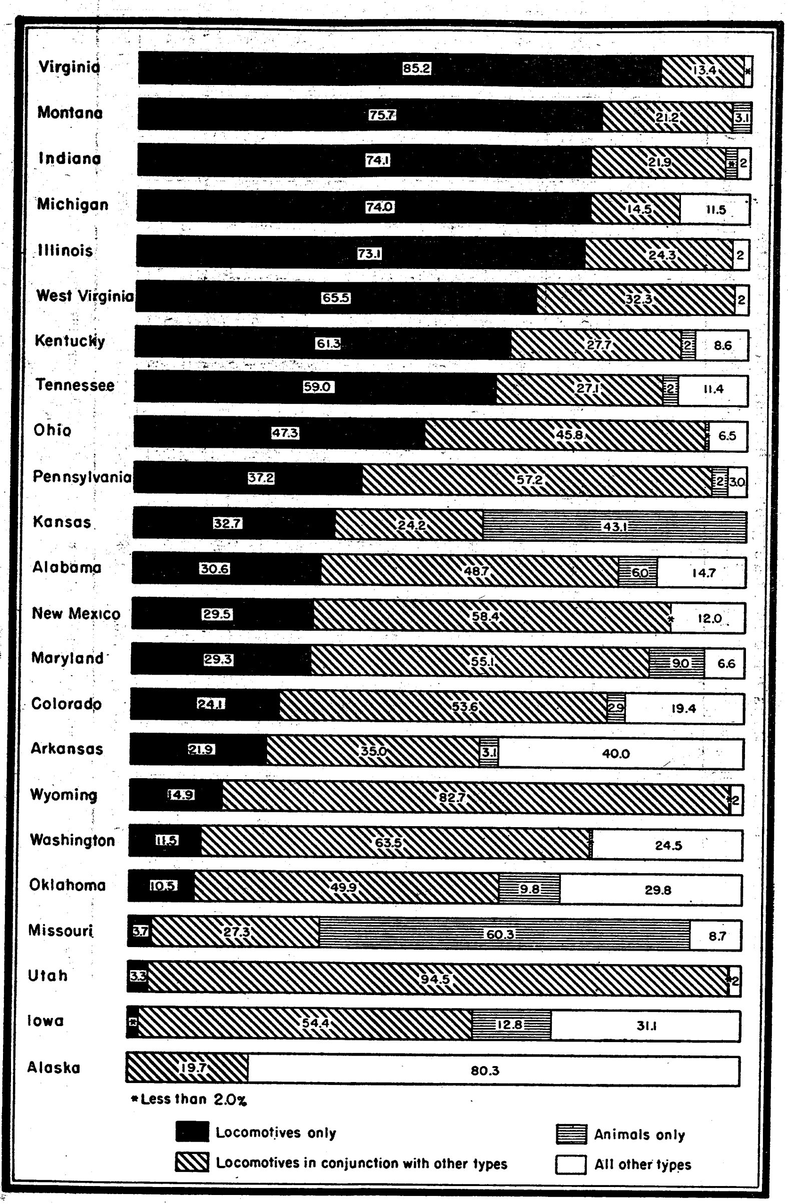

FIGURE 10.—Percentage of underground output of bituminous coal handled by various types of haulage equipment, by States, in 1944.

THICKNESS OF COAL MINED

TABLE 40.—Number of mines, production, output per man per day, and average thickness of seams mined, at strip and underground bituminous-coal and lignite mines in the United States, by States, in 1945 [1]

[Exclusive of mines producing less than 1,000 tons]

State	Strip mines				Underground mines				Total all mines			
	Number of mines	Production (net tons)	Average tons per man per day	Average thickness coal mined (feet)	Number of mines	Production (net tons)	Average tons per man per day	Average thickness coal mined (feet)	Number of mines	Production (net tons)	Average tons per man per day	Average thickness coal mined (feet)
Alabama	53	1,890,819	8.29	3.7	324	16,345,720	3.01	4.0	377	18,236,539	3.22	3.9
Alaska	----	----	----	----	5	297,644	2.95	10.6	5	297,644	2.95	10.6
Arizona	----	----	----	----	1	3,853	1.80	5.5	1	3,853	1.80	5.5
Arkansas	23	671,824	8.37	3.9	44	1,182,102	2.72	2.7	67	1,853,926	3.60	3.1
Colorado	5	52,811	7.51	14.8	161	7,568,201	4.52	7.2	166	7,621,012	4.53	7.3
Georgia	1	10,221	5.84	1.5	2	32,347	1.54	1.6	3	42,568	1.87	1.6
Illinois	43	16,909,100	18.52	4.9	270	56,102,092	7.85	7.2	313	73,011,192	9.06	6.7
Indiana	61	13,464,089	15.89	4.4	73	11,718,522	7.79	5.7	134	25,182,611	10.71	5.0
Iowa	23	521,058	8.28	4.9	94	1,524,542	3.39	4.7	117	2,045,600	3.99	4.7
Kansas	29	2,955,500	13.01	1.6	22	273,059	1.86	2.7	51	3,228,559	8.63	1.7
Kentucky	48	6,694,839	19.00	5.8	1,393	62,898,097	4.84	4.2	1,441	69,592,936	5.22	4.4
Maryland	10	217,526	8.49	11.0	84	1,545,177	3.68	4.7	94	1,762,703	3.95	5.4
Michigan	----	----	----	----	3	125,704	2.71	3.2	3	125,704	2.71	3.2
Missouri	36	3,492,302	14.74	2.6	50	490,422	2.32	3.0	86	3,982,724	8.88	2.7
Montana (bituminous and lignite)	2	2,556,341	78.92	25.0	31	1,910,447	7.04	5.8	33	4,466,788	14.70	16.8
New Mexico	1	1,480	2.24	5.5	25	1,482,206	4.19	5.3	26	1,483,686	4.19	5.3
North Dakota (lignite)	30	1,859,674	19.06	10.3	23	662,645	8.99	13.7	53	2,522,319	14.73	11.2
Ohio	172	13,483,789	16.08	4.1	363	19,253,646	5.25	4.5	535	32,737,435	7.27	4.3
Oklahoma	18	1,628,418	12.51	2.2	58	1,280,558	3.46	3.6	76	2,908,976	5.82	2.8
Oregon	----	----	----	----	1	16,500	2.32	4.5	1	16,500	2.32	4.5
Pennsylvania	598	27,707,670	14.10	4.2	1,359	105,257,673	4.64	5.2	1,957	132,965,343	5.39	5.0
South Dakota (lignite)	2	21,412	6.61	4.7	2	3,033	4.74	7.5	4	24,445	6.30	5.0
Tennessee	8	206,463	9.65	2.8	132	6,064,245	3.95	3.7	140	6,270,708	4.03	3.7
Texas (lignite)	1	79,949	19.52	12.0	----	----	----	----	1	79,949	19.52	12.0
Utah	----	----	----	----	52	6,679,063	6.18	11.8	52	6,679,063	6.18	11.8
Virginia	8	308,890	14.15	5.0	137	16,926,103	4.18	4.6	145	17,234,993	4.23	4.6
Washington	6	151,811	7.35	8.8	40	1,205,433	3.39	5.8	46	1,357,244	3.61	6.1
West Virginia	186	14,246,255	15.18	6.5	872	137,788,477	5.23	5.1	1,058	152,034,732	5.57	5.2
Wyoming	6	854,624	15.48	23.1	42	8,992,951	6.50	11.8	48	9,847,575	6.84	12.8
Total, 1945	1,370	109,986,865	15.46	5.3	5,663	467,630,462	5.04	5.4	7,033	577,617,327	5.78	5.4

[1] Young, W. H., and Anderson, R. L., Thickness of Bituminous-Coal and Lignite Seams Mined in the United States in 1945: Bureau of Mines Inf. Circ. 7442, 1947, 17 pp.

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 1946. 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.

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.

Because of a change in method of reporting, statistics of average production per man per day for 1946 are not precisely comparable with those for other years. The figure for 1946 was based on the average number of men working daily while the figure for previous years was based on the average number of men on the rolls per pay period.

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 1946

[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 men working daily: Underground	Average number of men working daily: Surface: In strip pits	Average number of men working daily: Surface: All others	Average number of men working daily: Total	Average number of days mines were active	Number of man-days worked	Average tons per man per day
ALABAMA													
Bibb	680,943	61,374	5,330	8,962	756,609	$5.18	846	83	220	1,149	199	228,812	3.31
Blount	131,844	101,042	241	356	233,483	4.51	279	54	84	417	218	90,735	2.57
Cullman		31,432	165	25	31,622	4.85	62		13	75	214	16,023	1.97
Jackson	2,195	18,849	40	10	21,094	4.73	31		8	39	237	9,226	2.29
Jefferson	7,877,833	239,279	64,854	31,284	8,213,250	4.88	8,721	210	1,753	10,684	219	2,342,132	3.51
Marion	184,084	143,560	3,132		330,776	6.11	439	15	108	562	212	118,958	2.78
St. Clair	866,236	44,753	7,599	20,231	938,819	4.79	480	135	123	738	221	162,980	5.76
Shelby	344,752	79,042	2,595	209	426,598	5.42	643		105	748	204	152,537	2.80
Tuscaloosa	403,809	68,125	610		472,544	4.02	325	60	97	482	211	101,691	4.65
Walker	3,711,447	629,761	409,089	1,074	4,751,371	4.59	3,979	347	902	5,228	204	1,063,986	4.47
Winston		7,132			7,132	4.73	7		3	10	227	2,270	3.14
Total, Alabama	14,203,143	1,424,349	493,655	[4] 62,151	16,183,298	4.81	15,812	904	3,416	20,132	213	4,289,350	3.77
ALASKA													
Total, Alaska	308,195	51,614	716	[4] 6,284	366,809	$6.42	184	20	76	280	282	79,022	4.64
ARIZONA													
Total, Arizona		6,379	35		6,414	$3.79	16		2	18	156	2,804	2.29

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 1946—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 men working daily				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	157,424	1,665	930	1,125	161,144	$6.00	175	20	35	230	196	45,128	3.57
Johnson	330,717	13,275	68	150	344,210	5.41	294	49	101	444	173	77,007	4.47
Logan	308,685	58	1,907		310,650	7.41	498		96	594	189	112,240	2.77
Pope	25,643	35,656			61,299	6.53	21	42	14	77	122	9,395	6.52
Scott	138,345	15,000			153,345	4.37		49	34	83	181	15,011	10.22
Sebastian	569,634	29,416	323	1,453	600,826	5.48	517	161	138	816	178	145,398	4.13
Total, Arkansas	1,530,448	95,070	3,228	[4] 2,728	1,631,474	5.82	1,505	321	418	2,244	180	404,179	4.04
COLORADO													
Boulder	163,269	207,271	3,158	3,941	377,639	$4.20	333		64	397	191	75,642	4.99
Delta	69,263	25,471	450	3,715	98,899	3.97	81		25	106	195	20,655	4.79
Elbert		1,060		129	1,189	2.80	2		1	3	133	398	2.99
El Paso	19,001	127,705	37,121	7,359	191,186	3.68	132		27	159	267	42,512	4.50
Fremont	119,126	272,883	2,428	70	394,507	4.50	305		83	388	194	75,410	5.23
Garfield	11,075	37,830		437	49,342	4.06	49		13	62	203	12,613	3.91
Gunnison	558,942	30,193	10,919	9,149	609,203	3.96	374		125	499	198	98,956	6.16
Huerfano	556,000	52,751	3,902	1,193	613,846	4.28	593		137	730	178	129,606	4.74
Jackson	22,731	12,833			35,564	3.74		16	3	19	214	4,073	8.73
Jefferson	99,849	23,575	1,137	815	125,376	3.47	100		17	117	207	24,180	5.19
La Plata	32,716	23,401	30		56,147	2.70	52		6	58	190	11,020	5.10
Las Animas	889,933	52,043	7,823	[5] 120,593	1,070,392	4.36	1,220		249	1,469	187	275,395	3.89
Mesa	69,756	21,327	448	315	91,846	3.45	76		14	90	199	17,928	5.12
Moffat	105,734	30,324	6,865		142,923	4.15	55		12	67	225	15,061	9.49
Montezuma		1,251			1,251	3.82	3			3	203	609	2.05
Montrose		1,459			1,459	4.15	2			2	149	298	4.90
Rio Blanco		10,423	45		10,468	4.58	8		2	10	291	2,910	3.60
Routt	823,969	36,855	7,165	28,314	896,303	4.25	664	38	419	1,121	156	174,796	5.13
Weld	816,413	304,252	10,321	14,982	1,145,968	3.54	774		177	951	168	159,939	7.17
Total, Colorado	4,357,777	1,272,907	91,812	[5] 191,012	5,913,508	4.04	4,823	54	1,374	6,251	183	1,142,001	5.18

GEORGIA

Total, Georgia	109, 978	3, 000	380	[4] 405	113, 763	$4. 70	57	40	26	123	253	31, 167	3. 65

ILLINOIS

Brown	-----	1, 570	-----	-----	1, 570	$2. 51	-----	2	-----	2	132	264	5. 95
Bureau	-----	95, 006	1, 091	2, 416	98, 513	3. 38	37	12	33	82	164	13, 434	7. 33
Christian	6, 373, 711	94, 308	21, 966	13, 632	6, 503, 617	2. 12	1, 843	-----	692	2, 535	235	595, 204	10. 93
Clinton	110, 859	113, 396	1, 094	3, 313	228, 662	2. 84	290	-----	60	350	150	52, 448	4. 36
Edgar	-----	32, 477	-----	2, 461	34, 938	3. 06	45	-----	6	51	156	7, 980	4. 38
Franklin	13, 532, 223	283, 202	191, 305	160, 480	14, 167, 210	2. 83	5, 584	-----	1, 959	7, 543	225	1, 699, 634	8. 34
Fulton	5, 492, 316	351, 546	9, 524	8, 178	5, 861, 564	2. 37	232	555	712	1, 499	215	322, 564	18. 17
Gallatin	34, 579	25, 186	3, 336	4, 325	67, 426	3. 49	72	-----	14	86	211	18, 185	3. 71
Grundy	1, 160, 539	238, 812	5, 296	3, 609	1, 408, 256	3. 04	-----	263	236	499	255	127, 300	11. 06
Henry	474, 347	67, 600	863	360	543, 170	2. 70	55	47	121	223	252	56, 114	9. 68
Jackson	2, 200, 816	134, 206	18, 410	2, 009	2, 355, 441	2. 52	806	77	215	1, 098	223	244, 793	9. 62
Jefferson	474, 794	18, 606	-----	-----	493, 400	2. 61	235	-----	75	310	206	63, 860	7. 73
Knox	664, 232	96, 265	1, 220	2, 139	763, 856	2. 58	92	52	77	221	206	45, 511	16. 78
La Salle	14, 649	135, 897	10, 152	434	161, 132	4. 32	192	24	44	260	155	40, 315	4. 00
Livingston	-----	6, 189	-----	-----	6, 189	4. 12	-----	4	1	5	154	770	8. 04
Logan	-----	51, 762	-----	60	51, 822	3. 46	54	-----	8	62	159	9, 860	5. 26
Macon	-----	19, 637	490	1, 642	21, 769	5. 07	56	-----	7	63	128	8, 064	2. 70
Macoupin	4, 622, 122	200, 363	22, 843	139, 734	4, 985, 062	2. 39	2, 170	-----	531	2, 701	256	691, 378	7. 21
Madison	1, 143, 233	828, 015	14, 741	69, 495	2, 055, 484	2. 65	1, 012	-----	276	1, 288	238	306, 551	6. 71
Marion	130, 813	20, 947	1, 212	6, 950	159, 922	2. 50	101	-----	47	148	198	29, 363	5. 45
Menard	-----	41, 738	857	151	42, 746	2. 97	62	-----	12	74	207	15, 353	2. 78
Mercer	-----	1, 100	23	100	1, 223	4. 09	3	-----	1	4	177	708	1. 73
Montgomery	740, 075	30, 893	-----	43, 900	814, 868	2. 23	229	-----	88	317	264	83, 688	9. 74
Peoria	332, 726	256, 117	2, 476	311	591, 630	2. 65	352	-----	63	415	200	83, 194	7. 11
Perry	3, 648, 787	50, 597	12, 864	33, 068	3, 745, 316	2. 47	763	246	626	1, 635	202	330, 392	11. 34
Randolph	2, 125, 256	89, 469	8, 184	18, 863	2, 241, 772	2. 48	647	57	265	969	208	201, 562	11. 12
St. Clair	1, 567, 821	1, 364, 846	14, 151	55, 753	3, 002, 571	2. 50	1, 217	99	327	1, 643	208	342, 238	8. 77
Saline	4, 212, 266	77, 945	23, 943	45, 269	4, 359, 423	3. 00	1, 637	155	598	2, 390	231	551, 216	7. 91
Sangamon	1, 479, 724	621, 600	13, 929	18, 261	2, 133, 514	2. 64	1, 427	-----	232	1, 659	197	327, 026	6. 52
Schuyler	99, 550	46, 726	140	3	146, 419	2. 54	21	20	33	74	199	14, 707	9. 96
Tazewell	-----	78, 154	1, 043	346	79, 543	3. 95	92	-----	14	106	170	18, 062	4. 40
Vermilion	1, 152, 213	179, 136	20, 909	5, 075	1, 357, 333	2. 82	1, 218	21	198	1, 437	160	230, 299	5. 89
Warren	-----	3, 398	-----	20	3, 418	3. 75	3	-----	1	4	300	1, 200	2. 85
Washington	413, 870	58, 827	1, 674	14, 445	488, 816	2. 64	240	-----	58	298	221	65, 801	7. 43
Will	88, 281	125, 303	93	69	213, 746	2. 97	-----	47	29	76	187	14, 190	15. 06
Williamson	3, 892, 614	347, 209	10, 501	11, 046	4, 261, 370	2. 70	1, 569	197	531	2, 297	178	408, 771	10. 42
Woodford	-----	14, 109	-----	1, 765	15, 874	5. 69	39	-----	7	46	223	10, 258	1. 55
Total, Illinois	56, 182, 416	6, 202, 157	414, 330	[4] 669, 682	63, 468, 585	2. 61	22, 395	1, 878	8, 197	32, 470	217	7, 032, 257	[6] 9. 03

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 1946—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 men working daily				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			
INDIANA													
Clay	1,675,547	195,729	1,306	2,003	1,874,585	$2.82	23	418	282	723	194	139,942	13.40
Daviess	28,688	17,797			46,485	3.11	31	5	9	45	227	10,203	4.56
Dubois		22,334		6	22,340	2.73	13		4	17	274	4,659	4.80
Fountain		87,338			87,338	3.67		22	6	28	248	6,944	12.58
Gibson	600,257	124,170		21,154	745,581	3.10	469		78	547	169	92,435	8.07
Greene	1,036,422	49,281	873	4,108	1,090,684	2.76	271	70	95	436	180	78,544	13.89
Knox	3,122,459	336,000	16,503	21,989	3,496,951	2.51	1,222	74	420	1,716	242	415,861	8.41
Martin		1,324	10		1,334	2.52	3			3	233	699	1.91
Owen		14,698	33		14,731	3.34		9	2	11	134	1,469	10.03
Parke		30,461	171	12	30,644	3.80	39		9	48	198	9,520	3.22
Perry		2,450			2,450	2.72	3			3	200	600	4.08
Pike	3,387,097	53,831	6,246	11,642	3,458,816	2.43	27	478	411	916	218	200,119	17.28
Spencer	111,604	135,834	350	562	248,350	3.13	27	54	38	119	195	23,237	10.69
Sullivan	2,740,818	87,941	7,103	8,300	2,844,162	2.70	723	250	385	1,358	206	279,572	10.17
Vermillion	182,620	84,316	455	688	268,079	2.48	48	89	84	221	136	30,162	8.89
Vigo	3,260,103	300,803	426,883	17,183	4,004,972	2.58	1,783	106	388	2,277	192	437,048	9.16
Warrick	3,264,760	190,347	3,248	1,090	3,459,445	2.50	347	401	374	1,122	222	249,581	13.86
Total, Indiana	19,410,375	1,734,654	463,181	[4] 88,737	21,696,947	2.61	5,029	1,976	2,585	9,590	207	1,980,545	[6] 10.96
IOWA													
Appanoose	68,446	121,536	2,418	345	192,745	$4.41	482		63	545	138	75,410	2.56
Boone	51,274	30,296	1,355		82,925	4.10	112		18	130	163	21,197	3.91
Dallas	172,233	44,942	710	679	218,564	3.64	217		45	262	201	52,783	4.14
Davis	3,429	3,486			6,915	3.60	3	10	2	15	194	2,912	2.37
Greene	1,585	9,079	55	180	10,899	3.56	13		3	16	218	3,484	3.13

Guthrie		4,791	40		4,831	5.79	16		2	18	144	2,590	1.87
Jasper		16,970	116		17,086	4.09	36		8	44	173	7,629	2.24
Lucas	38,190	33,856	1,478	1,103	74,627	4.02	113		12	125	140	17,475	4.27
Mahaska	135,266	113,559	1,844	188	250,857	3.33	16	93	52	161	217	34,880	7.18
Marion	331,318	196,980	2,115	42	530,455	3.60	250	70	77	397	211	83,691	6.34
Monroe	92,466	80,866	1,634	320	175,286	3.42	203		34	237	191	45,157	3.88
Page		6,900			6,900	5.51	8		1	9	300	2,700	2.56
Polk		47,647	709	195	48,551	4.09	106		14	120	105	12,508	3.86
Van Buren		28,348	80	37	28,465	3.80	16	13	11	40	187	7,472	3.81
Wapello	20,000	103,817	212	172	124,201	3.04	63	16	21	100	181	18,106	6.86
Warren		6,302			6,302	3.68	6		2	8	225	1,800	3.50
Wayne		4,269		30	4,299	4.26	14		2	16	188	2,200	1.95
Webster		4,334	91		4,425	3.81	21		3	24	50	1,200	3.69
Total, Iowa	914,207	857,978	12,657	[4] 3,291	1,788,133	3.68	1,695	202	370	2,267	173	393,254	4.55

KANSAS

Bourbon	137,367	24,836	87	548	162,838	$2.78		45	30	75	174	13,080	12.45
Cherokee	832,826	46,870	3,496	1,671	884,863	2.65	20	147	151	318	216	68,566	12.91
Crawford	1,286,530	56,427	4,074	2,963	1,349,994	2.71	214	290	182	686	185	127,101	10.62
Franklin		1,571			1,571	5.95	7		1	8	98	784	2.00
Labette		3,038			3,038	3.67		6	2	8	103	825	3.68
Leavenworth		3,665	44,812	1,106	49,583	5.04	184		50	234	305	71,370	.69
Linn		5,685			5,685	3.58	11	9	6	26	158	4,109	1.38
Osage		35,565	248		35,813	5.06	82	10	13	105	187	19,598	1.83
Total, Kansas	2,256,723	177,657	52,717	[4] 6,288	2,493,385	2.78	518	507	435	1,460	209	305,433	[7] 8.16

KENTUCKY

Eastern Kentucky:													
Bell	2,164,206	240,970	21,051	326	2,426,553	$3.96	2,436		399	2,835	191	540,670	4.49
Boyd	438,807	157,799			596,606	3.45	232	76	65	373	270	100,740	5.92
Breathitt	17,194	12,980	45,619	15	75,808	3.83	76		16	92	205	18,881	4.02
Carter	56,476	129,730	177	622	187,005	3.51	205		41	246	196	48,323	3.87
Clay	176,590	205,561	42		382,193	3.51	452	53	88	593	199	118,120	3.24
Clinton		42,300			42,300	3.32	41		6	47	178	8,370	5.05
Elliott		31,734			31,734	2.77	26	3	5	34	274	9,300	3.41
Floyd	6,014,994	175,825	17,328	104	6,208,251	3.82	4,618		906	5,524	204	1,126,069	5.51
Greenup		58,424			58,424	3.07	87		15	102	218	22,212	2.63
Harlan	11,057,098	149,130	98,090	7,853	11,312,171	4.00	9,451		1,774	11,225	234	2,621,768	4.31
Jackson		115,093	2,253	420	117,766	3.45	114		41	155	247	38,339	3.07
Johnson	664,659	155,950	4,434	1,462	826,505	4.27	926		148	1,074	205	219,910	3.76
Knott	988,451	2,056	2,454	170	993,131	3.64	628		116	744	208	154,844	6.41
Knox	447,145	70,090	3,485		520,720	3.93	466		97	563	207	116,681	4.46
Laurel	186,284	231,788	155		418,227	3.50	247	54	49	350	194	67,913	6.16

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 1946—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 men working daily: 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—Continued													
Lawrence	4,713	9,141			13,854	$3.01	27		5	32	185	5,921	2.34
Lee	19,050	44,071			63,121	3.41	58		11	69	239	16,460	3.83
Leslie	339,542	18,281			357,823	3.99	241		44	285	213	60,727	5.89
Letcher	6,033,369	1,469,720	41,238	3,416	7,547,743	3.89	6,371	32	1,155	7,558	213	1,610,721	4.69
Magoffin	54,036	26,217	45		80,298	3.42	115		20	135	145	19,549	4.11
Martin	367,715	28,387	224		396,326	3.21	206		50	256	213	54,432	7.28
McCreary	693,304	51,970	9,670	10,682	765,626	3.90	717		96	813	209	170,209	4.50
Menifee		25,725			25,725	3.29	25		4	29	238	6,889	3.73
Morgan		31,649			31,649	3.76	56		9	65	225	14,651	2.16
Perry	5,995,434	157,708	88,988	1,747	6,243,877	3.65	4,656	85	857	5,598	213	1,195,041	5.22
Pike	8,406,379	472,130	77,767	[8] 144,564	9,100,840	3.51	6,415	37	1,243	7,695	214	1,643,844	5.54
Pulaski		117,000			117,000	3.27	104	5	15	124	213	26,390	4.43
Rockcastle	3,068	64,270	75	18	67,431	2.95	78	12	15	105	180	18,850	3.58
Wayne		24,790			24,790	3.45	37		8	45	206	9,248	2.68
Whitley	157,250	150,356	601	50	308,257	3.75	451	19	74	544	147	79,851	3.86
Total, Eastern Kentucky	44,285,764	4,470,845	413,696	[8] 171,449	49,341,754	3.78	39,562	376	7,372	47,310	214	10,144,923	4.86
Western Kentucky:													
Butler		52,888	20		52,908	2.47	45	2	11	58	212	12,285	4.31
Christian		5,980			5,980	2.78	6		2	8	190	1,520	3.93
Daviess	13,511	260,297	275	783	274,866	2.61	206	12	42	260	181	47,013	5.85
Edmonson		16,770			16,770	2.50	14		5	19	238	4,520	3.71
Hancock	28,621	39,565			68,186	2.61	34	25	19	78	140	10,945	6.23
Henderson		299,007	20		299,027	2.14	223		37	260	237	61,720	4.84
Hopkins	9,477,292	401,051	7,642	7,481	9,893,466	2.35	2,773	616	1,042	4,431	213	945,685	10.46
McLean	8,067	37,783			45,850	2.73	44		8	52	202	10,516	4.36
Muhlenberg	4,271,832	402,589	22,487	10,043	4,706,951	2.33	2,329	170	612	3,111	186	577,886	8.15

Ohio	466,980	268,693	1,807	50	737,530	2.51	306	67	118	491	192	94,465	7.81
Union	601,060	22,273	1,005	492	624,830	2.16	383	--------	66	449	175	78,757	7.93
Webster	390,023	91,060	3,776	--------	484,859	2.46	261	46	60	367	159	58,432	8.30
Total, Western Kentucky	15,257,386	1,897,956	37,032	18,849	17,211,223	2.35	6,624	938	2,022	9,584	199	1,903,744	[6] 9.04
Total, Kentucky	59,543,150	6,368,801	450,728	190,298	66,552,977	3.41	46,186	1,314	9,394	56,894	212	12,048,667	5.52
MARYLAND													
Allegany	836,678	272,292	3,697	182	1,112,849	$4.20	752	256	267	1,275	173	220,226	5.05
Garrett	752,235	131,757	3,163	2,541	889,696	4.06	648	82	149	879	201	176,655	5.04
Total, Maryland	1,588,913	404,049	6,860	[4] 2,723	2,002,545	4.14	1,400	338	416	2,154	184	396,881	5.05
MICHIGAN													
Bay	--------	9,373	267	1,764	11,404	$5.73	22	--------	6	28	225	6,300	1.81
Saginaw	--------	15,738	323	1,080	17,141	6.61	31	--------	6	37	208	7,696	2.23
Tuscola	29,539	17,057	1,138	3,711	51,445	6.56	75	--------	10	85	160	13,600	3.78
Total, Michigan	29,539	42,168	1,728	[4] 6,555	79,990	6.45	128	--------	22	150	184	27,596	2.90
MISSOURI													
Adair	25,624	75,665	466	522	102,277	$3.43	177	--------	31	208	177	36,716	2.79
Barton	132,693	43,040	479	2	176,214	2.86	24	48	27	99	156	15,433	11.42
Bates	1,002,577	--------	745	--------	1,003,322	2.56	--------	99	100	199	253	50,279	19.96
Boone	--------	45,586	--------	--------	45,586	2.20	--------	12	2	14	268	3,748	12.16
Callaway	--------	170,160	--------	--------	170,160	2.91	--------	45	36	81	315	25,511	6.67
Clay	--------	15,751	325	163	16,239	4.95	98	--------	13	111	42	4,680	3.47
Dade	--------	8,073	29	--------	8,102	3.50	--------	8	3	11	270	2,970	2.73
Daviess	--------	7,637	236	--------	7,873	5.31	20	--------	5	25	160	4,000	1.97
Harrison	--------	6,471	195	805	7,471	5.08	16	--------	3	19	253	4,810	1.55
Henry	596,412	84,400	--------	--------	680,812	2.63	2	92	51	145	253	36,661	18.57
Jasper	--------	2,914	--------	512	3,426	3.32	--------	4	1	5	205	1,025	3.34
Johnson	33,626	6 074	--------	--------	39,700	2.78	--------	8	3	11	220	2,416	16.43
Lafayette	--------	43,137	801	13	43,951	5.32	108	--------	17	125	185	23,110	1.90
Linn	--------	9,261	--------	--------	9,261	3.97	30	--------	6	36	121	4,362	2.12
Macon	423,203	72,483	1,923	--------	497,609	2.60	54	86	67	207	239	49,494	10.05
Monroe	--------	6,152	--------	--------	6,152	3.48	--------	10	1	11	259	2,854	2.16
Putnam	--------	18,904	--------	--------	18,904	4.36	33	--------	9	42	159	6,688	2.83
Ralls	--------	1,202	--------	--------	1,202	4.45	2	--------	1	3	203	609	1.97
Randolph	451,626	70,063	70	--------	521,759	2.80	141	33	76	250	230	57,386	9.09
Ray	1,933	44,562	403	--------	46,898	5.73	165	--------	17	182	152	27,617	1.70
Vernon	279,227	46,239	431	--------	325,897	2.81	--------	82	35	117	229	26,762	12.18
Total, Missouri	2,946,921	777,774	6,103	[4] 2,017	3,732,815	2.79	870	527	504	1,901	204	387,131	[7] 9.64

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 1946—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 men working daily				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			
MONTANA													
Montana bituminous coal:													
Blaine		8,985			8,985	$5.57	14		2	16	280	4,476	2.01
Carbon	314,532	25,512	3,750	627	344,421	3.61	183		98	281	197	55,391	6.22
Cascade	108,118	13,076	153	100	121,447	2.32	70		10	80	139	11,119	10.92
Chouteau		2,700			2,700	4.53	5		1	6	162	969	2.79
Fergus		1,215			1,215	4.80	2			2	175	350	3.47
Musselshell	705,117	39,448	4,395	2,432	751,392	3.20	412		207	619	194	120,081	6.26
Rosebud	2,449,897			2,856	2,452,753	1.00		98	51	149	298	44,411	55.23
Total bituminous coal	3,577,664	90,936	8,298	6,015	3,682,913	1.73	686	98	369	1,153	205	236,797	[6] 15.55
Montana lignite		40,013			40,013	2.63	27	4	8	39	175	6,837	5.85
Total, Montana	3,577,664	130,949	8,298	[4] 6,015	3,722,926	1.76	713	102	377	1,192	204	243,634	[6] 15.28
NEW MEXICO													
Bernalillo		2,986	20		3,006	$4.65	5		1	6	166	995	3.02
Colfax	996,601	5,799	4,065	3,715	1,010,180	3.90	595		172	767	227	174,437	5.79
McKinley	114,503	45,855	2,143	28,948	191,449	5.24	278		66	344	171	58,992	3.25
Rio Arriba	18,472	3,183	50		21,705	3.64	18		6	24	229	5,484	3.96
Sandoval		1,610	4		1,614	5.00	4		1	5	192	960	1.68
San Juan		19,802	50		19,852	3.49	35		6	41	294	12,035	1.65
Santa Fe	12,093	13,662	2,175		27,930	5.64	45		20	65	300	19,500	1.43
Socorro		4,404	25	114	4,543	5.27	13		4	17	241	4,092	1.11
Total, New Mexico	1,141,669	97,301	8,532	[4] 32,777	1,280,279	4.14	993		276	1,269	218	276,495	4.63

NORTH DAKOTA (LIGNITE)													
Total, North Dakota	2,097,317	373,631	[9] 67,981	[4] 15,753	2,554,682	$1.68	156	255	263	674	241	162,388	[6] 15.73
OHIO													
Athens	1,638,976	95,645	11,132		1,745,753	$3.57	1,182	96	527	1,755	173	303,636	5.75
Belmont	7,721,048	208,775	21,074	3,465	7,954,362	3.14	4,217	220	996	5,423	230	1,193,124	6.67
Carroll	376,621	167,289	2,017	191	546,118	2.96	222	54	60	336	227	76,306	7.16
Columbiana	88,913	611,303	88	73	700,377	3.02	139	135	71	345	227	78,477	8.92
Coshocton	153,787	319,176	1,032	535	474,480	3.20	269	61	82	412	188	77,577	6.12
Gallia	47,364	86,667	15		134,046	3.36	111		23	134	243	32,623	4.11
Guernsey	321,846	72,059	1,211	192	395,308	3.08	262	50	50	362	180	65,034	6.08
Harrison	6,182,551	47,504	6,105	11,713	6,247,873	2.78	850	648	747	2,245	231	518,203	12.06
Hocking	600,573	142,882	701	10	744,166	3.40	415	94	95	604	184	111,180	6.69
Holmes		113,812			113,812	3.02	6	14	22	42	272	11,440	9.95
Jackson	54,614	64,127	33,637		152,378	3.50	132	38	33	203	188	38,186	3.99
Jefferson	4,539,315	825,391	10,624	7,981	5,383,311	2.93	1,617	420	666	2,703	213	575,254	9.36
Lawrence	819	75,830	5,249		81,898	2.85	96		16	112	219	24,487	3.34
Mahoning	2,571	144,916		1,739	149,226	3.06	7	43	12	62	204	12,658	11.79
Meigs	290,098	68,002	527		318,627	3.19	299	14	60	373	198	73,985	4.31
Morgan	262,837	35,318	220	70	298,445	3.29	168	33	55	256	181	46,440	6.43
Muskingum	970,515	189,940	1,002	260	1,161,717	2.37	390	122	69	581	197	114,459	10.15
Noble	266,676	32,070			298,746	2.00	17	48	20	85	173	14,743	20.26
Perry	2,851,497	312,469	1,805	121	3,165,892	3.00	1,286	419	478	2,183	182	398,100	7.95
Stark	1,386	256,975	277	19	258,657	2.81	32	75	34	141	198	27,923	9.26
Tuscarawas	161,739	1,417,526	69,646	391	1,649,302	2.81	528	197	164	889	225	199,872	8.25
Vinton	119,340	77,828	86	6	197,260	3.46	66	106	38	210	163	34,168	5.77
Wayne		46,417	75		46,492	2.67		20	7	27	128	3,461	13.43
Other counties: Portage and Washington		96,016			96,016	2.76	2	17	6	25	270	6,739	14.25
Total, Ohio	26,613,036	5,507,937	166,523	[4] 26,766	32,314,262	2.99	12,263	2,924	4,331	19,518	207	4,038,075	[6] 8.00
OKLAHOMA													
Coal	216,791	22,609	74	5	239,479	$4.28	20	59	46	125	232	29,018	[7] 8.25
Craig		10,784			10,784	3.64		13	4	17	192	3,266	3.30
Haskell	37,598	1,853		482	39,933	3.98	10	34	19	63	115	7,238	5.52
Latimer	123,893	2,855			126,748	4.00	6	29	24	59	255	15,073	[7] 8.41
Le Flore	181,178	16,812	475	434	198,899	5.73	384		89	473	153	72,249	2.75
Muskogee	143,542	8,656			152,198	3.00		54	15	69	270	18,624	[7] 8.17
Okmulgee	827,941	19,315		1,490	848,746	3.93	488	28	85	601	238	142,982	5.94
Pittsburg	91,720	5,196	245	858	98,019	5.17	117	17	27	161	192	30,911	3.17
Rogers	449,154	37,976	2,398	4,992	494,520	2.96		107	63	170	287	48,721	[7] 10.15
Tulsa	14,542	8,075	132	2,480	25,229	3.59	24	11	11	46	156	7,158	3.52
Wagoner	400,266	12,559			412,825	2.90		76	80	156	192	30,028	[7] 13.75
Total, Oklahoma	2,486,625	146,690	3,324	[4] 10,741	2,647,380	3.75	1,049	428	463	1,940	209	405,268	6.53

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 1946—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 men working daily				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	7,900	9,218	35	----------	17,153	$4.40	72	--------	13	85	249	21,164	.81
PENNSYLVANIA (BITUMINOUS COAL)													
Allegheny	12,064,051	2,434,353	1,242,616	3,566	15,744,586	$3.43	8,239	991	1,796	11,026	209	2,299,930	6.85
Armstrong	4,825,582	225,987	23,336	391	5,075,296	3.41	2,794	394	807	3,995	190	760,423	6.67
Beaver	45,165	211,705	41	2,166	259,077	3.52	129	75	49	253	197	49,720	5.21
Bedford	661,551	50,591	3,116	1,260	716,518	4.30	612	82	137	831	193	160,444	4.47
Blair	53,380	120,198	1,251	----------	174,829	3.39	128	28	33	189	195	36,815	4.75
Butler	1,099,607	628,566	16,059	38	1,744,270	3.46	737	379	249	1,365	205	280,489	6.22
Cambria	13,118,093	657,197	1,233,643	173,683	15,182,616	4.18	12,379	474	2,595	15,448	206	3,189,827	4.76
Cameron	----------	3,000	10	10	3,020	2.98	4	--------	1	5	200	1,000	3.02
Centre	1,280,412	201,492	953	70	1,482,927	3.27	612	314	190	1,116	206	230,100	6.44
Clarion	2,551,363	439,795	2,664	55	2,993,877	3.25	833	536	335	1,704	215	367,006	8.16
Clearfield	6,013,880	732,789	8,647	23,302	6,778,618	3.68	2,749	1,537	994	5,280	195	1,027,703	6.60
Clinton	32,237	230,098	338	84	262,757	3.19	66	65	27	158	202	31,983	8.22
Elk	261,906	243,702	2,148	11,597	519,353	3.78	387	98	92	577	176	101,657	5.11
Fayette	11,945,672	1,428,044	181,504	[10] 3,112,190	16,667,410	3.58	10,883	592	1,794	13,269	207	2,745,865	6.07
Forest	----------	3,498	----------	----------	3,498	3.75	5	--------	3	8	304	2,432	1.44
Greene	9,474,245	41,018	30,675	15,129	9,561,067	3.69	6,200	183	1,348	7,731	224	1,733,985	5.51
Huntingdon	501,427	188,482	3,284	1,140	694,333	4.21	400	158	98	656	203	133,460	5.20
Indiana	7,778,990	432,915	287,848	[10] 314,771	8,814,524	3.65	4,961	601	1,166	6,728	206	1,383,441	6.37
Jefferson	2,267,700	313,231	28,725	2,934	2,612,590	3.41	1,261	446	337	2,044	195	399,188	6.54
Lawrence	----------	142,721	3,010	4	145,735	3.12	29	41	25	95	176	16,685	8.73
Lycoming	----------	49,065	150	----------	49,215	3.61	27	8	14	49	257	12,579	3.91
McKean	8,135	33,809	----------	----------	41,944	3.01	2	15	7	24	167	4,000	10.49

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Mercer	124,566	266,845	1,146	70	392,627	3.66	75	102	40	217	203	43,987	8.93
Somerset	5,867,853	502,888	23,112	37,719	6,431,572	3.84	4,361	473	1,006	5,840	198	1,157,322	5.56
Tioga	77,942	84,809	831	1,101	164,683	4.30	143	19	43	205	198	40,524	4.06
Venango	15,890	107,655	2,200		125,745	3.42	28	34	19	81	157	12,738	9.87
Washington	17,818,720	838,651	262,228	31,210	18,950,809	3.69	11,190	856	2,258	14,304	218	3,124,980	6.06
Westmoreland	7,322,424	1,397,558	140,515	[10] 1,042,863	9,903,360	3.51	5,225	823	1,230	7,278	204	1,488,057	6.66
Total, Pennsylvania	105,210,791	12,010,662	3,500,050	[10] 4,775,353	125,496,856	3.66	74,459	9,324	16,693	100,476	207	20,836,340	6.02

SOUTH DAKOTA (LIGNITE)

Total, South Dakota	1,680	15,266			16,946	$2.15		14		14	169	2,364	7.17

TENNESSEE

Anderson	1,180,841	8,826	10,235	615	1,200,517	$3.75	917	7	167	1,091	208	227,259	5.28
Bledsoe	45,800	7,282	260		53,342	3.93	13	17	7	37	207	7,670	6.95
Campbell	1,365,460	69	32,800	1,340	1,399,669	4.07	1,363	26	291	1,680	207	347,135	4.03
Claiborne	1,208,947	32,101	15,168	153	1,256,369	3.76	1,184		235	1,419	192	273,115	4.60
Cumberland		3,255		424	3,679	4.00	10		2	12	248	2,980	1.23
Fentress	204,917	25,431	2,709		233,057	3.56	167		26	193	226	43,705	5.33
Grundy	348,323		18,770	610	367,703	4.19	444	13	45	502	185	92,982	3.95
Hamilton	18,578	15,768	230		34,576	3.47	48		15	63	208	13,105	2.64
Marion	306,550	28,922	3,222	154	338,848	4.00	657		110	767	135	103,216	3.28
Morgan	86,218	28,694	400	13,200	128,512	1.95	226	12	74	312	243	75,777	1.70
Overton	44,885	4,630	10,849	957	61,321	3.58	62		10	72	212	15,228	4.03
Putnam	73,000	60,000			133,000	3.90	103		17	120	240	28,800	4.62
Rhea	9,439	3,700	100	200	13,439	3.85	22		5	27	200	5,409	2.48
Scott	309,703		1,738		311,441	3.89	263		33	296	199	58,906	5.29
Sequatchie	56,465	23,762	77		80,304	3.82	116		16	132	200	26,403	3.04
Van Buren	1,001	1,574			2,575	3.61	8		3	11	205	2,260	1.14
Total, Tennessee	5,260,127	244,014	96,558	[4] 17,653	5,618,352	3.84	5,603	75	1,056	6,734	197	1,323,950	4.24

TEXAS (LIGNITE)

Total, Texas	55,604		374		55,978	$0.83		10	15	25	248	6,200	9.03

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 1946—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 men working daily				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				
UTAH													
Carbon	3,953,794	133,795	12,081	[11] 18,890	4,118,560	$3.57	1,809	--------	695	2,504	230	576,519	7.14
Emery	1,701,044	53,256	4,576	10,612	1,769,488	3.61	840	--------	273	1,113	229	255,376	6.93
Grand	30,338	--------	--------	--------	30,338	3.57	25	--------	7	32	234	7,488	4.05
Iron	--------	8,786	--------	--------	8,786	2.64	8	--------	1	9	255	2,295	3.83
Kane	--------	3,719	--------	--------	3,719	3.55	3	--------	1	4	281	1,124	3.31
Sevier	--------	37,846	--------	--------	37,846	3.30	28	--------	6	34	210	7,130	5.31
Summit	8,072	16,979	225	--------	25,276	2.58	13	--------	5	18	198	3,571	7.08
Total, Utah	5,693,248	254,381	16,882	[11] 29,502	5,994,013	3.58	2,726	--------	988	3,714	230	853,503	[12] 7.02
VIRGINIA													
Buchanan	4,428,634	22,123	20,906	984	4,472,647	$3.71	2,870	67	548	3,485	236	823,483	5.43
Dickenson	1,320,434	1,729	10,955	530	1,333,648	3.83	972	--------	195	1,167	233	271,492	4.91
Lee	511,802	80,120	6,614	465	599,001	4.01	619	--------	114	733	197	144,740	4.14
Montgomery	166,793	10,791	1,882	900	180,366	3.99	133	--------	76	209	217	45,438	3.97
Russell	1,076,288	99,103	10,273	939	1,186,603	3.66	749	37	156	942	222	208,993	5.68
Scott	1,855	40,730	1,861	--------	44,446	3.47	45	--------	10	55	240	13,201	3.37
Tazewell	3,813,667	21,130	38,534	10,866	3,884,197	4.24	3,363	--------	672	4,035	247	994,972	3.90
Wise	3,437,718	86,505	23,368	[13] 278,396	3,825,987	3.61	2,818	141	621	3,580	207	741,389	5.16
Total, Virginia	14,757,191	362,231	114,393	[13] 293,080	15,526,895	3.84	11,569	245	2,392	14,206	228	3,243,708	4.79

WASHINGTON

King	143, 645	168, 029	2, 029	191	313, 894	$5. 90	343	28	114	485	190	92, 389	3. 40
Kittitas	393, 077	22, 981	17, 418	9, 200	442, 676	5. 24	372	32	199	603	223	134, 340	3. 30
Lewis	7, 231	49, 228	217	----------	56, 676	4. 69	61	----------	12	73	210	15, 353	3. 69
Pierce	7, 598	6, 748	----------	23	14, 369	5. 94	17	----------	4	21	213	4, 466	3. 22
Thurston	42, 834	7, 363	----------	410	50, 607	3. 72	29	9	17	55	176	9, 657	5. 24
Whatcom	63, 840	45, 159	749	3, 157	112, 905	6. 26	104	----------	32	136	244	33, 213	3. 40
Total, Washington	658, 225	299, 508	20, 413	[4] 12, 981	991, 127	5. 47	926	69	378	1, 373	211	289, 418	3. 42

WEST VIRGINIA

Barbour	2, 836, 455	10, 043	2, 984	45	2, 849, 527	$3. 05	1, 170	259	435	1, 864	180	335, 000	8. 51
Boone	5, 077, 062	33, 295	27, 620	1, 365	5, 139, 342	3. 54	3, 054	29	685	3, 768	233	879, 308	5. 84
Braxton	70, 316	3, 680	----------	----------	73, 996	3. 03	33	22	16	71	125	8, 868	8. 34
Brooke	737, 464	411, 771	815, 939	178	1, 965, 352	3. 15	682	184	161	1, 027	224	230, 174	8. 54
Clay	1, 089, 823	9, 198	19, 716	23, 935	1, 142, 672	4. 24	634	----------	219	853	253	216, 148	5. 29
Fayette	11, 803, 968	193, 483	377, 750	[14] 69, 565	12, 444, 766	4. 08	8, 551	369	1, 645	10, 565	237	2, 503, 713	4. 97
Gilmer	67, 487	2, 448	----------	----------	69, 935	2. 19	21	25	14	60	149	8, 931	7. 83
Grant	----------	137, 367	----------	----------	137, 367	3. 91	52	30	21	103	199	20, 515	6. 70
Greenbrier	2, 335, 035	69, 366	16, 488	379	2, 421, 268	4. 21	1, 575	141	303	2, 019	217	438, 156	5. 53
Hancock	20, 086	61, 453	----------	1, 010	82, 549	2. 74	5	22	6	33	247	8, 144	10. 14
Harrison	10, 331, 922	631, 023	56, 583	260	11, 019, 788	3. 05	2, 967	1, 321	1, 248	5, 536	166	919, 899	11. 98
Kanawha	7, 849, 067	261, 824	54, 438	2, 108	8, 167, 437	3. 65	5, 549	12	947	6, 508	232	1, 512, 548	5. 40
Lewis	21, 510	1, 541	----------	----------	23, 051	3. 17	3	30	5	38	62	2, 350	9. 81
Logan	19, 849, 468	22, 575	133, 627	21, 625	20, 027, 295	3. 47	9, 685	----------	2, 460	12, 145	238	2, 894, 846	6. 92
Marion	7, 277, 150	143, 404	466, 529	22, 438	7, 909, 521	3. 21	4, 447	45	1, 012	5, 504	200	1, 098, 819	7. 20
Marshall	595, 623	69, 178	175, 657	13, 604	854, 062	3. 44	580	18	92	690	221	152, 694	5. 59
Mason	146, 341	53, 052	438	----------	199, 831	3. 37	174	----------	39	213	186	39, 694	5. 03
McDowell	21, 215, 010	128, 407	299, 495	66, 108	21, 709, 020	4. 08	13, 563	25	3, 322	16, 910	242	4, 097, 740	5. 30
Mercer	2, 506, 355	14, 692	29, 914	799	2, 551, 760	4. 15	2, 045	----------	566	2, 611	246	642, 912	3. 97
Mineral	395, 581	71, 791	534	82	467, 988	4. 14	110	84	58	252	201	50, 542	9. 26
Mingo	4, 648, 624	79, 828	37, 406	68	4, 765, 926	3. 62	3, 187	63	668	3, 918	220	861, 063	5. 53
Monongalia	8, 560, 230	509, 409	14, 824	318	9, 084, 781	3. 09	3, 933	189	1, 127	5, 249	200	1, 049, 084	8. 66
Nicholas	1, 690, 740	27, 186	5, 893	[14] 29, 808	1, 753, 627	3. 81	1, 016	75	203	1, 294	203	263, 317	6. 66
Ohio	1, 280, 932	172, 146	5, 329	10	1, 458, 417	3. 43	1, 171	----------	186	1, 357	216	293, 687	4. 97
Preston	2, 408, 492	29, 448	133, 327	[14] 134, 858	2, 706, 125	3. 61	1, 674	131	365	2, 170	225	487, 297	5. 55
Putnam	----------	12, 260	40	----------	12, 300	2. 93	17	----------	4	21	186	3, 910	3. 15
Raleigh	12, 724, 722	56, 677	123, 214	41, 041	12, 945, 654	4. 02	8, 814	76	1, 906	10, 796	239	2, 576, 076	5. 03
Randolph	1, 797, 759	104, 341	7, 268	4, 546	1, 913, 914	3. 51	1, 080	184	337	1, 601	183	292, 855	6. 54
Taylor	863, 961	232, 312	821	1, 134	1, 098, 228	3. 18	394	149	134	677	179	120, 965	9. 08
Tucker	1, 065, 439	8, 793	7, 499	32, 962	1, 114, 693	3. 96	360	184	102	646	219	141, 570	7. 87
Upshur	389, 699	52, 721	700	1, 834	444, 954	2. 92	327	23	68	418	150	62, 816	7. 08
Wayne	381, 211	24, 234	179	----------	405, 624	3. 41	379	----------	77	456	190	86, 555	4. 69
Webster	1, 784, 545	12, 665	7, 013	1, 803	1, 806, 026	3. 23	1, 195	3	334	1, 532	210	322, 444	5. 60
Wyoming	5, 136, 755	62, 291	40, 356	13, 894	5, 253, 296	4. 02	3, 161	----------	685	3, 846	234	901, 608	5. 83
Total, West Virginia	136, 958, 832	3, 713, 902	2, 861, 581	[14] 485, 777	144, 020, 092	3. 65	81, 608	3, 693	19, 450	104, 751	225	23, 524, 248	6. 12

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 1946—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 men working daily				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	152,959	25,920	666	9,292	188,837	$1.38	------	22	36	58	225	13,066	14.45
Carbon	1,035,521	14,867	4,032	24,386	1,078,806	2.93	248	74	142	464	217	100,868	10.70
Converse	------	13,627	------	------	13,627	2.67	2	5	1	8	221	1,770	7.70
Fremont	------	8,099	58	12	8,169	4.03	12	------	5	17	208	3,544	2.31
Hot Springs	52,120	20,117	50	10	72,297	4.75	91	------	34	125	144	17,975	4.02
Johnson	------	5,069	300	360	5,729	2.21	3	------	2	5	234	1,169	4.90
Lincoln	387,598	6,181	1,598	160	395,537	3.50	258	------	65	323	195	62,843	6.29
Sheridan	1,292,257	34,704	2,153	1,180	1,330,294	2.21	228	87	107	422	226	95,176	13.98
Sweetwater	4,434,908	15,503	24,981	63,226	4,538,618	3.24	2,428	------	674	3,102	218	675,271	6.72
Uinta	------	2,550	6	14	2,570	3.35	5	------	------	5	192	962	2.67
Total, Wyoming	7,355,363	146,637	33,844	[4] 98,640	7,634,484	3.00	3,275	188	1,066	4,529	215	972,644	[6] 7.85
UNITED STATES													
Total, United States	475,257,057	42,730,884	8,896,918	7,037,209	533,922,068	$3.44	296,030	25,408	74,996	396,434	214	84,719,686	6.30

[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 105,297 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 operations production per man per day is large.

[7] Output obtained chiefly from strip pits in which the production per man per day is large.

[8] Includes 133,500 tons "Made into beehive coke at mine" in Pike County.

[9] In North Dakota some lignite made into briquets is included in "Other uses at mine."

[10] Includes coal "Made into beehive coke at mine" in the following counties: Fayette, 3,096,598; Indiana, 223,033; Westmoreland, 1,025,730; grand total, 4,345,361 tons.

[11] Includes 12,075 tons "Made into beehive coke at mine" in Carbon County.

[12] Output is obtained chiefly by use of mechanical devices in which type of operation production per man per day is large.

[13] Includes 271,243 tons "Made into beehive coke at mine" in Wise County.

[14] Includes coal "Made into beehive coke at mine" in the following counties: Fayette, 54,647; Nicholas, 29,808; Preston, 134,633; grand total, 219,088 tons.

STATISTICS ON LIGNITE IN 1946 [3]

PRODUCTION

The production of lignite in 1946 totaled 2,667,619 net tons, compared with 2,668,310 tons in 1945. Neither of these figures includes tonnage from small mines producing less than 1,000 tons. North Dakota, the chief producer, accounted for 96 percent of the total output; Texas, Montana, and South Dakota produced the remaining 4 percent. The average value per ton increased from $1.55 in 1945 to $1.68 in 1946. The average number of men working daily was 752; and the average output per man per day, based on calculated man-days, was 15 tons. Compared with other coal mining in the United States, the output per man per day in the lignite industry is high, because a large part of the production (83 percent in 1946) is recovered from strip pits where the average output per man per day is much higher than in underground mines.

According to the Federal Power Commission, 1,120,486 tons of lignite were consumed in generating electric energy in 1946, the West North Central States consuming 787,595 tons, the West South Central States 772 tons, and the Mountain States 332,119 tons, a large part of which was subbituminous.

Final statistics of the lignite-mining industry are prepared from an annual canvass, by mail, of producers. The data on individual operations are furnished voluntarily and treated confidentially. The Bureau wishes to thank the producers for their cooperation in filing these reports.

[3] Compiled by J. A. Corgan and M. I. Cooke.

TABLE 42.—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 1946, by States [1]

	Montana [2]	North Dakota	South Dakota	Texas	Total
Production (net tons):					
Loaded at mines for shipment	----------	2,097,317	1,680	55,604	2,154,601
Commercial sales by truck or wagon	40,013	373,631	15,266	----------	428,910
Used by employees, taken by locomotives at tipple, and other uses	----------	[3] 67,981	----------	374	68,355
Used at mine for power and heat	----------	15,753	----------	----------	15,753
Total production:					
1946	40,013	2,554,682	16,946	55,978	2,667,619
1945	41,597	2,522,319	24,445	79,949	2,668,310
Value:					
Total:					
1946	$105,331	$4,301,603	$36,362	$46,454	$4,489,750
1945	$99,000	$3,924,000	$53,000	$68,000	$4,144,000
Average per ton:					
1946	$2.63	$1.68	$2.15	$0.83	$1.68
1945	$2.38	$1.56	$2.17	$0.85	$1.55
Average number of men working daily:					
Underground	27	156	----------	----------	183
Surface (including strip pits)	12	518	14	25	569
Total:					
1946	39	674	14	25	752
1945	40	757	15	26	838
Average number of days mines operated:					
1946	175	241	169	248	236
1945	196	226	259	158	223
Man-days of labor: 1946	6,837	162,388	2,364	6,200	177,789
Average output (tons) per man per day: 1946	5.85	15.73	7.17	9.03	15.00

[1] Exclusive of small mines producing less than 1,000 tons.
[2] Includes output from Custer, Dawson, McCone, Richland, Roosevelt, and Sheridan Counties.
[3] Includes some lignite made into briquets.

TABLE 43.—Production, value, men employed, days operated, man-days of labor, and output per man per day at lignite mines in the United States in 1946, by States and counties

County	Total production (net tons)	Value: Total	Value: Average per ton	Total number of men working daily	Man-days of labor	Average number of days mine operated	Average tons per man per day
MONTANA							
Custer	13,281	$36,403	$2.74	11	1,690	154	7.86
Dawson	2,560	6,400	2.50	4	720	180	3.56
McCone	1,079	2,838	2.63	4	256	64	4.21
Richland	8,022	21,990	2.74	5	1,250	250	6.42
Roosevelt	2,320	9,280	4.00	5	900	180	2.58
Sheridan	12,751	28,420	2.23	10	2,021	202	6.31
Total, Montana	40,013	105,331	2.63	39	6,837	175	5.85
NORTH DAKOTA							
Adams	68,043	$131,417	$1.93	24	4,962	207	[1] 13.71
Bowman	6,455	14,620	2.26	8	666	83	[1] 9.69
Burke	374,734	610,736	1.63	72	19,137	266	[1] 19.58
Burleigh	5,777	16,705	2.89	7	1,676	239	3.45
Divide	255,512	316,477	1.24	45	10,221	227	[1] 25.00
Dunn	3,750	9,000	2.40	4	840	210	4.46
Golden Valley	1,140	2,850	2.50	4	500	125	2.28
Grant	17,281	43,103	2.49	10	1,400	140	[1] 12.34
Hettinger	16,679	40,460	2.43	14	2,447	175	6.82
McKenzie	4,004	10,979	2.74	6	873	146	4.59
McLean	40,191	81,281	2.02	39	5,078	130	7.91
Mercer	1,070,018	1,661,926	1.55	233	61,490	264	[1] 17.40
Morton	26,734	57,578	2.15	19	3,646	192	7.33
Oliver	4,000	10,000	2.50	5	650	130	6.15
Stark	97,746	364,963	3.73	42	13,579	323	7.20
Ward	539,395	868,727	1.61	121	31,886	264	[1] 16.92
Williams	23,223	60,781	2.62	21	3,337	159	6.96
Total, North Dakota	2,554,682	4,301,603	1.68	674	162,388	241	15.73
SOUTH DAKOTA							
Corson	1,370	$3,525	$2.57	4	258	65	5.31
Dewey	13,029	27,361	2.10	7	1,620	231	8.04
Perkins	2,547	5,476	2.15	3	486	162	5.24
Total, South Dakota	16,946	36,362	2.15	14	2,364	169	7.17
TEXAS							
Total, Texas: Milam	55,978	$46,454	$0.83	25	6,200	248	[1] 9.03
UNITED STATES							
Total, United States	2,667,619	$4,489,750	$1.68	752	177,789	236	15.00

[1] Output is obtained chiefly from strip pits in which the production per man per day is large.

NUMBER AND SIZE OF LIGNITE MINES

The Bureau of Mines received reports from 59 mines producing 1,000 tons or more annually, 6 of which produced 100,000 tons or over and accounted for 81 percent of the total lignite mined; 3 mines produced 50,000 to 100,000 tons or 8 percent, and 50 mines produced under 50,000 tons and accounted for 11 percent. The classification, by size of output, in the field as a whole is given in table 44.

TABLE 44.—Number and production of lignite mines in the United States in 1946, classified by size of output

Class	Mines		Production		
			Net tons		Percent of total
	Number	Percent	Total	Average per mine	
100,000 tons and over	6	10.2	2,167,604	361,267	81.2
50,000 and under 100,000	3	5.1	201,645	67,215	7.6
10,000 and under 50,000	10	16.9	178,292	17,829	6.7
Under 10,000 tons	40	67.8	120,078	3,002	4.5
Total	59	100.0	2,667,619	45,214	100.0

METHODS OF RECOVERY

TABLE 45.—Lignite mined by different methods in the United States in 1946, by States, in net tons

	Montana	North Dakota	South Dakota	Texas	Total
From underground workings:					
Shot off the solid	38,934	33,875			72,809
Cut by machines [1]		393,231			393,231
Total underground	38,934	427,106			466,040
From strip pits	1,079	2,127,576	16,946	55,978	2,201,579
Grand total production	40,013	2,554,682	16,946	55,978	2,667,619

[1] A total of 7 machines was used—2 "permissible" and 5 other types.

STRIPPING OPERATIONS

A large part of the total production of lignite (83 percent in 1946) is recovered from strip pits where the average output per man per day is much higher than in underground mines. Of the 2,201,579 tons of lignite recovered from strip pits in 1946, 97 percent was from pits in North Dakota. The output from stripping operations in Montana, South Dakota, and Texas totaled only 74,003 tons. The average number of men working daily in stripping operations totaled 508, with an average output per man per day of 18.90 tons. Detailed statistics for stripping operations in the lignite industry in 1946 are given in table 46.

TABLE 46.—Summary of stripping operations that produced lignite in the United States in 1946, by States

	Montana	North Dakota	South Dakota	Texas	Total
Number of strip pits [1]	1	28	3	1	33
Number of shovels, dragline excavators, and coal-loading machines [2]	1	45	3	3	52
Coal produced by stripping	1,079	2,127,576	16,946	55,978	2,201,579
Total value at mines	$2,838	$3,401,432	$36,362	$46,454	$3,487,086
Average value per ton	$2.63	$1.60	$2.15	$0.83	$1.58
Average number of men working daily:					
In strip pits	4	255	14	10	283
All others	-	210	-	15	225
Total	4	465	14	25	508
Average number of days mines operated	64	232	169	248	229
Man-days of labor	256	107,668	2,364	6,200	116,488
Average tons per man per day	4.21	19.76	7.17	9.03	18.90

[1] Includes some pits in which stripping is done by hand.
[2] In some cases the same equipment was used for stripping or excavating and for loading coal; this duplication has been eliminated. In some cases coal was excavated by machine and loaded by hand.

FOREIGN TRADE [4]

TABLE 47.—Bituminous coal [1] imported for consumption in the United States, 1945–47, by countries and customs districts, in net tons

[U. S. Department of Commerce]

COUNTRY	1945	1946	1947
North America:			
Canada	466,565	434,130	288,394
Mexico	1	-	114
South America:			
Colombia	-	-	6
Peru	7	-	-
Europe:			
Netherlands	-	-	130
Poland and Danzig	-	538	1,120
United Kingdom	577	-	349
Oceania:			
Australia	318	-	-
New Zealand	2	-	-
Africa: Union of South Africa	3	12	28
	467,473	434,680	290,141

CUSTOMS DISTRICT	1945	1946	1947
Alaska	-	2,929	7,372
Chicago	2	-	6
Dakota	491	548	758
Duluth and Superior	327	135	-
Florida	-	-	60
Hawaii	-	-	64
Laredo	-	-	114
Maine and New Hampshire	105,020	133,039	45,418
Michigan	84	44	864
Montana and Idaho	276,055	242,668	213,313
New York	731	550	1,927
Pittsburgh	8	-	-
St. Lawrence	97	925	77
San Francisco	16	-	-
Vermont	786	1,528	2,099
Virginia	151	-	-
Washington	83,643	52,164	18,069
Wisconsin	62	150	-
	467,473	434,680	290,141

[1] Includes slack, culm, and lignite.

[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 48.—Exports of bituminous coal to Canada and Mexico, the West Indies and Central America, and "overseas" destinations, 1943–47, in thousands of net tons

[U. S. Department of Commerce]

Year	Canada and Mexico	West Indies and Central America [1]	"Overseas" (all other countries)							Grand total
			Newfoundland, Miquelon, Bermuda, Greenland, and Iceland	South America	Europe	Asia	Africa	Oceania	Total "overseas"	
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	21,589	295	191	1,080	3,924	(2)	873	4	6,072	27,956
1946	21,882	254	160	1,723	16,074	201	878	37	19,073	41,209
1947	25,849	369	404	2,866	36,642	311	2,057	108	42,388	68,606

[1] Includes Bahamas and Panama.
[2] Less than 1,000 net tons.

TABLE 49.—Bituminous coal exported from the United States, 1945–47, by countries, in net tons [1]

[U. S. Department of Commerce]

Country	1945	1946	1947
North America:			
Bermuda	8,234	2,555	14,567
Canada	21,585,606	21,879,705	25,848,117
Central America:			
British Honduras	424	76	30
Canal Zone	25,667	9,554	34,342
Costa Rica	26	62	50
El Salvador	70	77	128
Guatemala	190	253	257
Honduras	400	262	302
Nicaragua	3	10	8
Panama, Republic of	12	50	35
Greenland	940	4,110	4,493
Iceland	------------	------------	57,627
Mexico	2,629	1,688	694
Miquelon and St. Pierre	------------	------------	4,864
Newfoundland and Labrador	181,663	153,212	321,553
West Indies:			
British:			
Barbados	2,006	1,269	2,574
Jamaica	38,102	65,604	89,339
Leeward and Windward	2,270	------------	14,800
Trinidad and Tobago	110,252	68,038	100,797
Other British	48	24	491
Cuba	99,706	99,798	98,277
Curaçao (N. W. I.)	971	63	374
Dominican Republic	971	3,175	7,309
French	13,661	5,504	20,448
Haiti	35	------------	2
	22,073,886	22,295,089	26,621,478
South America:			
Argentina	313,784	486,809	1,113,734
Bolivia	5,241	28,211	329
Brazil	665,112	1,083,379	1,468,312
Chile	6,359	17,372	163,693
Surinam	2,218	577	2,570
Uruguay	86,878	105,458	117,135
Other South America	927	787	500
	1,080,519	1,722,593	2,866,273

See footnote at end of table.

TABLE 49.—Bituminous coal exported from the United States, 1945–47, by countries, in net tons [1]—Continued

Country	1945	1946	1947
Europe:			
Austria	----------	----------	122,391
Azores	4,698	1,608	6,966
Belgium and Luxembourg	436,644	887,957	3,363,800
Denmark	199,244	1,059,596	2,377,583
Eire	----------	----------	1,005,584
Finland	----------	250,171	637,271
France	624,378	5,092,481	12,434,486
Germany	----------	----------	42,630
Gibraltar	144,603	9,330	156,872
Greece	37,351	91,676	34,056
Italy	1,111,939	4,687,950	8,750,900
Netherlands	433,773	1,607,383	2,691,248
Norway	353,610	744,277	738,735
Portugal	344,746	455,024	846,901
Sweden	134,496	860,854	2,074,092
Switzerland	98,787	307,586	683,400
United Kingdom	----------	----------	675,043
Other Europe	112	18,310	----------
	3,924,381	16,074,203	36,641,958
Asia:			
British Malaya	----------	58,940	99,519
China	----------	88,321	4,234
French Indochina	----------	14,494	2,520
Hong Kong	----------	39,696	92,203
Netherlands Indies	----------	----------	95,417
Palestine and Trans-Jordan	----------	----------	3,436
Syria	----------	----------	13,667
Other Asia	26	11	33
	26	201,462	311,029
Africa:			
Algeria	561,830	551,350	1,052,370
Belgian Congo	----------	----------	14,151
British West Africa	47,220	----------	36,425
Canary Islands	12,555	----------	51,822
Cape Verde Islands	7,621	25,685	89,354
Egypt	----------	85,399	298,135
French West Africa	67,229	40,505	244,643
Libya	----------	----------	27,083
Madeira Islands	14,123	27,838	21,491
Morocco, French	76,347	47,031	92,020
Spanish Africa	15,725	----------	114,311
Tunisia	70,245	99,931	14,531
Other Africa	9	5	1,075
	872,904	877,744	2,057,411
Oceania	4,476	37,487	107,553
	27,956,192	41,208,578	68,605,702

[1] Amounts stated do not include fuel or bunker coal loaded on vessels engaged in foreign trade, which aggregated 1,784,956 tons in 1945, 1,380,514 tons in 1946, and 1,689,328 tons in 1947.

TABLE 50.—Bituminous coal exported from the United States, 1945–47, by customs districts, in net tons

[U. S. Department of Commerce]

Customs district	1945	1946	1947
North Atlantic:			
Maine and New Hampshire	12,087	33,495	57,408
Massachusetts		1,691	61
New York	36,027	701,602	1,382,037
Philadelphia	1,160,647	2,492,021	2,740,855
Rhode Island		73	
South Atlantic:			
Georgia			10,708
Maryland	2,269,026	6,450,702	10,871,709
North Carolina		4,501	
South Carolina	294,753	1,369,553	1,814,889
Virginia	1,643,106	4,437,316	20,124,474
Gulf Coast:			
Florida	986,940	1,363,403	2,015,102
Galveston	89,128	633,911	434,150
Mobile	347,207	809,566	1,427,881
New Orleans	19,650	20,129	315,944
Sabine		531,302	731,418
Mexican border:			
Arizona	338	264	272
El Paso	277	58	45
Laredo	21	27	27
Pacific Coast:			
Los Angeles		334,727	142,522
Oregon		138,019	379,239
San Diego	164	92	83
San Francisco	14	15	20
Washington	1,020	92,037	301,035
Northern border:			
Buffalo	1,413,882	1,580,304	1,548,629
Chicago	583,981	1,199,033	1,505,335
Dakota	15,555	30,360	23,392
Duluth and Superior	273,868	300,414	385,036
Michigan	2,297,837	2,369,744	3,046,644
Montana and Idaho	9	48	4,431
Ohio	10,825,722	10,433,093	11,619,905
Rochester	3,155,747	2,899,833	3,829,918
St. Lawrence	2,523,021	2,876,940	3,677,266
Vermont	1,263	2,517	4,106
Wisconsin	468	538	193
Miscellaneous:			
Alaska	78	413	204
Colorado			3,037
Hawaii		70,346	3,282
Indiana			5
Minnesota		5,984	
Pittsburgh	4,356	3,381	11,210
Puerto Rico		4	325
St. Louis		12,298	
	27,956,192	[1] 41,208,578	[2] 68,605,702

[1] Includes 8,824 tons, representing export shipments (except by air) individually valued under $25, data for which are not separately classified by customs districts.
[2] Includes 192,905 tons, representing shipments on vessels operated by the U. S. Army or Navy.

TABLE 51.—Shipments of bituminous coal to noncontiguous territories, 1945–47

[U. S. Department of Commerce]

Territory	1945		1946		1947	
	Net tons	Value	Net tons	Value	Net tons	Value
Alaska:						
Anthracite / Bituminous	36,599	$464,053	7,865	$111,451	6,860	$112,272
Hawaii	567	17,586	259	7,174	365	10,135
Puerto Rico	8,220	50,204	11,526	73,121	9,148	78,593
Virgin Islands	32,168	218,066	53,771	361,170	44,514	334,149

WORLD PRODUCTION

TABLE 52.—World production of coal and lignite, 1940–47, by countries, in thousands of metric tons [1]

[Compiled by B. B. Mitchell and P. Roberts]

Country [1]	1940	1941	1942	1943	1944	1945	1946	1947
North America:								
Canada:								
Coal	12,638	12,872	13,018	11,591	14,201	13,584	14,776	12,964
Lignite	3,298	3,662	4,096	4,610	1,245	1,391	1,382	1,424
Greenland	6	7	5	7	8	7	8	(2)
Mexico	816	856	914	1,025	904	915	977	850
United States:								
Anthracite (Pennsylvania)	46,706	51,136	54,728	55,015	57,789	49,835	54,891	(2)
Bituminous / Lignite	415,336 / 2,666	463,908 / 2,518	525,948 / 2,659	532,903 / 2,494	559,750 / 2,317	521,582 / 2,421	481,943 / 2,420	561,544
South America:								
Argentina [3]	(4)	(4)	5	8	9	7	(2)	(2)
Brazil:								
Coal	1,047	1,110	1,354	1,537	1,415	1,492	1,274	1,999
Lignite	(2)	2	17	23	16	9	(2)	(2)
Chile	1,639	1,717	1,782	2,032	2,047	1,827	1,740	1,765
Colombia	521	403	415	476	499	[5] 525	[5] 550	[5] 850
Peru	113	117	150	187	173	201	230	(2)
Venezuela	5	6	9	11	12	7	4	(2)
Europe:								
Albania: Lignite [5]	20	20	20	10	5	5	(2)	(2)
Austria:								
Coal	228	226	225	214	195	72	108	178
Lignite	3,608	3,537	3,523	3,646	3,674	2,066	2,407	2,836
Belgium	25,539	26,722	25,055	23,737	13,525	15,826	22,779	24,390
Bulgaria:								
Coal	188	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Lignite	2,544	2,784	3,444	3,816	2,892	3,432	3,420	4,011
Czechoslovakia:								
Coal	20,820	20,930	22,635	24,500	23,159	11,716	14,167	16,216
Lignite	21,476	21,623	23,316	26,750	26,112	15,356	19,475	22,362
Denmark: Lignite	200	1,000	1,800	2,600	2,200	2,320	2,300	(2)
Eire	118	155	167	186	206	216	216	(2)
France:								
Coal	39,323	41,849	41,869	40,531	25,241	33,372	47,208	45,229
Lignite	1,661	2,008	1,958	1,896	1,336	1,692	2,100	2,094
Germany:								
Coal	240,101	243,607	251,970	158,616	135,336	41,208	65,688	85,758
Lignite	223,946	234,996	244,643	254,604	230,808	107,772	159,876	160,450
Greece: Lignite	250	180	365	370	190	70	125	140
Hungary:								
Coal [6]	1,207	1,301	1,250	1,376	[7] 1,050	710	722	1,060
Lignite [6]	10,306	11,298	11,720	11,296	[7] 8,400	3,580	5,630	7,752
Italy:								
Coal	2,282	2,393	2,522	439	(2)	612	1,178	1,317
Lignite	2,109	2,030	2,306	1,934	(2)	709	1,521	1,825
Netherlands:								
Coal	12,145	13,356	12,330	12,497	8,313	5,097	8,314	10,104
Lignite	199	199	281	383	243	130	499	474

See footnotes at end of table.

TABLE 52.—World production of coal and lignite, 1940–47, by countries, in thousands of metric tons [1]—Continued

Country [1]	1940	1941	1942	1943	1944	1945	1946	1947
Europe—Continued								
Poland:								
Coal	[8] 77,077	[8] 76,343	[8] 83,972	[8] 91,362	[8] 87,389	27,366	47,288	59,130
Lignite	(2)	(2)	(2)	(2)	(2)	(2)	857	4,600
Portugal:								
Coal	369	435	438	403	426	436	380	377
Lignite	64	84	108	106	127	163	141	108
Rumania:								
Coal	297	264	285	306	202	211	167	163
Lignite	2,384	2,195	2,367	2,604	2,069	1,820	1,784	2,105
Spain:								
Coal	8,862	8,763	9,257	9,591	10,485	10,732	10,759	10,474
Lignite	569	793	1,106	1,112	1,202	1,351	1,336	1,275
Svalbard (Spitsbergen)	565	330	---	---	---	6	92	345
Sweden	498	557	582	557	570	615	488	(2)
Switzerland:								
Coal	8	72	184	157	71	311	178	18
Lignite	---	8	27	75	74			
U. S. S. R.:								
Coal	148,700	146,800	[5] 90,000	[5] 131,400	[5] 118,000	[5] 146,000	[5] 161,000	[5] 175,000
Lignite	15,900	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United Kingdom:								
Great Britain [9]	227,899	209,656	208,231	202,112	195,839	185,706	194,869	202,948
Northern Ireland:								
Coal	(4)	(4)	3	(4)	(4)	(4)	(2)	(2)
Lignite	(4)	(4)	1	1	2	3	(2)	(2)
Yugoslavia:								
Coal	[10] 3,170	7,310	[10] [11] 1,160	(2)	(2)	(2)	(2)	(2)
Lignite								
Asia:								
China:								
China (including Manchuria):								
Coal	46,481	58,426	65,267	[5] 62,713	[5] 62,465	[5] 16,200	[5] 15,000	[5] 20,000
Lignite	346	397	419			(2)	(2)	(2)
Formosa	[5] 2,080	2,885	[5] 2,360	[5] 2,500	[5] 2,500	(2)	[5] 1,200	(2)
India	29,860	29,937	29,906	25,921	26,546	29,635	29,747	[12] [13] 27,350
Indochina, French:								
Coal	2,470	2,308	1,218	996	533	231	262	248
Lignite	30	21	24	25	4	---	---	---
Iran [14]	92	90	82	69	100	[5] 150	[5] 150	[5] 150
Japan: [15]								
Coal	[16] 57,309	[16] 55,602	[16] 54,179	[16] 55,539	[16] 49,335	[16] 22,371	19,823	26,331
Lignite	[16] 298	[16] 408	[16] 1,607	[16] 2,876	[16] 2,304	[16] 1,643	2,356	2,820
Korea:								
Coal	3,153	3,519	3,898	4,157	4,530	(2)	[17] 237	[17] 359
Lignite	2,588	2,638	2,958	2,430	2,519	(2)	[17] 25	[17] 38
Malayan Union	794	[18] 523	[5] 249	[5] 497	[5] 416	[5] 206	228	230
Netherlands Indies	2,009	[5] 1,500	872	1,038	753	(2)	73	288
Philippines, Republic of	[5] 61	[5] 60	(2)	(2)	(2)	(2)	48	74
Syria and Lebanon:								
Lignite	2	8	7	1	2	2	(4)	(2)
Turkey:								
Coal	3,019	3,020	2,510	2,071	2,383	2,150	2,312	2,623
Lignite	219	264	409	414	533	571	484	628
U. S. S. R.:								
Coal	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Lignite								
Africa:								
Algeria:								
Coal	55	80	148	117	120	162	215	205
Lignite		3	7	1	1	(2)	(2)	(2)
Belgian Congo	23	30	43	69	49	50	102	(2)
Madagascar	---	1	2	1	2	3	(2)	(2)
Morocco, French	143	139	119	102	134	179	222	[18] 202
Nigeria	313	[16] 409	[16] 471	(2)	651	679	648	591
Portuguese East Africa	20	17	7	13	16	12	16	(2)
Southern Rhodesia	1,291	1,412	1,561	1,779	1,808	1,669	1,613	1,508
Tunisia: Lignite	23	102	141	41	66	69	95	[18] 58
Union of South Africa	17,176	18,337	20,408	20,561	22,987	23,554	23,635	23,818

See footnotes at end of table.

TABLE 52.—World production of coal and lignite, 1940–47, by countries, in thousand of metric tons [1]—Continued

Country [1]	1940	1941	1942	1943	1944	1945	1946	1947
Oceania:								
Australia:								
New South Wales	9,703	11,955	12,433	11,714	11,280	10,402	11,397	11,873
Queensland	1,306	1,477	1,663	1,727	1,686	1,661	1,593	1,910
South Australia	------	------	2	------	35	42	138	183
Tasmania	84	111	137	148	146	151	161	170
Victoria:								
Coal	272	332	318	292	262	251	194	178
Lignite	4,347	4,639	5,013	5,173	5,097	5,533	5,799	(2)
Western Australia	548	566	591	540	567	552	653	732
New Zealand:								
Coal	1,163	1,199	1,194	1,157	1,085	980	974	2,825
Lignite	1,393	1,483	1,529	1,676	1,766	1,899	1,865	
Total, all grades	1,799,000	1,872,000	1,897,000	1,845,000	1,755,000	1,359,000	1,487,000	1,639,000
Lignite (total of items shown above)	301,000	315,000	327,000	338,000	303,000	168,000	231,000	237,000
Bituminous coal and anthracite (by subtraction)	1,498,000	1,557,000	1,570,000	1,507,000	1,452,000	1,191,000	1,256,000	1,402,000

1 Coal is also mined in British Borneo, Faroe Islands, Italian East Africa, and Karafuto, but production figures are not available.
2 Data not available; estimate included in total.
3 In addition, the following quantities of asphaltite were produced and used as solid fuel: 1940, 9,117; 1941, 16,646; 1942, 56,387; 1943, 105,625; 1944, 98,600; 1945, 126,100 tons; data for later years not available.
4 Production less than 1,000 tons.
5 Estimate.
6 Includes Northern Territories and Sub-Carpathia; in addition, beginning in 1941, includes Eastern Hungary and Transylvania; and beginning in 1942 includes Southern Territories. Data represents Trianon Hungary subsequent to October 1944.
7 January to October, inclusive.
8 Includes that part of Germany which is under Polish administration (east of the Oder and Neisse Rivers).
9 Includes opencast coal as follows, in thousands of tons: 1942, 1,329; 1943, 4,498; 1944, 8,786; 1945, 8,245; 1946, 9,053; 1947, 10,487.
10 Estimated production of Croatia.
11 January to June, inclusive.
12 Excludes production of Pakistan for the period August to December, inclusive.
13 Data represent 90 percent of total production.
14 Fiscal year ended Mar. 20 of year following that stated.
15 Preliminary and subject to revision.
16 Fiscal year ended Mar. 31 of year following that stated.
17 South Korea only.
18 January to September, inclusive.

Coal—Pennsylvania Anthracite

By J. A. CORGAN and MARIAN I. COOKE

GENERAL SUMMARY

PRODUCTION of Pennsylvania anthracite in 1947 totaled 57,190,009 net tons, a decline of 5 percent from the output in 1946. The principal reason advanced for the decline in production was inadequate stocking of anthracite for winter consumption by home owners. About 80 percent of the anthracite output is normally used for space-heating purposes, and if a large part of the annual requirement is not purchased and stored by consumers during the summer months it is difficult for the industry to step up production during the winter months sufficiently to meet the increased seasonal demand. Thus, many domestic consumers could not obtain adequate supplies of certain desired sizes during the winter of 1947–48. Production from deep mines accounted for 65 percent of the total output, strip pits 22 percent, and culm banks 11 percent, and 2 percent was recovered by dredging operations from streams in the anthracite region. The recovery of coal from culm banks declined 24 percent from 1946, and the tonnage obtained from strip-pit operations was slightly under that in 1946. The industry operated 259 days compared with 271 days in 1946. The demand for anthracite in foreign countries was extremely strong during 1947, and exports reached a record peak of 8,509,995 tons for the year. Shipments to Canada totaled 4,470,034 tons, and virtually all of the remainder was shipped to European countries. In the fall of 1947, when it became apparent that continuing heavy exports to Europe would adversely affect the supply situation in this country, an embargo was placed against the shipment of certain sizes to that area in the winter months. During the 1947–48 coal year, 83 percent of the anthracite shipments was destined to the New England and Middle Atlantic States. Of the total shipments, 86 percent moved by rail and 14 percent by truck.

The Anthracite Institute greatly extended its research program on the utilization of anthracite. Funds were approved by the Congress for establishing a Bureau of Mines anthracite research laboratory at Schuylkill Haven, Pa.

Statistical Trends.—Tables 1 and 2 present pertinent statistical data on the Pennsylvania anthracite industry.

TABLE 1.—Salient statistics of Pennsylvania anthracite industry, 1943–47

	1943	1944	1945	1946	1947
Production:					
Loaded at mines for shipment:					
Breakers net tons	[1] 50,812,873	53,067,227	[1] 45,249,706	50,115,427	[1] 48,073,153
Washeries do	[1] 2,401,065	3,492,187	[1] 2,551,426	3,106,521	[1] 2,009,233
Dredges do	821,899	1,081,156	741,319	886,639	970,027
Sold to local trade and used by employees net tons	4,233,732	3,765,641	4,273,864	4,435,536	4,232,871
Used at collieries for power and heat net tons	2,374,051	2,295,152	2,117,594	1,962,750	1,904,725
Total production do	60,643,620	63,701,363	54,933,909	60,506,873	57,190,009
Value at breaker, washery, or dredge	$306,816,018	$354,582,884	$323,944,435	$413,417,070	$413,019,486
Average sales realization per net ton on breaker shipments:					
Domestic:					
Lump and Broken	$6.77	$7.47	$8.02	$9.23	$10.07
Egg	$6.96	$7.56	$8.13	$9.38	$10.08
Stove	$6.96	$7.57	$8.10	$9.40	$10.03
Chestnut	$6.97	$7.58	$8.12	$9.42	$10.05
Pea	$5.48	$6.11	$6.62	$7.79	$8.23
Total domestic	$6.76	$7.38	$7.93	$9.21	$9.82
Steam:					
Buckwheat No. 1	$4.00	$4.52	$4.79	$5.53	$5.82
Buckwheat No. 2 (Rice)	$3.12	$3.59	$3.91	$4.52	$4.83
Buckwheat No. 3 (Barley)	$2.25	$2.53	$2.65	$3.11	$3.56
Buckwheat No. 4	$1.55	$1.82	$1.85	$2.09	$2.38
Other (including silt)	$1.13	$1.39	$1.58	$1.90	$2.17
Total steam	$3.02	$3.42	$3.56	$4.08	$4.32
Total all sizes	$5.38	$5.91	$6.26	$7.25	$7.65
Percent by sizes in total breaker shipments:					
Domestic:					
Lump and Broken	0.4	0.3	0.3	0.3	0.5
Egg	7.1	7.1	6.5	6.3	5.8
Stove	22.4	21.9	21.7	22.0	21.7
Chestnut	24.5	25.2	25.5	25.8	25.1
Pea	8.7	8.3	7.8	7.4	7.3
Total domestic	63.1	62.8	61.8	61.8	60.4
Steam:					
Buckwheat No. 1	14.2	14.2	14.1	13.9	13.5
Buckwheat No. 2 (Rice)	8.3	8.5	8.1	7.8	7.7
Buckwheat No. 3 (Barley)	9.9	9.7	9.9	9.8	10.2
Buckwheat No. 4	3.0	3.1	3.6	4.0	5.3
Other (including silt)	1.5	1.7	2.5	2.7	2.9
Total steam	36.9	37.2	38.2	38.2	39.6
Producers' stocks [2] net tons	329,000	445,000	130,000	251,168	702,109
Exports [3] do	4,139,000	4,186,000	3,691,000	6,497,245	8,509,995
Imports [3] do	166,000	12,000	149	9,556	10,350
Consumption (apparent) do	57,100,000	59,400,000	51,600,000	53,900,000	48,200,000
Average number of days worked	270	292	269	271	259
Average number of men employed	79,153	77,591	72,842	78,145	78,600
Output per man per day net tons	2.78	2.79	2.79	2.84	2.78
Output per man per year do	751	815	751	770	720
Quantity cut by machines do	1,624,883	1,336,082	1,210,171	1,232,828	1,209,983
Quantity mined by stripping do	8,989,387	10,953,030	10,056,325	12,858,930	12,603,545
Quantity loaded by machines underground net tons	14,745,793	14,975,146	13,927,955	15,619,162	16,054,011
Distribution:					
Total receipts in New England [4] net tons	5,722,000	6,222,000	5,081,000	5,643,076	4,737,946
Exports to Canada [3] do	4,097,000	4,144,000	3,393,000	4,513,637	4,470,034
Loaded into vessels at Lake Erie [5] net tons	661,000	1,066,000	1,234,000	1,112,996	936,040
Receipts at Duluth-Superior [6] do	302,000	580,000	766,000	639,900	446,605

[1] Small quantity of washery coal included with "Breakers."
[2] Anthracite Committee.
[3] U. S. Department of Commerce.
[4] Commonwealth of Massachusetts, Division on the Necessaries of Life; and Association of American Railroads.
[5] Ore and Coal Exchange, Cleveland, Ohio.
U. S. Engineer Office, Duluth, Minn.

TABLE 2.—Statistical summary of monthly developments in the Pennsylvania anthracite industry in 1947

[All tonnage figures represent net tons]

	1947														1946 (total)
	January	February	March	April	May	June	July	August	September	October	November	December	Total	Change from 1946 (percent)	
Production (including mine fuel, local sales, and dredge coal)	5,172,000	4,254,000	4,984,000	4,293,000	4,564,000	4,624,000	4,098,000	5,011,000	5,158,000	5,524,000	4,629,000	4,879,000	57,190,000	−5.5	60,507,000
Shipments (breakers and washeries only, all sizes):															
By rail [1]	3,980,342	3,166,450	4,146,363	3,730,119	4,199,263	4,009,284	3,364,132	4,527,963	4,435,135	4,740,669	3,986,669	3,953,510	48,239,899	−5.6	51,076,047
By truck [2]	680,682	662,980	681,035	614,001	472,430	457,960	566,736	389,878	488,443	605,141	602,535	739,863	6,961,684	−9.1	7,658,090
Carloadings [3]	76,506	60,364	78,062	71,667	77,015	76,752	68,618	86,453	86,185	92,831	74,814	76,562	925,829	−6.3	987,730
Distribution:															
Lake Erie loadings [4]				60,408	82,166	90,322	128,222	126,691	149,395	185,916	103,805	9,115	936,040	−15.9	1,112,996
Lake Ontario loadings [5]				25,157	29,169	19,782	35,226	35,513	29,697	35,003	22,223		231,770	−8.0	251,813
Receipts at Duluth-Superior [6]					67,270	57,544	50,851	79,040	58,275	94,197	39,428		446,605	−30.2	639,900
Upper Lake dock trade: [7]															
Receipts:															
Lake Superior					67,266	65,133	51,032	79,041	66,372	94,286	47,193		470,323	−31.9	690,759
Lake Michigan	1,125	1,645	2,315	27,481	40,706	10,656	72,945	52,641	54,763	64,700	50,142	1,578	380,697	−6.2	405,765
Deliveries (reloadings):															
Lake Superior	77,532	45,864	26,861	7,124	16,159	31,424	40,147	37,968	41,509	68,739	58,576	64,118	516,021	−28.3	719,226
Lake Michigan	27,122	24,659	35,179	14,908	21,351	27,968	52,246	23,404	29,786	33,769	22,545	29,648	342,585	−18.0	417,720
New England receipts:															
By tide [3]	13,294	13,598	11,512	9,682	41,522	26,020	22,891	18,369	20,269	23,186	30,243	9,193	239,779	−39.8	398,625
By rail [8]	467,307	326,715	313,882	265,680	363,475	374,270	287,353	391,743	419,280	456,746	399,864	431,852	4,498,167	−14.2	5,244,451
Exports [9]	567,708	386,555	527,540	869,571	820,478	714,249	699,904	844,432	855,416	829,725	765,123	629,294	8,509,995	+31.0	6,497,245
Imports [9]	548		4,811	2,560		3			501			1,927	10,350	+8.3	9,556
Industrial consumption and stocks by:															
Railroads (class 1 only): [3]															
Consumption	99,200	89,096	94,364	75,690	67,363	61,590	56,017	53,382	87,600	97,929	68,730	89,652	940,613	−12.8	1,079,028
Stocks	114,937	106,136	102,767	103,471	106,384	123,475	111,618	112,427	109,262	110,657	115,068	114,515	114,515	−2.8	117,860
Electric-power utilities: [10]															
Consumption	303,661	286,144	289,126	265,880	256,942	256,126	266,337	305,986	309,626	346,172	309,862	326,180	3,522,042	+2.0	3,453,326
Stocks	1,746,655	1,696,814	1,715,294	1,844,407	1,932,930	2,052,384	2,085,482	2,159,373	2,234,779	2,262,155	2,252,367	2,208,583	2,208,583	+29.6	1,703,659
Stocks on Upper Lake Docks: [7]															
Lake Superior	136,276	90,412	62,207	50,213	101,320	135,029	145,611	186,666	211,530	235,825	223,992	160,933	160,933	−24.7	213,808
Lake Michigan	89,645	66,635	33,771	50,570	69,925	52,613	65,572	102,480	127,457	158,388	185,985	157,915	157,915	+36.6	115,642
Producers' stocks [11]	283,528	292,454	320,528	404,368	520,480	485,456	291,532	294,681	397,922	529,465	674,933	702,109	702,109	+179.5	251,168

See footnotes at end of table.

TABLE 2.—Statistical summary of monthly developments in the Pennsylvania anthracite industry in 1947—Continued

[All tonnage figures represent net tons]

	1947														1946 (total)
	January	February	March	April	May	June	July	August	September	October	November	December	Total	Change from 1946 (percent)	
Sales of mechanical stokers: [9]															
Class 1 (capacity under 61 lb. of coal per hour)	185	132	96	112	163	352	256	346	443	528	344	407	3,364	−52.2	7,044
Class 2 (capacity 61 to 100 lb. of coal per hour)	24	21	16	14	12	39	26	41	57	65	31	45	391	−56.9	908
Wholesale prices: [12]															
On tracks, destination:															
Chestnut	$13.75	$13.75	$13.77	$13.65	$13.46	$13.52	$13.71	$14.62	$14.70	$14.73	$14.78	$14.80	$14.10	+8.0	$13.06
Pea	$12.09	$12.10	$12.11	$11.99	$11.79	$11.85	$11.96	$12.77	$12.88	$12.90	$12.96	$12.98	$12.36	+7.6	$11.49
Index number (1926=100)	114.7	114.8	114.9	113.9	112.2	112.7	114.1	121.7	122.5	122.8	123.3	123.4	117.6	+7.9	109.0
Labor conditions: [12]															
Average weekly earnings	$62.40	$57.42	$64.84	$49.89	$59.15	$62.39	$58.10	$68.51	$67.37	$71.40	$63.43	$67.42	$62.69	+9.7	$57.15
Average hourly earnings	$1.594	$1.637	$1.632	$1.545	$1.593	$1.596	$1.575	$1.780	$1.765	$1.784	$1.754	$1.756	$1.668	+11.6	$1.494
Average hours worked per week	39.1	35.1	39.8	32.3	37.2	39.2	37.0	38.5	38.2	40.0	36.2	38.4	37.6	−1.8	38.3
Index of employment (1939 average=100)	94.1	93.5	92.3	90.4	91.4	90.5	88.7	91.7	91.0	91.2	91.2	91.5	91.5	+12.1	81.6
Index of pay-roll totals (1939 average=100)	228.1	208.5	232.8	175.5	210.2	219.4	200.3	244.0	237.9	252.7	224.4	239.4	222.8	+23.0	181.1

[1] Furnished by Anthracite Institute.
[2] Pennsylvania Department of Mines.
[3] Association of American Railroads.
[4] Ore and Coal Exchange, Cleveland, Ohio.
[5] Buffalo Branch, Ore and Coal Exchange, Cleveland, Ohio.
[6] U. S. Engineer Office, Duluth, Minn.
[7] 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.
[8] Furnished by Commonwealth of Massachusetts, Division on the Necessaries of Life.
[9] U. S. Department of Commerce.
[10] Federal Power Commission.
[11] Anthracite Committee. Represents coal in storage on nearest available date to the end of the month.
[12] Bureau of Labor Statistics.

Anthracite Institute.—The Anthracite Institute continued its extensive research program on various phases of the utilization of anthracite at its large laboratory in Wilkes-Barre, Pa. The anthratube, a new kind of automatic anthracite-burning equipment, developed by the Anthracite Institute, was improved greatly. The unit is now being produced by a number of heating-equipment manufacturers, and several hundred have been installed throughout the anthracite market area. The institute began a large advertising program to present the many advantages of anthracite and anthracite-burning equipment to the public. This campaign, coupled with an expanded research and dealer training program, is evidence that the industry is taking aggressive steps aimed at holding present customers and obtaining an increasing share of the future fuel market. Representatives of the institute appeared before various Government agencies in opposition to the extension of natural-gas lines into the anthracite markets, and the institute was influential in having removed the import duty of 50 cents per ton on Pennsylvania anthracite entering Canada. The Anthracite Institute Weekly Bulletin presented valuable information to industry and the public on matters pertinent to the industry—particularly on production and requirements.

Anthracite Committee.—The Anthracite Committee adopted new standard size specifications, effective July 28, 1947, which are shown in table 3. The committee kept the industry well-informed on the subjects of production, employment, and other phases of the industry, and was also active in matters relating to the "bootleg" element within the anthracite-mining industry.

Labor Relations.—A new wage agreement for the anthracite industry was signed by representatives of the anthracite operators and the United Mine Workers of America on July 10, 1947, to supersede the contract consummated on June 7, 1946. The new agreement granted a $1.20 a day increase for both inside and outside men and an additional levy of 5 cents per ton for the Anthracite Health and Welfare Fund. Aside from doubling the Health and Welfare Fund levy, the only amendment to the contract designates the 1948 vacation as that period beginning on the morning shift of June 26, 1948, and ending on the morning shift of July 6, 1948. The vacation pay of $100 was continued.

A joint statement released by the United Mine Workers of America and the anthracite operators upon signing the agreement is as follows:

> The prompt adjustment of the existing anthracite wage agreement through collective bargaining is made possible by the completely satisfactory relationship which exists in that industry between the anthracite operators and the UMWA and its membership.
>
> The industry, during the past year, has enjoyed wholesome and effective cooperation between the contracting parties as a result of the successful negotiation of the existing agreement in 1946.

In May 1947, trustees of the Anthracite Health and Welfare Fund announced the establishment of a death-benefit program providing for the payment of $1,000 to the beneficiary of each United Mine Worker member in good standing, in districts 1, 7, and 9, who dies accidentally or from natural causes. Retroactive coverage to June 1, 1946, the day on which the fund was created, is provided in this program.

TABLE 3.—Standard anthracite specifications approved and adopted by the Anthracite Committee effective July 28, 1947

	Round test mesh, inches	Percent					
		Oversize maximum	Undersize		Maximum impurities [1]		
			Maximum	Minimum	Slate	Bone	Ash [2]
Broken	Through 4 3/8				1 1/2	2	11
	Over 3 1/4 to 3		15	7 1/2			
Egg	Through 3 1/4 to 3	5			1 1/2	2	11
	Over 2 7/16		15	7 1/2			
Stove	Through 2 7/16	7 1/2			2	3	11
	Over 1 5/8		15	7 1/2			
Chestnut	Through 1 5/8	7 1/2			3	4	11
	Over 13/16		15	7 1/2			
Pea	Through 13/16	10			4	5	12
	Over 9/16		15	7 1/2			
Buckwheat No. 1	Through 9/16	10					13
	Over 5/16		15	7 1/2			
Buckwheat No. 2 (Rice)	Through 5/16	10					13
	Over 3/16		17	7 1/2			
Buckwheat No. 3 (Barley)	Through 3/16	10					15
	Over 3/32		20	10			
Buckwheat No. 4	Through 3/32	20					15
	Over 3/64		30	10			
Buckwheat No. 5	Through 3/64	30	(3)	(3)			16

[1] When slate content in the sizes from Broken to Chestnut, inclusive, is less than above standards, bone content may be increased by 1½ times the decrease in the slate content under the allowable limits, but slate content specified above shall not be exceeded in any event. A tolerance of 1 percent is allowed on the maximum percentage of undersize and the maximum percentage of ash content.

The maximum percentage of undersize is applicable only to anthracite as it is produced at the preparation plant.

"Slate" is defined as any material which has less than 40 percent of fixed carbon.

"Bone" is defined as any material which has 40 percent or more, but less than 75 percent of fixed carbon.

[2] Ash determinations are on a dry basis.

[3] No limit.

Research.—Research was continued on an expanded basis by the Anthracite Institute on various subjects dealing with the utilization of anthracite. The anthratube heating unit was improved further and is now being manufactured and installed throughout the primary anthracite market area. The basic elements in this new method of burning anthracite are the anthratube and centrifugal heat-absorber principles. These revolutionary principles of combustion give designers and manufacturers of automatic anthracite-burning equipment new fundamentals with which to work. Research on the recovery, upgrading, and utilization of the fine sizes of anthracite is receiving considerably more technologic and economic consideration than in the past, and the Anthracite Institute is doing considerable work on this program. In addition to the research being conducted at the institute laboratory, the Anthracite Institute and the Commonwealth of Pennsylvania have since 1939 sponsored a research program at Pennsylvania State College. The principal purpose of the State college program has been upgrading of the smaller sizes by extending present uses and finding new ones. Studies have been made on the production of city gas by water-gas machines, the production of synthesis gas with air and oxygen, and the use of anthracite in cupolas. Research work has also been done on the blending of anthrafines with bituminous coal in producing coke. Transactions of the Sixth Annual Anthracite Conference at Lehigh University, Bethlehem, Pa., May 1948, give a detailed discussion of these and other related subjects.

The Bureau of Mines research program on anthracite has also been expanded. Investigative work on the anthracite-mine flood problem had as its main objectives collection of factual data on infiltration of surface water into underground workings, location of underground water pools, a study of the "buried valley" of the Susquehanna River, and determination of the extent of Pennsylvania anthracite reserves. Water already present in the anthracite mines and the infiltration of additional quantities present a serious problem to the anthracite industry, and the Bureau of Mines plans to do considerable work on it during the next few years.

A number of studies dealing with mechanical mining in anthracite operations have been undertaken by the Bureau. Among these is the design and construction of a scraper-shaker loader to solve the problem of transportation delays in mechanizing development work in thin, steeply pitching anthracite beds. Tests were made also on shearing machines to determine their suitability for use in anthracite mines. A vibrating-blade coal planer was designed and construction started on it.

Further enlargement of the Bureau's research work is expected when the new $450,000 Anthracite Research Laboratory is completed at Schuylkill Haven, Pa. This laboratory, for which a 14-acre site has been donated to the Government, will serve as an information center for the Bureau's scientific research on anthracite.

Imports and Exports.—The demand for Pennsylvania anthracite in foreign countries during 1947 was without precedent in the history of the industry; and exports in that year totaled 8,509,995 net tons, surpassing by more than 2,000,000 tons the 1946 record of 6,497,245 tons. Exports of anthracite to Europe, totaling 3,918,463 tons, were the greatest in history. Belgium and France received approximately 71 percent of these shipments. About 66 percent of the European tonnage consisted of Buckwheat No. 1 and smaller—sizes that were not in great demand in this country during the winter of 1947–48. The larger sizes shipped abroad moved principally in the summer months of 1947, when American consumers failed to stock those sizes for winter consumption. However, when it became apparent that the fuel situation in this country might become critical, the Office of International Trade placed an embargo, effective October 1, on shipments of Pea and larger sizes to Europe, and this restriction was not lifted until April 1, 1948, when supplies of domestic coal again became more plentiful.

Canada, which for many years has been considered an important part of the American market, received 4,470,034 net tons of anthracite in 1947, as compared to the 4,513,637 tons imported in 1946. Canada is justly considered the anthracite industry's secondary market, since it consumes about 8 percent of the total anthracite shipments. Toronto is exceeded in the consumption of anthracite only by New York City and Philadelphia, and in the 1946–47 coal year this Canadian city received 1,196,478 tons. One of the principal reasons for our greatly increased exports to Canada in the last several years has been the inability of Great Britain to export anthracite to the Dominion in quantities approaching its prewar shipments. In 1947, exports of anthracite from Great Britain to Canada totaled only 51,660 net tons, compared with average annual shipments of 1,200,000 tons before the war. The great demand for Pennsylvania anthracite in Europe is also related with the low production of coal in Great Britain and with decreased output in the other European coal-producing countries.

Imports of anthracite into the United States are negligible and constitute but an insignificant part of our total consumption. Details on imports and exports are given in tables 38 and 39.

OUTLOOK

Strong demand for Pennsylvania anthracite should continue throughout the winter of 1948–49, and it is expected that the market will readily absorb all available supplies. Shipments to Canada should approach 4,500,000 net tons. Exports to Europe are expected to decline to approximately 1,800,000 tons in the 1948–49 coal year. The cooperation of the Anthracite Institute with architects and manufacturers of primary and auxiliary equipment for burning anthracite should be of material assistance to the anthracite industry in retaining old customers and obtaining new ones. It is expected that the extensive advertising campaign conducted under the auspices of the Anthracite Institute will greatly benefit the industry.

SOURCES AND ACKNOWLEDGMENTS

Annual statistics on the Pennsylvania anthracite industry are prepared, for the most part, from reports received direct from producers and shippers. As a result of the canvass, coverage is obtained for more than 99 percent of the tonnage, and information on the remainder is either obtained by personal visits by a representative of the Bureau of Mines or is educed from reliable collateral evidence. All information is furnished voluntarily by the respondents and, as is customary with statistical surveys of the Bureau, is treated confidentially.

In compiling the various data, 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

Production statistics contained in this chapter on the Pennsylvania anthracite industry include coal from deep mines, strip pits, culm banks, purchases from "bootleg" operators, and river (or creek) coal recovered from the streams draining the anthracite fields. The small quantity of semianthracite produced in Sullivan County (42,960 net tons in 1947) is included also for historical comparison. Total production from these sources in 1947 was 57,190,009 net tons, a 5-percent decline from the 1946 output of 60,506,873 tons. See tables 4 to 9 for production and shipments by regions, fields, and counties. Table 10 shows percentages, by regions, of various sizes in relation to total breaker product.

TABLE 4.—Pennsylvania anthracite produced, 1943–47, by fields, in net tons

[The figures of breaker product include a certain quantity of culm-bank coal, which amounted to 4,481,348 tons in 1947]

Field	1943	1944	1945	1946	1947
Eastern Middle:					
Breakers	6,140,224	5,905,623	[1] 5,005,245	5,057,619	4,270,240
Washeries	356,450	403,688	[1] 342,116	282,481	315,014
Total Eastern Middle	6,496,674	6,309,311	5,347,361	5,340,100	4,585,254
Western Middle:					
Breakers	12,577,769	12,721,704	11,540,524	13,040,147	12,147,528
Washeries	280,525	538,875	130,789	530,246	591,652
Dredges	442,608	385,137	308,976	362,423	411,804
Total Western Middle	13,300,902	13,645,716	11,980,289	13,932,816	13,150,984
Southern:					
Breakers	10,519,946	12,194,069	10,916,769	11,817,427	11,643,971
Washeries	1,486,803	2,091,473	1,373,578	1,386,125	237,131
Dredges	879,379	983,046	896,250	761,131	796,174
Total Southern	12,886,128	15,268,588	13,186,597	13,964,683	12,677,276
Northern:					
Breakers	[1] 27,417,425	27,794,639	[1] 23,503,306	26,227,918	25,831,439
Washeries	[1] 432,021	531,338	[1] 735,041	925,427	890,368
Dredges	12,750	4,554		8,840	11,728
Total Northern	27,862,196	28,330,531	24,238,347	27,162,185	26,733,535
Total, excluding Sullivan County:					
Breakers	[1] 56,655,364	58,616,035	[1] 50,965,844	56,143,111	53,893,178
Washeries	[1] 2,555,799	3,565,374	[1] 2,581,524	3,124,279	2,034,165
Dredges	1,334,737	1,372,737	1,205,226	1,132,394	1,219,706
Total, excluding Sullivan County	60,545,900	63,554,146	54,752,594	60,399,784	57,147,049
Sullivan County:					
Breakers	97,720	147,217	149,505	85,402	[1] 42,960
Washeries			31,810	21,687	(1)
Total Sullivan County	97,720	147,217	181,315	107,089	42,960
Grand total	60,643,620	63,701,363	54,933,909	60,506,873	57,190,000

[1] Small quantity of washery coal included with breaker.

TABLE 5.—Pennsylvania anthracite shipped, sold locally, and used as colliery fuel in 1947, 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	8, 504, 515	$63, 207, 656	368, 778	$3, 186, 051	290, 385	$1, 409, 452	9, 163, 678	$67, 803, 159
Washeries	299, 099	1, 163, 277	16, 219	135, 788	1, 110	5, 084	316, 428	1, 304, 149
Dredges	46, 478	93, 431					46, 478	93, 431
Total Lehigh	8, 850, 092	64, 464, 364	384, 997	3, 321, 839	291, 495	1, 414, 536	9, 526, 584	69, 200, 739
Schuylkill:								
Breakers	17, 535, 001	122, 270, 159	1, 141, 596	8, 830, 049	221, 464	505, 765	18, 898, 061	131, 605, 973
Washeries	823, 081	2, 625, 627	3, 226	18, 430	1, 062	3, 513	827, 369	2, 647, 570
Dredges	914, 649	1, 944, 936	219, 888	391, 327	26, 963	23, 394	1, 161, 500	2, 359, 657
Total Schuylkill	19, 272, 731	126, 840, 722	1, 364, 710	9, 239, 806	249, 489	532, 672	20, 886, 930	136, 613, 200
Wyoming:								
Breakers	22, 003, 815	181, 933, 308	2, 464, 128	19, 010, 556	1, 363, 496	3, 459, 543	25, 831, 439	204, 403, 407
Washeries	887, 053	2, 484, 320	3, 070	11, 440	245	854	890, 368	2, 496, 614
Dredges	8, 900	20, 474	2, 828	6, 506			11, 728	26, 980
Total Wyoming	22, 899, 768	184, 438, 102	2, 470, 026	19, 028, 502	1, 363, 741	3, 460, 397	26, 733, 535	206, 927, 001
Total, excluding Sullivan County:								
Breakers	48, 043, 331	367, 411, 123	3, 974, 502	31, 026, 656	1, 875, 345	5, 374, 760	53, 893, 178	403, 812, 539
Washeries	2, 009, 233	6, 273, 224	22, 515	165, 658	2, 417	9, 451	2, 034, 165	6, 448, 333
Dredges	970, 027	2, 058, 841	222, 716	397, 833	26, 963	23, 394	1, 219, 706	2, 480, 068
Total	51, 022, 591	375, 743, 188	4, 219, 733	31, 590, 147	1, 904, 725	5, 407, 605	57, 147, 049	412, 740, 940
Sullivan County: [2]								
Breakers [3]	29, 822	194, 957	13, 138	83, 589			42, 960	278, 546
Grand total: 1947	51, 052, 413	375, 938, 145	4, 232, 871	31, 673, 736	1, 904, 725	5, 407, 605	57, 190, 009	413, 019, 486
1946	54, 108, 587	376, 908, 404	4, 435, 536	31, 487, 550	1, 962, 750	5, 021, 116	60, 506, 873	413, 417, 070
Change, 1947—percent	−5.6	−0.3	−4.6	+0.6	−3.0	+7.7	−5.5	−0.1

[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] 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.
[3] Includes a small quantity of washery coal.

TABLE 6.—Pennsylvania anthracite produced in 1947, 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	620, 615	5, 087, 310	2, 684, 971	770, 782		9, 163, 678
Washeries		19, 547	23, 162	273, 719		316, 428
Dredges					46, 478	46, 478
Total Lehigh	620, 615	5, 106, 857	2, 708, 133	1, 044, 501	46, 478	9, 526, 584
Schuylkill:						
Breakers	1, 993, 571	6, 398, 941	7, 320, 715	3, 184, 834		18, 898, 061
Washeries			65, 187	762, 182		827, 369
Dredges					1, 161, 500	1, 161, 500
Total Schuylkill	1, 993, 571	6, 398, 941	7, 385, 902	3, 947, 016	1, 161, 500	20, 886, 930
Wyoming:						
Breakers	13, 439, 825	9, 362, 784	2, 506, 010	522, 820		25, 831, 439
Washeries		3, 971		886, 397		890, 368
Dredges					11, 728	11, 728
Total Wyoming	13, 439, 825	9, 366, 755	2, 506, 010	1, 409, 217	11, 728	26, 733, 535
Total, excluding Sullivan County:						
Breakers	16, 054, 011	20, 849, 035	12, 511, 696	4, 478, 436		53, 893, 178
Washeries		23, 518	88, 349	1, 922, 298		2, 034, 165
Dredges					1, 219, 706	1, 219, 706
Total	16, 054, 011	20, 872, 553	12, 600, 045	6, 400, 734	1, 219, 706	57, 147, 049
Sullivan County: Breakers [1]		36, 548	3, 500	2, 912		42, 960
Grand total	16, 054, 011	20, 909, 101	12, 603, 545	6, 403, 646	1, 219, 706	57, 190, 009

[1] Small quantity of washery coal included with breaker.

TABLE 7.—Pennsylvania anthracite produced in 1947, 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	620,615	2,021,311	1,379,163	249,151		4,270,240
Washeries		19,547	23,162	272,305		315,014
Total Eastern Middle	620,615	2,040,858	1,402,325	521,456		4,585,254
Western Middle:						
Breakers	1,478,799	4,864,786	4,196,777	1,607,166		12,147,528
Washeries			2,597	589,055		591,652
Dredges					411,804	411,804
Total Western Middle	1,478,799	4,864,786	4,199,374	2,196,221	411,804	13,150,984
Southern:						
Breakers	514,772	4,600,154	4,429,746	2,099,299		11,643,971
Washeries			62,590	174,541		237,131
Dredges					796,174	796,174
Total Southern	514,772	4,600,154	4,492,336	2,273,840	796,174	12,677,276
Northern:						
Breakers	13,439,825	9,362,784	2,506,010	522,820		25,831,439
Washeries		3,971		886,397		890,368
Dredges					11,728	11,728
Total Northern	13,439,825	9,366,755	2,506,010	1,409,217	11,728	26,733,535
Total, excluding Sullivan County:						
Breakers	16,054,011	20,849,035	12,511,696	4,478,436		53,893,178
Washeries		23,518	88,349	1,922,298		2,034,165
Dredges					1,219,706	1,219,706
Total	16,054,011	20,872,553	12,600,045	6,400,734	1,219,706	57,147,049
Sullivan County: Breakers [1]		36,548	3,500	2,912		42,960
Grand total	16,054,011	20,909,101	12,603,545	6,403,646	1,219,706	57,190,009

[1] Small quantity of washery coal included with breaker.

TABLE 8.—Pennsylvania anthracite shipped in 1947, by regions and sizes

Size	Breaker shipments [1]						Washery shipments	Dredge shipments	Grand total
					Total				
	Lehigh region	Schuylkill region	Wyoming region	Sullivan County [2]	Excluding Sullivan County	Including Sullivan County [2]			
NET TONS									
Lump [3] and Broken	54, 892	129, 449	64, 017	----------	248, 358	248, 358	----------	----------	248, 358
Egg	426, 571	922, 622	1, 420, 440	----------	2, 769, 633	2, 769, 633	----------	----------	2, 769, 633
Stove	1, 700, 449	2, 793, 458	5, 942, 088	2, 548	10, 435, 995	10, 438, 543	15, 727	----------	10, 454, 270
Chestnut	1, 848, 008	3, 712, 304	6, 498, 296	8, 841	12, 058, 608	12, 067, 449	104, 127	----------	12, 171, 576
Pea	698, 197	1, 341, 034	1, 488, 882	4, 602	3, 528, 113	3, 532, 715	33, 340	359	3, 566, 414
Total domestic	4, 728, 117	8, 898, 867	15, 413, 723	15, 991	29, 040, 707	29, 056, 698	153, 194	359	29, 210, 251
Buckwheat No. 1	1, 145, 466	2, 471, 532	2, 878, 612	3, 044	6, 495, 610	6, 498, 654	42, 295	16, 127	6, 557, 076
Buckwheat No. 2 (Rice)	743, 421	1, 501, 738	1, 443, 193	178	3, 688, 352	3, 688, 530	40, 727	15, 468	3, 744, 725
Buckwheat No. 3 (Barley)	859, 733	2, 559, 918	1, 500, 225	----------	4, 919, 876	4, 919, 876	117, 595	200, 001	5, 237, 472
Buckwheat No. 4	476, 475	1, 583, 825	466, 252	----------	2, 526, 552	2, 526, 552	1, 071, 028	462, 413	4, 059, 993
Other (including silt)	551, 303	519, 121	301, 810	10, 609	1, 372, 234	1, 382, 843	584, 394	275, 659	2, 242, 896
Total steam	3, 776, 398	8, 636, 134	6, 590, 092	13, 831	19, 002, 624	19, 016, 455	1, 856, 039	969, 668	21, 842, 162
Grand total	8, 504, 515	17, 535, 001	22, 003, 815	29, 822	48, 043, 331	48, 073, 153	2, 009, 233	970, 027	51, 052, 413
VALUE									
Lump [3] and Broken	$560, 603	$1, 307, 961	$632, 148	----------	$2, 500, 712	$2, 500, 712	----------	----------	$2, 500, 712
Egg	4, 365, 894	9, 325, 687	14, 216, 060	----------	27, 907, 641	27, 907, 641	----------	----------	27, 907, 641
Stove	17, 395, 752	27, 983, 016	59, 307, 170	$28, 951	104, 685, 938	104, 714, 889	$166, 074	----------	104, 880, 963
Chestnut	18, 931, 891	37, 371, 276	64, 830, 427	90, 195	121, 133, 594	121, 223, 789	998, 674	----------	122, 222, 463
Pea	5, 896, 046	10, 959, 068	12, 188, 735	42, 709	29, 043, 849	29, 086, 558	266, 887	$1, 764	29, 355, 209
Total domestic	47, 150, 186	86, 947, 008	151, 174, 540	161, 855	285, 271, 734	285, 433, 589	1, 431, 635	1, 764	286, 866, 988
Buckwheat No. 1	6, 839, 580	14, 239, 861	16, 718, 950	12, 103	37, 798, 391	37, 810, 494	241, 446	51, 772	38, 103, 712
Buckwheat No. 2 (Rice)	3, 668, 254	7, 173, 796	6, 979, 143	559	17, 821, 193	17, 821, 752	194, 353	66, 513	18, 082, 618
Buckwheat No. 3 (Barley)	3, 073, 318	9, 005, 909	5, 444, 226	----------	17, 523, 453	17, 523, 453	439, 507	466, 926	18, 429, 886
Buckwheat No. 4	1, 260, 400	3, 783, 507	968, 893	----------	6, 012, 800	6, 012, 800	2, 614, 936	948, 592	9, 576, 328
Other (including silt)	1, 215, 918	1, 120, 078	647, 556	20, 440	2, 983, 552	3, 003, 992	1, 351, 347	523, 274	4, 878, 613
Total steam	16, 057, 470	35, 323, 151	30, 758, 768	33, 102	82, 139, 389	82, 172, 491	4, 841, 589	2, 057, 077	89, 071, 157
Grand total	63, 207, 656	122, 270, 159	181, 933, 308	194, 957	367, 411, 123	367, 606, 080	6, 273, 224	2, 058, 841	375, 938, 145

See footnotes at end of table.

TABLE 8.—Pennsylvania anthracite shipped in 1947, by regions and sizes—Continued

Size	Breaker shipments [1]						Washery shipments	Dredge shipments	Grand total
	Lehigh region	Schuylkill region	Wyoming region	Sullivan County [2]	Total				
					Excluding Sullivan County	Including Sullivan County [2]			
AVERAGE VALUE PER TON									
Lump [3] and Broken	$10.21	$10.10	$9.87	----------	$10.07	$10.07	----------	----------	$10.07
Egg	10.23	10.11	10.01	----------	10.08	10.08	----------	----------	10.08
Stove	10.23	10.02	9.98	$11.36	10.03	10.03	$10.56	----------	10.03
Chestnut	10.24	10.07	9.98	10.20	10.05	10.05	9.59	----------	10.04
Pea	8.44	8.17	8.19	9.28	8.23	8.23	8.01	$4.91	8.23
Total domestic	9.97	9.77	9.81	10.12	9.82	9.82	9.35	4.91	9.82
Buckwheat No. 1	5.97	5.76	5.81	3.98	5.82	5.82	5.71	3.21	5.81
Buckwheat No. 2 (Rice)	4.93	4.78	4.84	3.14	4.83	4.83	4.77	4.30	4.83
Buckwheat No. 3 (Barley)	3.57	3.52	3.63	----------	3.56	3.56	3.74	2.33	3.52
Buckwheat No. 4	2.65	2.39	2.08	----------	2.38	2.38	2.44	2.05	2.36
Other (including silt)	2.21	2.16	2.15	1.93	2.17	2.17	2.31	1.90	2.18
Total steam	4.25	4.09	4.67	2.39	4.32	4.32	2.61	2.12	4.08
Grand total	7.43	6.97	8.27	6.54	7.65	7.65	3.12	2.12	7.36

[1] Figures of shipments from breakers include some culm-bank coal handled in breakers.
[2] Small quantity of washery coal included with breaker.
[3] Quantity of Lump included is insignificant.

TABLE 9.—Pennsylvania anthracite produced in 1947, 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
Berks, Lancaster, Lebanon, Northampton, and Snyder [2]	295, 137	$599, 703	18, 244	$31, 493	2	$5	313, 383	$631, 201
Carbon	3, 120, 167	22, 417, 290	54, 092	466, 039	67, 269	453, 355	3, 241, 528	23, 336, 684
Columbia	1, 340, 803	10, 759, 261	72, 873	471, 071	44, 168	97, 334	1, 457, 844	11, 327, 666
Dauphin	136, 961	396, 842	167, 565	306, 296	25, 776	22, 206	330, 302	725, 344
Lackawanna	6, 881, 608	53, 000, 926	1, 093, 327	8, 986, 800	347, 689	1, 114, 063	8, 322, 624	63, 101, 789
Luzerne	18, 837, 669	153, 772, 543	1, 611, 501	12, 090, 406	1, 162, 431	2, 895, 788	21, 611, 601	168, 758, 737
Northumberland	5, 897, 819	36, 682, 712	516, 000	4, 087, 600	37, 629	73, 434	6, 451, 448	40, 843, 746
Schuylkill	14, 374, 011	97, 743, 910	684, 432	5, 133, 213	218, 866	748, 278	15, 277, 309	103, 625, 401
Sullivan	29, 822	194, 957	13, 138	83, 589			42, 960	278, 546
Susquehanna and Wayne	138, 416	370, 001	1, 699	17, 229	895	3, 142	141, 010	390, 372
Total	51, 052, 413	375, 938, 145	4, 232, 871	31, 673, 736	1, 904, 725	5, 407, 605	57, 190, 009	413, 019, 486

[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 10.—Sizes of Pennsylvania anthracite shipped from breakers, 1945–47, 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		
	1945	1946	1947	1945	1946	1947	1945	1946	1947
Lump [1] and Broken	0.6	0.6	0.7	0.1	0.1	0.7	0.2	0.2	0.3
Egg	5.8	6.5	5.0	5.9	5.2	5.3	7.4	7.3	6.5
Stove	19.3	19.2	20.0	16.1	17.1	15.9	27.6	27.2	27.0
Chestnut	22.1	21.5	21.7	21.8	22.7	21.2	30.2	30.0	29.5
Pea	8.9	8.2	8.2	8.9	8.2	7.6	6.3	6.5	6.8
Total domestic	56.7	56.0	55.6	52.8	53.3	50.7	71.7	71.2	70.1
Buckwheat No. 1	13.6	13.7	13.5	15.4	15.0	14.1	13.3	12.9	13.1
Buckwheat No. 2 (Rice)	9.2	9.2	8.7	9.5	8.5	8.6	6.4	6.5	6.5
Buckwheat No. 3 (Barley)	9.9	10.4	10.1	14.3	13.9	14.6	6.4	6.3	6.8
Buckwheat No. 4	3.5	3.3	5.6	6.5	6.8	9.0	1.4	2.1	2.1
Other (including silt)	7.1	7.4	6.5	1.5	2.5	3.0	.8	1.0	1.4
Total steam	43.3	44.0	44.4	47.2	46.7	49.3	28.3	28.8	29.9

Size	Sullivan County			Total					
				Excluding Sullivan County			Including Sullivan County		
Lump [1] and Broken				0.3	0.3	0.5	0.3	0.3	0.5
Egg				6.5	6.3	5.8	6.5	6.3	5.8
Stove	25.3	18.9	8.5	21.7	22.0	21.7	21.7	22.0	21.7
Chestnut	28.4	20.8	29.7	25.5	25.8	25.1	25.5	25.8	25.1
Pea	12.7	12.3	15.4	7.8	7.4	7.3	7.8	7.4	7.3
Total domestic	66.4	52.0	53.6	61.8	61.8	60.4	61.8	61.8	60.4
Buckwheat No. 1	13.0	16.4	10.2	14.1	13.9	13.5	14.1	13.9	13.5
Buckwheat No. 2 (Rice)	2.3	30.2	0.6	8.1	7.8	7.7	8.1	7.8	7.7
Buckwheat No. 3 (Barley)				10.0	9.8	10.3	9.9	9.8	10.2
Buckwheat No. 4				3.6	4.0	5.3	3.6	4.0	5.3
Other (including silt)	18.3	1.4	35.6	2.4	2.7	2.8	2.5	2.7	2.9
Total steam	33.6	48.0	46.4	38.2	38.2	39.6	38.2	38.2	39.6

[1] Quantity of Lump included is insignificant.

Before 1941, the Bureau of Mines did not include "bootleg" coal in production statistics of the anthracite industry; however, in 1941 some recognized operators began purchasing run-of-mine coal produced in "bootleg" holes for preparation at their plants and reported the cleaned product with their production. In 1946 these purchases totaled 352,112 net tons and in 1947, 604,060 tons. Segregation of this purchased "bootleg" coal from the output of the recognized industry would be impossible; it is, therefore, included in the various production tables in the Minerals Yearbook chapters on Pennsylvania anthracite for the years 1941–47. No attempt has been made to include in production figures any "bootleg" coal other than that purchased by recognized operators. To compute output per man per day for the industry in 1941–47 it was necessary to deduct "bootleg" purchases from the total production reported by the recognized industry, because adequate data are not available on the number of man-days required to produce a ton of "bootleg" coal. Details on this procedure are discussed further under Employment.

By Weeks and Months.—Tables 11 and 12 summarize weekly and monthly production of anthracite. Statistics on current output are estimated from records of carloadings and from reports obtained from trade sources. The weekly and monthly figures have been adjusted to the annual total as ascertained by direct mail canvass of the operators.

TABLE 11.—Estimated weekly production of Pennsylvania anthracite in 1947

Week ended—	Net tons
Jan. 4	[1] 505,000
11	1,219,000
18	1,170,000
25	1,202,000
Feb. 1	1,244,000
8	1,111,000
15	973,000
22	1,053,000
Mar. 1	1,103,000
8	1,056,000
15	1,199,000
22	1,169,000
29	1,194,000
Apr. 5	807,000
12	978,000
19	1,047,000
26	1,075,000
May 3	1,098,000
10	1,060,000
17	1,078,000
24	1,088,000
31	838,000
June 7	1,112,000
14	1,159,000
21	1,225,000
28	1,109,000
July 5	98,000
12	1,011,000
July 19	1,120,000
26	1,121,000
Aug. 2	1,130,000
9	1,183,000
16	1,063,000
23	1,198,000
30	1,204,000
Sept. 6	949,000
13	1,223,000
20	1,260,000
27	1,282,000
Oct. 4	1,293,000
11	1,335,000
18	1,227,000
25	1,234,000
Nov. 1	940,000
8	1,189,000
15	1,101,000
22	1,217,000
29	1,061,000
Dec. 6	1,185,000
13	1,202,000
20	1,222,000
27	748,000
31	[1] 522,000
Calendar year	57,190,000

[1] Figures represent output of working days in that part of week included in the calendar year 1947. Preliminary production for week of Jan. 3, 1948, was 786,000 tons. Revised total for week of Jan. 4, 1947, was 882,000 tons.

TABLE 12.—Estimated monthly production of Pennsylvania anthracite, 1940–47, in thousands of net tons [1]

Month	1940	1941	1942	1943	1944	1945	1946	1947
January	5,783	5,162	4,560	4,466	4,970	4,219	4,968	5,172
February	3,648	4,596	4,801	5,203	5,811	4,471	4,774	4,254
March	3,881	4,765	5,116	5,855	5,512	5,269	5,476	4,984
April	3,853	3,317	5,185	5,337	5,141	5,124	5,069	4,293
May	4,070	4,001	4,873	5,219	5,781	2,083	5,453	4,564
June	4,492	5,072	5,153	3,244	5,558	5,667	3,625	4,624
July	4,534	4,855	5,374	5,698	4,905	4,944	5,248	4,098
August	3,883	5,441	5,212	5,653	5,558	4,656	5,428	5,011
September	4,172	5,334	5,459	5,474	5,380	4,640	5,033	5,158
October	4,355	5,580	5,132	5,359	5,538	5,304	5,393	5,524
November	3,980	3,974	4,824	4,140	5,029	4,559	4,975	4,629
December	4,834	4,271	4,639	4,996	4,518	3,998	5,065	4,879
	51,485	56,368	60,328	60,644	63,701	54,934	60,507	57,190

[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. Includes in 1941–47 some "bootleg" coal purchased by legitimate operators and prepared at their breakers.

Culm-Bank Coal.—Production of anthracite from culm banks has been declining since the record output of 9,600,180 net tons in 1944 and totaled only 6,403,646 tons in 1947. The reserves of bank coal will diminish considerably during the next few years as the available coal is shipped to market, and it is to be expected that future output from this source will drop substantially. Tables 6, 7, 13, and 14 give details on culm-bank output.

TABLE 13.—Production of Pennsylvania anthracite from culm banks, by regions, 1933–47, in net tons

Year	Lehigh	Schuylkill	Wyoming	Sullivan County	Total
1933	301, 222	1, 662, 959	1, 074, 059		3, 038, 240
1934	185, 213	1, 332, 503	625, 516		2, 143, 232
1935	192, 790	1, 748, 960	760, 718		2, 702, 468
1936	136, 058	2, 532, 116	525, 798		3, 193, 972
1937	101, 239	2, 178, 482	442, 878		2, 722, 599
1938	53, 037	1, 941, 896	345, 511		2, 340, 444
1939	64, 180	2, 159, 548	360, 086		2, 583, 814
1940	192, 878	2, 109, 557	480, 603		2, 783, 038
1941	326, 755	2, 881, 049	449, 062		3, 656, 866
1942	745, 934	3, 529, 757	459, 373		4, 735, 064
1943	1, 944, 047	4, 577, 917	1, 041, 841	19, 893	7, 583, 698
1944	2, 125, 317	5, 787, 036	1, 673, 994	13, 833	9, 600, 180
1945	2, 086, 864	4, 936, 907	1, 728, 440	34, 448	8, 786, 659
1946	1, 875, 590	4, 752, 141	1, 780, 874	22, 487	8, 431, 092
1947	1, 044, 501	3, 947, 016	1, 409, 217	2, 912	6, 403, 646

TABLE 14.—Culm-bank coal put through breakers, 1943–47, by fields, in net tons

Year	Northern	Eastern Middle	Western Middle	Southern	Total
1943	[1] [2] 629, 713	1, 087, 648	2, 102, 124	1, 208, 414	[1] 5, 027, 899
1944	[2] 1, 156, 489	743, 867	2, 528, 221	1, 699, 875	6, 128, 452
1945	[1] [2] 996, 037	[1] 698, 876	2, 335, 200	2, 206, 187	[1] 6, 236, 300
1946	[2] 856, 247	708, 012	1, 902, 369	1, 845, 163	5, 311, 791
1947	[1] 525, 732	249, 151	1, 607, 166	2, 099, 299	4, 481, 348

[1] Includes some washery coal.
[2] A small quantity of culm-bank coal was put through breakers in Sullivan County.

Historical Statistics.—Historical data on the Pennsylvania anthracite industry, 1890–1947, are given in table 15.

TABLE 15.—Statistical trends in the Pennsylvania anthracite industry, 1890–1947

Year	Production (net tons)	Value of production	Average value per net ton	Exports [1] (net tons)	Imports [1] (net tons)	Apparent consumption [2] (net tons)	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 [3] (net tons)	Quantity produced by stripping [4] (net tons)	Quantity loaded mechanically underground [5] (net tons)
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	----
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

See footnotes at end of table.

TABLE 15.—Statistical trends in the Pennsylvania anthracite industry, 1890–1947—Continued

Year	Production (net tons)	Value of production	Average value per net ton	Exports [1] (net tons)	Imports [1] (net tons)	Apparent consumption [2] (net tons)	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 [3] (net tons)	Quantity produced by stripping [4] (net tons)	Quantity loaded mechanically underground [5] (net tons)
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
1946	[8] 60, 506, 873	413, 417, 070	6. 83	6, 497, 245	9, 556	53, 900, 000	78, 145	271	[9] 2. 84	770	1, 232, 828	12, 858, 930	15, 619, 162
1947	[8] 57, 190, 009	413, 019, 486	7. 22	8, 509, 995	10, 350	48, 200, 000	78, 600	259	[9] 2. 78	720	1, 209, 983	12, 603, 545	16, 054, 011

[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.

"Bootleg" Coal.—According to the Anthracite Committee, the production of "bootleg" coal in 1947 totaled 1,634,635 net tons compared with 1,448,529 tons in 1946. The number of active holes on March 31, 1948, was 835 compared with 863 on the same date in 1947, and the number of men employed was 2,825 and 2,817, respectively.

The increase in "bootleg" production over 1946 is not so great as some observers had expected because there is little incentive for a man to work at a "bootleg" operation with the legitimate industry working full time. Then, too, it has become increasingly difficult to find good "bootleg" holes, because the choice locations have been exploited and stripping operations have removed many potential sites. Another deterrent has been the difficulty some "bootleg" operators encountered in meeting the rigid inspection standards created under the State Small Mines Act, which became effective September 1, 1947.

Data on "bootleg" operations are shown in tables 16 and 17.

TABLE 16.—Production, purchases by recognized operators, and fatalities at "bootleg" operations in the Pennsylvania anthracite industry, 1941–47

Year	Production (net tons) [1]	Purchased for preparation by recognized operations (net tons) [2]	Number of fatalities [1]	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	1945	1,026,000	260,342	16
1942	3,931,000	2,616,839	45	1946	1,448,529	352,112	19
1943	1,912,467	1,265,617	22	1947	1,634,635	604,060	15
1944	1,332,957	506,842	21				

[1] Anthracite Committee, Harrisburg, Pa.
[2] As reported to Federal Bureau of Mines.

TABLE 17.—Number of men employed in "bootleg" operations in the Pennsylvania anthracite industry, 1941–48

[Anthracite Committee, Harrisburg, Pa.]

Date of survey	Number of "bootleg" operations	Average number of men employed	Date of survey	Number of "bootleg" operations	Average number of men employed
Mar. 31, 1941	3,006	10,762	Mar. 31, 1944	652	2,220
May 1, 1942	2,029	7,554	Mar. 7, 1945	502	1,806
Dec. 15, 1942	1,363	4,967	Mar. 30, 1946	526	1,939
Apr. 20, 1943	1,065	3,607	Mar. 31, 1947	863	2,817
Oct. 14, 1943	791	2,725	Mar. 31, 1948	835	2,825

VALUE OF SALES

Increased mining costs, such as higher wages and supplies, have made it necessary for producers to advance anthracite prices materially during the last several years. A new agreement between the anthracite operators and the United Mine Workers of America, signed in July 1947, granted a substantial wage raise to the mine workers; and, largely because of this increase, the average sales realization on breaker shipments advanced from $7.25 per ton in 1946 to $7.65 in 1947. Including colliery fuel, washery coal, local sales, and dredge coal, the average per ton value of 1947 production is $7.22 compared with $6.83 in 1946. Average realization figures shown in this study represent value at the breaker, washery, or dredge, as reported by the operating companies. The companies are requested to "estimate value of the product not sold" and to "exclude selling expenses" in making their reports. See tables 18 and 19 for sales realization and value data.

TABLE 18.—Average sales realization per net ton on Pennsylvania anthracite shipments from breakers, 1945–47, by regions and sizes

[Value does not include margins of separately incorporated sales companies]

Size	Lehigh region			Schuylkill region			Wyoming region		
	1945	1946	1947	1945	1946	1947	1945	1946	1947
Lump [1] and Broken	$7.98	$9.14	$10.21	$8.17	$9.43	$10.10	$8.00	$9.26	$9.87
Egg	8.10	9.32	10.23	8.18	9.48	10.11	8.11	9.33	10.01
Stove	8.11	9.42	10.23	8.18	9.52	10.02	8.07	9.33	9.98
Chestnut	8.09	9.40	10.24	8.20	9.54	10.07	8.09	9.34	9.98
Pea	6.56	7.72	8.44	6.66	7.89	8.17	6.60	7.74	8.19
Total domestic	7.86	9.15	9.97	7.93	9.27	9.77	7.95	9.19	9.81
Buckwheat No. 1	4.76	5.51	5.97	4.80	5.55	5.76	4.79	5.51	5.81
Buckwheat No. 2 (Rice)	3.87	4.50	4.93	3.89	4.54	4.78	3.95	4.52	4.84
Buckwheat No. 3 (Barley)	2.67	3.09	3.57	2.61	3.09	3.52	2.72	3.16	3.63
Buckwheat No. 4	2.02	2.26	2.65	1.81	2.14	2.39	1.82	1.85	2.08
Other (including silt)	1.62	1.95	2.21	1.48	1.83	2.16	1.48	1.86	2.15
Total steam	3.36	3.88	4.25	3.43	3.94	4.09	3.89	4.38	4.67
Total all sizes	5.91	6.83	7.43	5.81	6.78	6.97	6.80	7.81	8.27

Size	Sullivan County			Total—					
				Excluding Sullivan County			Including Sullivan County		
Lump [1] and Broken	------	------	------	$8.02	$9.23	$10.07	$8.02	$9.23	$10.07
Egg	------	------	------	8.13	9.38	10.08	8.13	9.38	10.08
Stove	$7.41	$9.19	$11.36	8.11	9.40	10.03	8.10	9.40	10.03
Chestnut	7.53	9.13	10.20	8.12	9.42	10.05	8.12	9.42	10.05
Pea	6.40	7.95	9.28	6.62	7.79	8.23	6.62	7.79	8.23
Total domestic	7.27	8.87	10.12	7.93	9.21	9.82	7.93	9.21	9.82
Buckwheat No. 1	4.08	4.70	3.98	4.79	5.53	5.82	4.79	5.53	5.82
Buckwheat No. 2 (Rice)	2.55	2.62	3.14	3.91	4.52	4.83	3.91	4.52	4.83
Buckwheat No. 3 (Barley)	------	------	------	2.65	3.11	3.56	2.65	3.11	3.56
Buckwheat No. 4	------	------	------	1.85	2.09	2.38	1.85	2.09	2.38
Other (including silt)	2.27	1.75	1.93	1.57	1.90	2.17	1.58	1.90	2.17
Total steam	2.99	3.31	2.39	3.56	4.08	4.32	3.56	4.08	4.32
Total all sizes	5.83	6.20	6.54	6.26	7.25	7.65	6.26	7.25	7.65

[1] Quantity of Lump included is insignificant.

TABLE 19.—Average value per ton of Pennsylvania anthracite shipments, local sales, colliery fuel, and total production, 1946–47, by regions [1]

[Values include washery and dredge coal]

Region	1946				1947			
	Shipments	Local sales	Colliery fuel	Total production	Shipments	Local sales	Colliery fuel	Total production
Lehigh	$6.72	$8.24	$4.22	$6.73	$7.28	$8.63	$4.85	$7.26
Schuylkill	6.36	6.47	2.33	6.32	6.58	6.77	2.14	6.54
Wyoming	7.62	7.19	2.26	7.30	8.05	7.70	2.54	7.74
Total, excluding Sullivan County	6.97	7.10	2.56	6.83	7.36	7.49	2.84	7.22
Sullivan County	6.20	6.43	5.78	6.26	6.54	6.36		6.48
Grand total	6.97	7.10	2.56	6.83	7.36	7.48	2.84	7.22

[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.

SHIPMENTS

The data shown in table 20 are the fifth in a series on the distribution of Pennsylvania anthracite and were furnished to the Bureau of Mines by producers and wholesalers. Data supplied during the first three coal years of the series which started with the 1942–43 coal year, were submitted in compliance with Solid Fuels Administration for War Order 7, promulgated September 28, 1943, and were used by that Administration during the war period to insure an equitable distribution of the available supplies of anthracite. The data collected during the war years proved of such value that the industry requested the Bureau to continue the annual collection of similar data as a regular service to industry and the public. As shown in the table, 81 percent of total anthracite shipments was destined to the New England and Middle Atlantic States. Other States received 7 percent, shipments to Canada accounted for 8 percent, and exports to other foreign countries totaled 4 percent. These percentages vary considerably from those of recent coal years, largely because of the tremendous shipments to European countries. When the European market declines as it is expected to do soon, future percentages for shipments to the New England and Middle Atlantic States and Canada are expected to more nearly approximate those shown for previous years. Data for the 1947–48 coal year are given in table 21.

According to data compiled from records of the Pennsylvania State Department of Mines, anthracite shipments from mines to destinations in the United States declined 10 percent in 1947, as compared with 1946. In both 1946 and 1947, 85 percent of total United States shipments moved from the mines by rail and 15 percent by truck. Pennsylvania received 86 percent of truck shipments in 1947, and New Jersey and New York followed with 7 and 6 percent, respectively. Anthracite rail shipments, by States of destination for 1944–47, are shown in table 22 and truck movement in 1947, by months and by States of destination, in table 23.

According to data compiled from records of the Massachusetts Division on the Necessaries of Life and the Association of American Railroads, New England rail receipts of Pennsylvania anthracite in

TABLE 20.—Shipments of Pennsylvania anthracite, April 1, 1946–March 31, 1947, by States, Provinces, and countries of destination, in net tons

Destination	Domestic sizes						Steam sizes						Total all sizes	Percent of total
	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		
United States:														
New England States:														
Connecticut	1,060	59,770	458,080	512,470	64,095	1,095,475	79,368	38,632	32,581	2,121	55	152,757	1,248,232	2.22
Maine		48,523	148,090	129,507	9,154	335,274	20,105	11,679		778	2,298	34,860	370,134	.66
Massachusetts	1,383	377,348	1,191,654	751,513	72,372	2,394,270	138,970	89,406	117,207	50,688	4,414	400,685	2,794,955	4.97
New Hampshire		35,229	109,417	84,029	7,253	235,928	26,067	16,169	86,550	820		129,606	365,534	.65
Rhode Island		31,014	149,559	115,711	12,972	309,256	18,598	11,836			9	30,443	339,699	.60
Vermont	512	21,472	109,357	83,704	10,312	225,357	40,297	15,838	20,452	590		77,177	302,534	.54
Total New England States	2,955	573,356	2,166,157	1,676,934	176,158	4,595,560	323,405	183,560	256,790	54,997	6,776	825,528	5,421,088	9.64
Middle Atlantic States:														
New Jersey	9,091	139,076	1,101,123	2,157,382	619,912	4,026,584	943,230	665,192	1,202,351	398,773	115,544	3,325,090	7,351,674	13.07
New York	25,175	1,072,271	4,067,997	3,916,664	1,368,320	10,450,427	3,809,200	1,293,379	1,203,388	237,650	258,851	6,802,468	17,252,895	30.66
Pennsylvania [1]	95,559	216,936	1,361,865	3,342,230	2,450,843	7,467,433	1,500,377	1,618,825	2,661,303	1,735,476	639,150	8,155,131	15,622,564	27.76
Total Middle Atlantic States	129,825	1,428,283	6,530,985	9,416,276	4,439,075	21,944,444	6,252,807	3,577,396	5,067,042	2,371,899	1,013,545	18,282,689	40,227,133	71.49
South Atlantic States: [2]														
Delaware	322	12,968	87,542	198,743	23,787	323,362	11,155	9,341	18,173	8,324	6,980	53,973	377,335	0.67
District of Columbia	54	17,958	98,968	118,370	18,548	253,898	26,598	1,475	52	190	181	28,496	282,394	.50
Maryland	1,444	50,970	300,591	336,488	68,803	758,296	119,957	12,458	56,520	5,477	447	194,859	953,155	1.70
Virginia		10,017	39,277	50,528	5,571	105,393	25,017	150	518	53	2,973	28,711	134,104	.24
Total South Atlantic States	1,820	91,913	526,378	704,129	116,709	1,440,949	182,727	23,424	75,263	14,044	10,581	306,039	1,746,988	3.11
Lake States: [3]														
Illinois	148	3,046	41,953	113,125	3,168	161,440	4,739	25,943	12,319	34,128	34,568	111,697	273,137	0.48
Michigan	237	28,663	126,331	128,152	2,723	286,106	6,050	16,242		52,494	13,764	88,550	374,656	.67
Minnesota		156	11,309	38,538	2,843	52,846	1,873	386			303	2,562	55,408	.10
Ohio	54	4,299	6,739	70,046	265	81,403	839	1,119	1,651	2,615	390	6,614	88,017	.16
Wisconsin		1,976	114,027	209,345	29,251	354,599	9,599	2,416		145,162	425,355	582,532	937,131	1.66
Total Lake States	439	38,140	300,359	559,206	38,250	936,394	23,100	46,106	13,970	234,399	474,380	791,955	1,728,349	3.07

All other States	308	3, 554	19, 596	147, 253	3, 793	174, 504	7, 354	1, 007	844	653	47, 369	57, 227	231, 731	.41
Total United States	135, 347	2, 135, 246	9, 543, 475	12, 503, 798	4, 773, 985	29, 091, 851	6, 789, 393	3, 831, 493	5, 413, 909	2, 675, 992	1. 552, 651	20, 263, 438	49, 355, 289	87. 72
Canada:														
Province:														
Ontario	11, 104	500, 082	1, 249, 570	1, 073, 397	124, 164	2, 958, 317	151, 960	89, 444	3, 404	386	7, 366	252, 560	3, 210, 877	5. 70
Quebec	299	98, 886	368, 888	226, 471	22, 914	717, 458	309, 361	167, 722	51, 006	9, 439	9, 544	547, 072	1, 264, 530	2. 25
Other Provinces	----------	14, 040	27, 361	43, 766	4, 610	89, 777	11, 122	6, 127	84	----------	50	17, 383	107, 160	.19
Total Canada [4]	11, 403	613, 008	1, 645, 819	1, 343, 634	151, 688	3, 765, 552	472, 443	263, 293	54, 494	9, 825	16, 960	817, 015	4, 582, 567	8. 14
Other countries: [5]	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	2, 329, 019	4. 14
Grand total [6]	146, 750	2, 748, 254	11, 189, 294	13, 847, 432	4, 925, 673	32, 857, 403	7, 261, 836	4, 094, 786	5, 468, 403	2, 685, 817	1, 569, 611	21, 080, 453	56, 266, 875	100. 00

[1] Includes "local sales."
[2] Shipments to other States generally referred to as being in the South Atlantic area are included in "all other States."
[3] Shipments to Indiana are included in "all other States."
[4] Shipments reported to final Canadian destinations were as shown—4,582,567 net tons. However, official data of U. S. Department of Commerce show total exports to Canada of 4,665,655 net tons during the 1946–47 coal year.
[5] Compiled from data of U. S. Department of Commerce.
[6] Size totals do not include exports of anthracite to countries other than Canada.

TABLE 21.—Shipments of Pennsylvania anthracite, April 1, 1947–March 31, 1948, by States, Provinces, and countries of destination, in net tons

Destinations	Domestic sizes: Broken	Domestic sizes: Egg	Domestic sizes: Stove	Domestic sizes: Chestnut	Domestic sizes: Pea	Domestic sizes: Total domestic sizes	Steam sizes: Buckwheat No. 1	Steam sizes: Buckwheat No. 2 (Rice)	Steam sizes: Buckwheat No. 3 (Barley)	Steam sizes: Buckwheat No. 4	Steam sizes: All other sizes	Steam sizes: Total steam sizes	Total all sizes	Percent of total
United States:														
New England States:														
Connecticut	693	33, 430	405, 821	442, 757	43, 710	926, 411	68, 115	33, 853	54, 575	----------	65	156, 608	1, 083, 019	1. 96
Maine	----------	29, 114	139, 041	113, 634	3, 945	285, 734	18, 493	10, 384	----------	----------	10	28, 887	314, 621	. 57
Massachusetts	3, 214	295, 485	1, 107, 121	658, 546	45, 505	2, 109, 871	123, 706	80, 376	69, 995	1, 171	3, 241	278, 489	2, 388, 360	4. 31
New Hampshire	----------	25, 146	96, 149	78, 531	5, 145	204, 971	23, 611	41, 018	87, 024	3, 537	105	155, 295	360, 266	. 65
Rhode Island	----------	21, 266	143, 638	111, 552	9, 117	285, 573	18, 276	13, 495	----------	50	2	31, 823	317, 396	. 57
Vermont	466	16, 573	91, 086	71, 311	7, 344	186, 780	32, 150	16, 701	19, 947	----------	----------	68, 798	255, 578	. 46
Total New England States	4, 373	421, 014	1, 982, 856	1, 476, 331	114, 766	3, 999, 340	284, 351	195, 827	231, 541	4, 758	3, 423	719, 900	4, 719, 240	8. 52
Middle Atlantic States:														
New Jersey	14, 286	110, 950	1, 009, 018	2, 025, 150	565, 698	3, 725, 102	815, 915	586, 061	1, 158, 728	423, 887	113, 028	3, 097, 619	6, 822, 721	12. 33
New York	27, 836	962, 702	3, 818, 879	3, 506, 799	1, 160, 788	9, 477, 004	3, 720, 665	1, 178, 783	1, 203, 160	224, 445	301, 851	6, 628, 904	16, 105, 908	29. 09
Pennsylvania [1]	105, 620	282, 913	1, 254, 340	3, 261, 289	2, 485, 151	7, 389, 313	1, 450, 528	1, 495, 974	2, 514, 316	2, 022, 602	1, 121, 322	8, 604, 742	15, 994, 055	28. 89
Total Middle Atlantic States	147, 742	1, 356, 565	6, 082, 237	8, 793, 238	4, 211, 637	20, 591, 419	5, 987, 108	3, 260, 818	4, 876, 204	2, 670, 934	1, 536, 201	18, 331, 265	38, 922, 684	70. 31
South Atlantic States: [2]														
Delaware	48	18, 820	76, 360	166, 179	23, 403	284, 810	9, 976	6, 488	18, 139	16, 013	8, 328	58, 944	343, 754	. 62
District of Columbia	35	16, 482	83, 177	91, 520	18, 208	209, 422	27, 706	1, 297	3	6	56	29, 068	238, 490	. 43
Maryland	1, 521	58, 707	233, 260	240, 023	46, 017	579, 528	83, 534	13, 005	45, 600	2, 714	10, 277	155, 130	734, 658	1. 33
Virginia	----------	13, 075	30, 414	38, 678	7, 227	89, 394	13, 978	339	110	22	341	14, 790	104, 184	. 19
Total South Atlantic States	1, 604	107, 084	423, 211	536, 400	94, 855	1, 163, 154	135, 194	21, 129	63, 852	18, 755	19, 002	257, 932	1, 421, 086	2. 57
Lake States: [3]														
Illinois	462	21, 462	46, 694	102, 132	1, 948	172, 698	1, 184	29, 191	14, 118	25, 293	17, 557	87, 343	260, 041	. 47
Michigan	450	48, 468	138, 934	105, 547	4, 157	297, 556	2, 128	12, 077	----------	84, 689	64, 263	163, 157	460, 713	. 83
Minnesota	----------	331	11, 785	24, 407	2, 641	39, 164	1, 934	447	----------	9, 285	133	11, 799	50, 963	. 09
Ohio	817	6, 711	5, 551	59, 087	900	73, 066	377	1, 085	1, 941	538	43, 337	47, 278	120, 344	. 22
Wisconsin	141	1, 155	131, 480	246, 257	29, 136	408, 169	10, 621	3, 213	----------	133, 566	242, 276	389, 676	797, 845	1. 44
Total Lake States	1, 870	78, 127	334, 444	537, 430	38, 782	990, 653	16, 244	46, 013	16, 059	253, 371	367, 566	699, 253	1, 689, 906	3. 05

All other States	3,712	2,998	13,046	108,451	1,537	129,744	5,514	1,430	2,441	1,581	34,667	45,633	175,377	.32
Total United States	159,301	1,965,788	8,835,794	11,451,850	4,461,577	26,874,310	6,428,411	3,525,217	5,190,097	2,949,399	1,960,859	20,053,983	46,928,293	84.77
Canada:														
Province:														
Ontario	18,423	419,288	1,202,746	1,007,937	104,755	2,753,149	136,134	63,025	2,064	338	1,983	203,544	2,956,693	5.34
Quebec	96	93,858	407,308	252,840	20,793	774,895	374,955	121,122	53,091	11,342	14,892	575,402	1,350,297	2.44
Other Provinces	----------	32,233	27,103	39,276	1,744	100,356	11,302	5,054	----------	----------	19	16,375	116,731	.21
Total Canada [4]	18,519	545,379	1,637,157	1,300,053	127,292	3,628,400	522,391	189,201	55,155	11,680	16,894	795,321	4,423,721	7.99
Other countries [5]	4,272	737,742	19,267	29,897	327,338	1,118,516	269,478	547,381	536,334	190,347	1,348,274	2,891,814	4,010,330	7.24
Grand total	182,092	3,248,909	10,492,218	12,781,800	4,916,207	31,621,226	7,220,280	4,261,799	5,781,586	3,151,426	3,326,027	23,741,118	55,362,344	100.00

[1] Includes "local sales."

[2] Shipments to other States generally referred to as being in the South Atlantic area are included in "all other States."

[3] Shipments to Indiana are included in "all other States."

[4] Shipments reported to final Canadian destinations were as shown—4,423,721 net tons. However, official data of U. S. Department of Commerce show total exports to Canada of 4,430,636 net tons during the 1947–48 coal year.

[5] Total compiled from data of U. S. Department of Commerce. Size totals estimated from information furnished by shippers and representatives of the purchasing countries.

1947 declined 14 percent from 1946 and tidewater receipts decreased 40 percent. Details on the movement of anthracite to New England are given in table 24. Loadings at Lake Erie ports decreased 16 percent and receipts at the upper Lake docks 22 percent from 1946. The substantial gain in anthracite loadings at Lake Erie ports in 1944–47 over prior years is due largely to increased use of the smaller sizes of anthracite by briquet manufacturers in the Great Lakes region.

TABLE 22.—Rail shipments of Pennsylvania anthracite, 1944–47, by destinations, in net tons

[Pennsylvania Department of Mines]

Destination	1944	1945	1946	1947
New England States	6,003,552	4,867,051	5,367,460	4,456,476
New York	16,821,928	13,867,150	15,440,475	14,530,238
New Jersey	9,465,559	7,963,782	7,945,666	6,697,055
Pennsylvania	11,693,186	9,647,371	11,360,229	10,138,523
Delaware	317,539	297,056	287,173	295,288
Maryland	905,993	784,863	918,195	830,546
District of Columbia	323,923	269,278	280,324	228,383
Virginia	147,013	128,642	126,187	116,650
Ohio	136,781	109,508	96,179	98,729
Indiana	85,124	87,123	100,077	78,303
Illinois	463,936	529,549	343,354	285,648
Wisconsin	392,696	470,501	524,066	486,975
Minnesota	146,857	108,210	55,231	19,749
Michigan	245,751	239,031	285,351	354,643
Other States	64,325	72,573	65,502	62,575
Total United States	47,214,163	39,441,688	43,195,469	38,679,781
Canada	3,675,870	3,059,062	3,818,303	3,828,980
Other foreign countries	5,118	16,079		1,854,042
Grand total	50,895,151	42,516,829	47,013,772	44,362,803

TABLE 23.—Truck shipments of Pennsylvania anthracite in 1947, by months, and by States of destination, in net tons [1]

Destination	January	February	March	April	May	June	July
Pennsylvania:							
Within region	428,360	421,250	387,537	405,276	253,247	224,401	316,068
Outside region	162,730	153,514	196,554	152,626	164,726	169,912	177,006
New York	40,059	35,565	35,278	26,408	22,047	27,421	29,069
New Jersey	40,517	44,041	51,623	24,768	27,901	29,881	37,974
Delaware	1,861	2,029	2,348	1,058	542	1,154	888
Maryland	6,073	5,750	6,248	2,677	2,779	4,024	4,553
District of Columbia		22					
Other States	1,082	809	1,447	1,188	1,188	1,167	1,178
Total: 1947	680,682	662,980	681,035	614,001	472,430	457,960	566,736
1946	840,188	759,560	907,944	693,878	788,441	362,683	360,788

Destination	August	September	October	November	December	Total	Percent of total trucked
Pennsylvania:							
Within region	174,781	218,601	282,159	339,075	446,442	3,897,197	56.0
Outside region	146,369	184,568	220,675	171,376	191,007	2,091,063	30.0
New York	29,953	29,400	37,779	39,864	41,196	394,039	5.7
New Jersey	33,710	48,362	52,377	41,460	47,444	480,058	6.9
Delaware	794	1,407	2,685	2,452	3,799	21,017	.3
Maryland	3,311	5,137	8,029	7,033	8,562	64,176	.9
District of Columbia		16		62	72	172	(2)
Other States	960	952	1,437	1,213	1,341	13,962	.2
Total: 1947	389,878	488,443	605,141	602,535	739,863	6,961,684	100.0
1946	424,292	526,893	660,330	667,114	665,979	7,658,090	100.0

[1] Compiled from reports of Pennsylvania Department of Mines.
[2] Less than 0.05 percent.

TABLE 24.—Receipts of anthracite in New England, 1917, 1920, 1923, 1927, and 1940–47, 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
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
1946						399	5,244	--------	5,643
1947						240	4,498	--------	4,738

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 1947, inclusive, are presented graphically in figure 1.

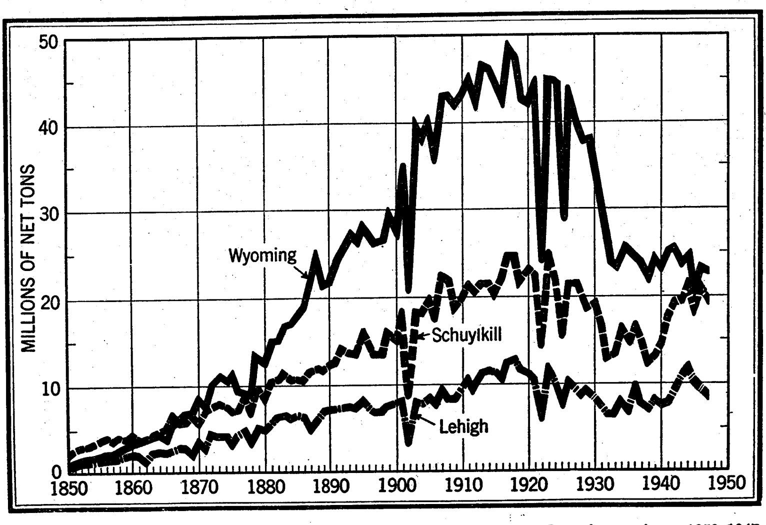

FIGURE 1.—Anthracite shipped from the Lehigh, Schuylkill, and Wyoming regions, 1850–1947

CONSUMPTION

Due largely to a decline in production, the apparent consumption of anthracite in the United States in 1947 totaled 48,200,000 net tons, compared with 53,900,000 tons in 1946. These figures include colliery fuel and coal dredged from streams and are based on production, imports, exports, and changes in producers' stocks but do not reflect changes in stocks held by retail dealers, as data on coal held in storage by this group are incomplete. Anthracite used in the manufacture of fuel briquets and packaged fuel totaled 1,064,790 tons in 1947, compared with 1,098,999 tons in 1946. Consumption by class 1 railroads declined 13 percent from that of 1946, whereas consumption by electric power utilities increased 2 percent over the same period.

Competitive Fuels in the United States and Principal Markets.—The primary anthracite market area is defined as the New England States, New York, New Jersey, Pennsylvania, Delaware, Maryland, and the District of Columbia. Complete data on the consumption of all fuels in these States for 1947 are not available; however, the apparent total consumption of anthracite, coke, briquets, and heating and range oils (in terms of anthracite), increased 10 percent in 1946 over that of 1945.

TABLE 25.—Apparent consumption of anthracite and selected competitive fuels in the principal anthracite markets, 1944–47

[Thousands of net tons]

Fuel	New England	New York	New Jersey	Pennsylvania	Delaware	Maryland	District of Columbia	Total	Percent of total fuels
Anthracite:									
All users: [1]									
1944	6,004	[2] 17,489	[2] 10,254	17,744	380	1,016	325	53,212	62.3
1945	4,867	[2] 14,488	[2] 8,666	15,776	343	868	270	45,278	56.5
1946	5,367	[2] 16,103	[2] 8,663	17,525	322	980	281	49,241	56.0
1947	4,457	[2] 14,924	[2] 7,177	16,127	316	895	228	44,124	(3)
Imports: [4]									
1944	12							12	(5)
1945								(6)	(5)
1946									
1947		7						7	(3)
Briquets:									
Domestic use:									
1944	76	48	12	45	3	7	1	192	.2
1945	83	67	16	52	3	10	2	233	.3
1946	121	94	28	50	4	21	2	320	.4
1947	49	49	32	126	1	29	2	288	(3)
Imports: [4]									
1944								(6)	(5)
1945								(6)	(5)
1946								(6)	(5)
1947								(6)	(3)
Coke:									
Domestic use:									
1944	1,352	1,232	464	386	7	4	1	3,446	4.1
1945	1,371	1,375	552	334	5	2	2	3,641	4.6
1946	1,085	987	469	291	3	5	(6)	2,840	3.2
1947	834	693	407	220	(6)	1		2,155	(3)
Imports: [4]									
1944	(6)	23						23	(5)
1945	1	19						20	(5)
1946	(6)	11						11	(5)
1947	1							1	(3)
Oil: Heating and range: [7]									
1944	10,411	9,554	4,442	2,496	140	988	526	28,557	33.4
1945	11,205	10,095	5,037	2,728	154	1,136	584	30,939	38.6
1946	12,924	11,554	5,713	3,175	184	1,327	665	35,542	40.4
1947	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Total fuel: [8]									
1944	17,855	28,346	15,172	20,671	530	2,015	853	85,442	100.0
1945	17,527	26,044	14,271	18,890	505	2,016	858	80,111	100.0
1946	19,497	28,749	14,873	21,041	513	2,333	948	87,954	100.0
1947	(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.

Virtually all of the increase is attributable to the gain in shipments registered by fuel oil, which supplied 40 percent of the total equivalent fuels consumed in these States. In addition to the legitimate anthracite shipped, large quantities of "bootleg" coal are moved into this area by truck. Data on fuels used in this market during 1947 are not yet available, but it is expected that total consumption will show a substantial increase over that of 1946. Details on the consumption of fuels in competition with anthracite are shown in table 25.

In general, the supplies of fuels commonly used for space heating in the United States increased in 1947 over 1946, a substantial gain being recorded in the sales of heating oils. Details on supplies of various fuels are given in table 26.

TABLE 26.—Total supplies of fuels commonly used for space-heating purposes in the United States, 1937 and 1944–47

[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	1944	1945	1946	1947
SOLID FUELS (NET TONS)					
Anthracite:					
Production:					
Shipments of domestic sizes	29,092,974	34,343,434	28,610,174	31,607,802	29,210,251
Shipments of Buckwheat No. 1	6,859,707	8,083,664	6,681,171	7,181,843	6,557,076
Shipments of smaller steam sizes [1]	10,250,463	15,213,472	13,251,106	15,318,942	15,285,086
Local sales	2,981,391	3,765,641	4,273,864	4,435,536	4,232,871
Total commercial production	49,184,535	61,406,211	52,816,315	58,544,123	55,285,284
Exports [2]	1,914,173	4,185,933	3,691,247	6,497,245	8,509,995
Imports for consumption [2]	395,737	11,847	149	9,556	10,350
Fuel briquets [3]	977,254	2,301,827	2,588,819	2,841,341	2,923,223
Packaged-fuel production	146,037	175,770	208,143	190,919	182,881
Coke:					
Oven-coke sales for domestic use	7,807,792	6,443,329	6,574,526	4,947,085	3,917,402
Beehive sales for domestic use	299,726	274,214	200,982	149,648	59,926
Imports for consumption [2]	286,364	63,004	51,964	52,188	104,093
Retort-coke sales	[4] 350,700	423,675	431,361	355,336	282,666
Petroleum-coke production	1,306,600	1,803,400	2,023,000	2,124,200	2,415,400
Anthracite and semianthracite production outside of Pennsylvania	468,852	(5)	(5)	(5)	(5)
Lignite production [6]	3,218,419	2,554,160	2,668,310	2,667,619	(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	47,636,000	51,021,000	60,564,000	[9] 72,000,000
Heating oils (domestic and commercial) [10]	116,617,000	152,203,000	165,216,000	192,371,000	[9] 234,000,000
Liquefied petroleum gases (domestic)	972,000	10,442,000	12,697,000	18,059,000	27,394,000
GAS (MILLION CUBIC FEET)					
Natural-gas consumption for domestic and commercial use [11]	489,234	782,930	837,499	902,622	(7)
Manufactured-gas sales for: [12]					
Domestic use	193,325	215,157	311,043	335,369	(7)
House heating	45,200	84,766			

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.
4 Partly estimated.
5 Data not available.
6 An estimated one-half of total production shown is used for domestic purposes.
7 Data not yet available.
8 Exact data not available.
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, well as houses.
12 American Gas Association.

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) decreased from 7,044 units in 1946 to 3,364 units in 1947. Sales of class 2 stokers (capacity 61 to 100 pounds of coal per hour) declined from 908 units in 1946 to 391 units in 1947.

Because of an increase in the supply of electric motors, shipments of oil burners increased tremendously, totaling 1,185,949 units in 1947, as compared with 579,453 in 1946. October, with shipments of 128,448 oil burners, was the peak month of the year, while December, with 57,898 units shipped, was the month of least activity. These data refer to oil burners consuming fuel oil of commercial standard No. 1 grade or heavier, generally used in central heating plants, in industrial process equipment such as heat-treating furnaces and industrial ovens, or for the generation of steam for power, but do not include burners of the range type.

STOCKS

Producers' stocks were at a low of 283,528 net tons in January 1947 and reached a peak of 702,109 tons in December. Virtually all coal in storage in December was Buckwheat No. 1 and No. 2; very little Pea or larger sizes was in stock at any time in 1947. It is of interest to note that, during the early months of 1948, the Buckwheat No. 1 and No. 2 sizes moved rapidly out of storage, and total stocks in May 1948 were only 95,847 net tons. Stocks held by electric power utilities increased 30 percent over 1946, while stocks of class 1 railroads declined 3 percent. Stocks on the upper Lake docks decreased 3 percent on December 31, 1947, over those held on the same date in 1946.

PRICES

According to Saward's Journal, f. o. b. mine prices of anthracite at the beginning of 1947 varied from $10.15 to $10.65 per net ton on Broken, Egg, Stove, and Chestnut sizes; from $8.30 to $8.80 on Pea; from $5.95 to $6.40 on Buckwheat No 1; from $4.90 to $5.20 on Rice; from $3.55 to $3.85 on Barley; and $2.65 per net ton on sizes smaller than Barley. To compensate the producers for added costs of production, due principally to wage increases granted the mine workers during 1947 circular prices were increased. At the end of the year price per net ton f. o. b. mine, on Broken and Egg varied from $10.95 to $11.50; Stove and Chestnut, from $11.00 to $11.50; Pea, from $9.00 to $9.55; Buckwheat No. 1, from $6.50 to $7.00; Rice, from $5.35 to $5.95; and Barley, from $4.10 to $4.35. However, a number of companies normally sell coal from certain collieries or of certain grades at a premium over the quoted circular prices. Details are given in table 27.

TABLE 27.—Quoted prices per net ton for Pennsylvania anthracite, Dec. 28, 1947

[Saward's Journal]

	Broken	Egg	Stove	Chestnut	Pea	Buckwheat No. 1	Buckwheat No. 2 (Rice)	Buckwheat No. 3 (Barley)
Hudson Coal Co	$10.95	$10.95	$11.05	$11.00	$9.00	$6.55	$5.50	$4.10
Cleveland-Cliffs Iron Co., Inc M. A. Hanna Co Philadelphia & Reading Coal & Iron Co	11.00	11.00	11.00	11.00	9.00	6.50	5.45	4.10
Delaware, Lackawanna & Western Coal Co	11.00	11.00	11.00	11.00	9.00	6.50	5.35	4.10
Pattison & Bowns, Inc Lehigh Valley Coal Sales Co., "Wyoming coal"	11.00	11.00	11.00	11.00	9.05	6.50	5.45	4.10
Lehigh Valley Coal Sales Co., other than "Wyoming coal" Payne Coal Co Lehigh Navigation Coal Co., other than "Greenwood coal"	11.25	11.25	11.25	11.25	9.30	6.75	5.70	4.10
Lehigh Navigation Coal Co., "Greenwood coal"	11.50	11.50	11.50	11.50	9.55	7.00	5.95	4.35
Weston Dodson & Co., Inc	11.20	11.20	11.20	11.20	9.25	6.70	5.60	4.10
Dickson Coal Co., Inc	11.25	11.25	11.25	11.25	9.25	6.50	5.45	4.10
Wilkes-Barre Coal Sales Co	11.25	11.25	11.25	11.25	9.30	6.50	5.45	4.10
Jeddo Highland Coal Co	11.30	11.30	11.30	11.30	9.35	6.80	5.75	4.10
Thorne Neale & Co., Inc	11.30	11.30	11.30	11.30	9.00	6.50	5.45	4.10
Pittston Coal Sales Co	11.50	11.50	11.50	11.50	9.50	7.00	5.90	--------

Retail prices of anthracite, bituminous coal, coke, and heating oils in selected cities, by months, in 1947, are shown in table 28. These prices were compiled from reports of the Bureau of Labor Statistics, United States Department of Labor.

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TABLE 28.—Retail prices of selected fuels in 1947, 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.: [2]												
Anthracite:												
Stove	$16.29	$16.33	$16.32	$16.32	$15.60	$15.62	$16.19	$17.34	$17.34	$17.60	$17.60	$17.80
Buckwheat No. 1	12.35	12.39	12.38	12.38	11.66	11.68	12.14	13.06	13.06	13.06	13.06	13.41
Heating oil: Fuel oil No. 2	8.90	8.90	8.90	9.70	9.70	9.70	9.89	10.04	10.11	9.89	10.71	10.71
Boston, Mass.:												
Anthracite:												
Stove	18.66	18.65	18.65	18.65	17.65	17.65	18.22	19.22	19.25	19.50	19.70	19.80
Buckwheat No. 1	13.96	13.95	13.95	13.95	13.45	13.45	13.75	14.40	14.44	14.69	14.81	14.88
Coke, Egg	17.96	17.95	17.95	17.95	16.85	16.85	17.50	18.60	18.60	18.60	18.85	19.25
Heating oil: Fuel oil No. 2	8.80	8.70	8.70	9.40	9.40	9.40	9.40	9.80	9.80	9.80	10.60	11.14
Buffalo, N. Y.: [3]												
Anthracite: Stove	16.80	16.80	16.80	16.80	16.40	16.48	16.77	17.89	17.99	18.16	18.22	18.22
Coke, Nut	14.30	14.30	14.30	14.30	13.90	13.90	14.42	15.50	15.50	15.81	15.81	16.01
Heating oil:												
Fuel oil No. 2	10.43	10.30	10.30	11.00	11.00	11.00	11.11	11.51	11.51	11.51	12.42	13.03
Fuel oil No. 3	10.50	10.30	10.30	11.00	11.00	11.00	11.11	11.51	11.51	11.51	12.42	13.33
Milwaukee, Wis.:												
Anthracite: Stove	18.09	18.09	18.12	18.12	18.58	18.20	18.42	19.55	19.55	19.55	20.05	20.05
Bituminous coal, low-volatile Stove	14.32	14.62	14.62	14.62	14.90	14.90	15.42	17.00	17.00	17.00	17.45	17.40
Coke, Nut	15.94	16.38	16.38	16.38	16.38	16.38	16.38	18.38	18.38	18.38	18.38	18.38
Heating oil:												
Fuel oil No. 2	9.60	9.60	10.00	10.10	10.10	10.60	10.60	10.60	11.10	11.60	12.20	13.64
Fuel oil No. 3	9.60	9.60	9.98	10.10	10.10	10.60	10.60	10.60	11.10	11.65	12.20	13.68
New York, N. Y.: [4]												
Anthracite:												
Stove	17.38	17.38	17.38	17.34	16.52	16.52	16.87	17.97	18.17	18.29	18.53	18.53
Buckwheat No. 1 [5]	11.82	----------	11.82	11.78	11.30	11.30	11.46	12.17	12.32	12.42	12.68	12.68
Coke, Nut	17.22	17.22	17.22	17.23	17.25	17.50	17.50	18.79	18.84	18.86	19.21	19.21
Heating oil: Fuel oil No. 2	8.87	8.57	8.81	9.54	9.53	9.53	9.55	10.02	10.13	10.11	11.08	11.81
Philadelphia, Pa.:												
Anthracite:												
Stove	16.35	16.35	16.35	16.35	15.75	15.75	16.09	16.95	17.36	17.58	17.58	17.60
Buckwheat No. 1	11.95	11.95	11.95	11.95	11.50	11.50	11.80	12.25	12.33	12.48	12.48	12.48
Coke, Nut	16.25	16.25	16.25	16.25	15.50	15.50	16.12	16.25	16.25	16.28	17.95	17.95
Heating oil: Fuel oil No. 2	8.61	8.61	8.66	9.16	9.16	9.16	9.16	9.76	9.76	9.76	10.16	11.02
Portland, Maine:												
Anthracite:												
Stove	18.58	18.58	18.59	18.46	18.00	18.00	18.00	19.25	19.25	19.30	19.45	19.50
Buckwheat No. 1	13.68	13.68	13.68	13.68	13.45	13.45	13.45	14.25	14.30	14.30	14.49	14.55
Coke, Egg	17.82	17.63	17.63	17.48	17.08	17.08	17.33	18.50	18.50	18.57	18.78	18.85
Heating oil: Fuel oil No. 2	8.80	8.80	8.80	9.50	9.50	9.50	9.50	9.82	9.82	9.82	10.62	11.10
Washington, D. C.:												
Anthracite:												
Stove	16.61	16.61	16.61	16.61	15.61	15.86	16.11	17.25	17.51	17.75	17.75	17.75
Buckwheat No. 1	12.07	12.07	12.07	12.07	11.57	11.72	11.87	12.75	12.98	13.09	13.09	13.09
Bituminous coal, low-volatile Stove	12.73	12.73	12.75	12.75	12.73	12.73	13.15	14.35	14.35	14.76	14.94	14.99
Heating oil: Fuel oil No. 2	9.30	9.30	9.30	10.10	10.10	10.10	10.10	10.10	10.60	10.48	10.90	10.90

[1] Compiled from reports of Bureau of Labor Statistics. Prices are as of the 15th of each month. Data are preliminary.

[2] Includes 2 percent sales tax July–December.

[3] Includes 1 percent sales tax July–December.

[4] Includes 2 percent sales tax.

[5] Commercial.

EMPLOYMENT

The average total number of men employed in the anthracite industry in 1947 was 78,600—a slight gain over the 78,145 men employed in 1946.

Employment statistics in this chapter do not include workers employed in "bootleg" coal-mining operations conducted principally in the Southern and Western Middle fields of the anthracite regions. According to the Anthracite Committee, 2,825 men were working 835 "bootleg" holes in March 1948. Although these workers are not included in the employment data, the coal produced by some was purchased (604,060 net tons) by the recognized industry for preparation and shipment to market, and the coal so purchased is included in the production tables of this chapter. Complete employment data on the "bootleg" holes from which this coal was produced are not available. The tonnage of "bootleg" coal reported purchased by the recognized industry was deducted from the total tonnage reported by the operators, and the resulting net production was then used to calculate the output per man per day. While it is true that men employed at preparation plants of the recognized companies were engaged part time in the preparation of this purchased coal for market, the omission of such time will not detract materially from the validity of the per-ton figure obtained.

See tables 29 and 30 for details on labor statistics.

TABLE 29.—Men employed and days worked at operations producing Pennsylvania anthracite in 1947, 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	5,196	3,306	8,502	1,665	980	2,398	5,043	13,545	244	3,311,022	[3] 2.76
Washery [2]	------	------	------	6	66	89	161	161	195	31,332	10.10
Dredge	------	------	------	------	6	9	15	15	174	2,616	17.77
Total Lehigh	5,196	3,306	8,502	1,671	1,052	2,496	5,219	13,721	244	3,344,970	[3] 2.84
Schuylkill:											
Breaker	7,302	5,230	12,532	4,481	1,873	3,934	10,288	22,820	241	5,492,018	[3] 3.33
Washery [2]	------	------	------	48	48	362	458	458	151	68,944	[3] 11.99
Dredge	------	------	------	------	226	291	517	517	250	129,475	8.97
Total Schuylkill	7,302	5,230	12,532	4,529	2,147	4,587	11,263	23,795	239	5,690,437	[3] 3.57
Wyoming:											
Breaker	20,832	10,556	31,388	1,055	1,891	6,404	9,350	40,738	277	11,279,881	2.29
Washery [2]	------	------	------	------	73	151	224	224	184	41,171	21.63
Dredge	------	------	------	------	4	3	7	7	228	1,596	7.35
Total Wyoming	20,832	10,556	31,388	1,055	1,968	6,558	9,581	40,969	276	11,322,648	2.36
Total, excluding Sullivan County:											
Breaker	33,330	19,092	52,422	7,201	4,744	12,736	24,681	77,103	260	20,082,921	[3] 2.65
Washery [2]	------	------	------	54	187	602	843	843	168	141,447	[3] 14.38
Dredge	------	------	------	------	236	303	539	539	248	133,687	9.12
Total	33,330	19,092	52,422	7,255	5,167	13,641	26,063	78,485	259	20,358,055	[3] 2.78
Sullivan County	54	21	75	9	22	9	40	115	123	14,146	3.04
Grand total	33,384	19,113	52,497	7,264	5,189	13,650	26,103	78,600	259	20,372,201	[3] 2.78

[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 30.—Men employed at operations producing Pennsylvania anthracite, 1946–47, by counties

[Includes operations of strip contractors]

County	1946	1947	County	1946	1947
Berks, Lancaster, Lebanon, Northampton, and Snyder [1]	129	149	Northumberland	5,805	6,380
Carbon	5,284	5,163	Schuylkill	18,245	18,010
Columbia	2,015	2,110	Sullivan	168	115
Dauphin	361	384	Susquehanna and Wayne	62	54
Lackawanna	12,012	12,198	Total	78,145	78,600
Luzerne	34,064	34,037			

[1] Counties producing dredge coal only.

MINING METHODS AND EQUIPMENT

Mechanical Loading.—The tonnage of Pennsylvania anthracite loaded mechanically has been increasing for many years, but the output of 16,054,011 tons in 1947 by this method of mining, while a record, is only a slight gain over that of 1946. The quantity of anthracite loaded mechanically in 1945 declined from that of some previous years, but this decline was attributed to the inability of producers to obtain sufficient mechanical loading equipment during the war years. Of the total underground production in 1947, mechanically loaded coal accounted for 43 percent, while coal loaded by hand comprised 57 percent. Statistics on anthracite loaded mechanically underground are given in tables 31 to 33.

Figure 2 illustrates graphically the trend of underground mechanical and hand loading and of stripping in the Pennsylvania anthracite regions, 1928–47.

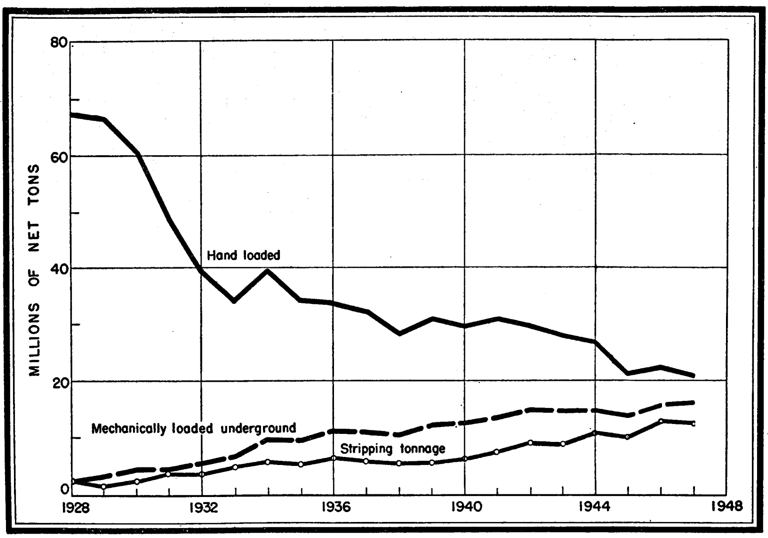

FIGURE 2.—Relative trend of mechanical loading, hand loading, and stripping of Pennsylvania anthracite 1928–47.

TABLE 31.—Pennsylvania anthracite loaded mechanically underground in 1947, by fields, in net tons

Field	Scraper loaders [1]	Pit-car loaders	Hand-loaded face conveyors, all types [2]	Total mechanically loaded underground
Northern	2,143,164	336,303	10,960,358	13,439,825
Eastern Middle	92,773	26,648	503,194	620,615
Western Middle	249,614	87,954	1,141,231	1,478,799
Southern	18,056	8,000	488,716	514,772
Total	2,503,607	458,905	13,091,499	16,054,011

[1] Includes mobile loaders.
[2] Shaker chutes, etc., including those equipped with duckbills.

TABLE 32.—Pennsylvania anthracite loaded mechanically underground, 1943–47

Year	Scrapers		Mobile loaders		Conveyors and pit-car loaders [1]		Total loaded mechanically	
	Number of units	Net tons loaded	Number of units	Net tons loaded	Number of units	Net tons loaded	Number of units	Net tons loaded
1943	510	2,750,256	5	57,033	2,701	11,938,504	3,216	14,745,793
1944	491	2,811,824	12	69,837	2,807	12,093,485	3,310	14,975,146
1945	548	2,747,254	20	146.209	3,006	11,034,492	3,574	13,927,955
1946	564	2,714,051	27	81,545	3,233	12,823,566	3,824	15,619,162
1947	594	2,371,370	25	132,237	3,457	13,550,404	4,076	16,054,011

[1] Includes duckbills and other self-loading conveyors.

TABLE 33.—Relative growth of mechanical loading, hand loading, and stripping in Pennsylvania anthracite mines, 1943–47

[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
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
1946	15,619,162	12,858,930	22,465,295	703	597	31
1947	16,054,011	12,603,545	20,909,101	722	585	29

Strip-Pit Operations.—The heavy demand for anthracite during and since the war caused a rapid expansion of stripping activities, and tonnage obtained by this method increased from 14 percent of the total fresh mined output in 1941 to 25 percent in 1947. The 12,603,545 tons produced by this method of mining in 1947 is slightly less than the 1946 output. It is believed, however, that no particular significance can be attached to this slight decline, and it is expected that a record production will be obtained from this source in 1948. Data on strip-pit mining are given in tables 34 and 35.

Figure 3 illustrates graphically the production of anthracite from strip pits, by regions, 1928–47.

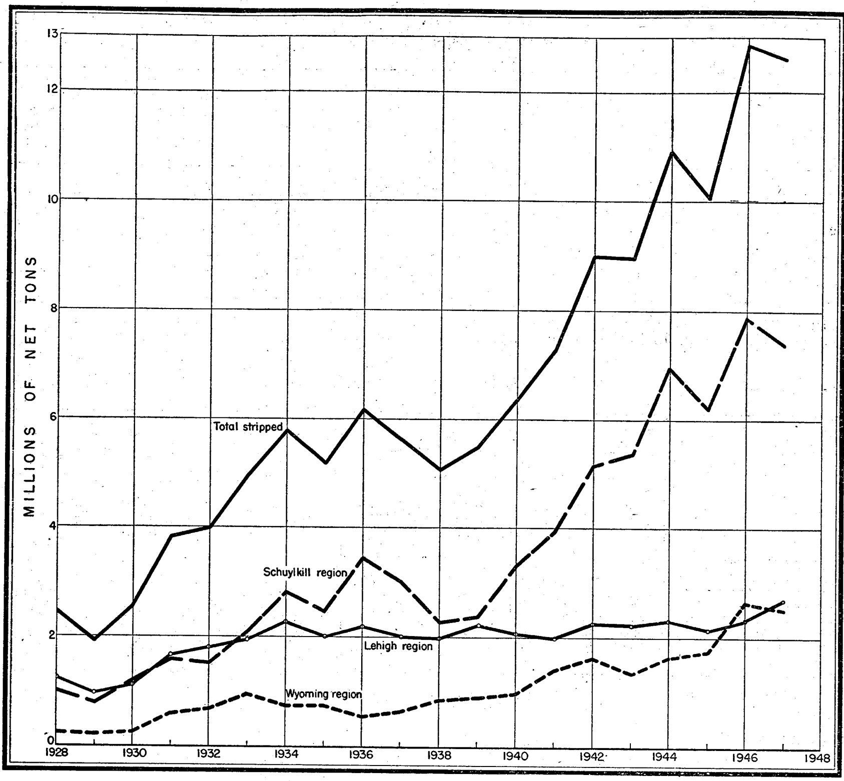

FIGURE 3.—Pennsylvania anthracite mined from strip pits, by regions, 1928–47

TABLE 34.—Relative growth of Pennsylvania anthracite mined from strip pits, 1915, 1920, 1925, 1930, and 1944–47

	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)
1944	10, 953, 030	20. 8	5, 595	246
1945	10, 056, 325	22. 4	5, 314	238
1946	12, 858, 930	25. 2	6, 152	252
1947:				
Lehigh region	2, 708, 133	32. 1	1, 671	245
Schuylkill region	7, 385, 902	46. 8	4, 529	238
Wyoming region	2, 506, 010	9. 9	1, 055	254
Total, excluding Sullivan County	12, 600, 045	25. 4	7, 255	242
Sullivan County	3, 500	8. 7	9	54
Grand total 1947	12, 603, 545	25. 4	7, 264	242

[1] Data not available.

TABLE 35.—Power shovels and draglines used in stripping Pennsylvania anthracite, by type of power, 1945–47

Type of power	1945			1946			1947		
	Number of power shovels	Number of draglines	Total	Number of power shovels	Number of draglines	Total	Number of power shovels	Number of draglines	Total
Gasoline	38	21	59	68	20	88	75	23	98
Electric	29	38	67	33	44	77	47	46	93
Diesel	89	202	291	155	254	409	158	256	414
All other	4		4	6		6	4		4
	160	261	421	262	318	580	284	325	609

Cutting Machines.—The quantity of anthracite cut by machines declined from 1,232,828 tons in 1946 to 1,209,983 tons in 1947. The number of cutting machines in use increased from 200 (177 "permissible" and 23 "all other types") in 1946 to 211 (184 "permissible" and 27 "all other types") in 1947.

Dredge Coal.—Operations have been conducted since the late 1800's to recover anthracite from the streams draining the Pennsylvania anthracite fields, but the earliest production reports received were for 1909. Table 36 gives statistics of dredging operations from 1909–47. The dredging industry reached peak production in 1941 when 1,517,563 net tons were taken from river and creek beds, as compared to the 1,219,706 tons recovered in 1947. Details are shown in table 37.

TABLE 36.—Pennsylvania anthracite produced by dredges, 1909–47, by rivers (including tributaries)

Year	Net tons				Value	
	Lehigh River	Schuylkill River	Susquehanna River	Total	Total	Average per ton
1909				107,788		
1910				102,853		
1911				106,005	(1)	(1)
1912				96,009		
1913				150,064		
1914				115,257		
1915	(1)	(1)	(1)	138,421	$100,744	$0.73
1916				160,507	110,831	.69
1917				170,672	206,754	1.21
1918				282,930	366,565	1.30
1919				693,093	868,746	1.25
1920				740,453	862,296	1.16
1921				623,329	650,654	1.04
1922				904,108	989,709	1.09
Total, 1909–22 [2]	(1)	(1)	(1)	4,391,489	[2] 4,156,299	1.12
1923	106,092	97,254	753,022	956,368	811,065	.85
1924	80,301	74,359	670,734	825,394	681,181	.83
1925	99,614	173,639	742,455	1,015,708	929,292	.91
1926	58,544	131,654	724,566	914,764	828,398	.91
1927	85,177	127,705	758,935	971,817	794,807	.82
1928	89,304	157,449	696,648	943,401	821,530	.87
1929	87,241	133,720	495,983	716,944	626,187	.87
1930	60,219	138,236	444,836	643,291	538,268	.84
1931	33,014	90,855	334,881	458,750	379,682	.83
1932	42,091	105,990	331,969	480,050	445,799	.93
1933	51,083	106,004	381,837	538,924	452,153	.84
1934	91,346	100,873	459,961	652,180	636,038	.98

See footnotes at end of table.

TABLE 36.—Pennsylvania anthracite produced by dredges, 1909–47, by rivers (including tributaries)—Continued

Year	Net tons				Value	
	Lehigh River	Schuylkill River	Susquehanna River	Total	Total	Average per ton
1935	78,578	73,326	438,563	590,467	$517,304	$0.88
1936	63,327	31,669	451,688	546,684	581,679	1.06
1937	[3] 95,065	(3)	665,409	760,474	842,052	1.11
1938	[3] 123,452	(3)	447,572	571,024	570,579	1.00
1939	62,134	67,539	574,187	703,860	746,000	1.06
1940	[3] 78,947	(3)	863,997	942,944	1,097,000	1.16
1941	47,838	396,522	1,073,203	1,517,563	1,839,784	1.21
1942	9,385	268,919	1,006,729	1,285,033	1,478,719	1.15
1943	37,452	342,815	954,470	1,334,737	1,972,777	1.48
1944	40,894	494,371	837,472	1,372,737	2,084,431	1.52
1945	41,409	366,161	797,656	1,205,226	1,924,148	1.60
1946	37,441	247,757	847,196	1,132,394	2,091,324	1.85
1947	46,478	158,102	1,015,126	1,219,706	2,480,068	2.03
Total, 1923–47	[3] 1,646,426	[3] 3,884,919	16,769,095	22,300,440	26,170,265	1.17
Grand total	(1)	(1)	(1)	26,691,929	(1)	(1)

[1] Data not available.
[2] Figures for value cover 1915–22.
[3] Schuylkill included with Lehigh in 1937, 1938, and 1940.

TABLE 37.—Pennsylvania anthracite produced by dredges in 1947, by rivers

River (including tributaries)	Net tons	Value	
		Total	Average
Lehigh	46,478	$93,431	$2.01
Schuylkill	158,102	314,879	1.99
Susquehanna	1,015,126	2,071,758	2.04
	1,219,706	2,480,068	2.03

FOREIGN TRADE [1]

Shipments of Pennsylvania anthracite to foreign countries in 1947 reached an all-time high of 8,509,995 net tons. Exports to Europe (3,918,463 tons) and shipments to Canada (4,470,034 tons) accounted for virtually all of the tonnage. Since recent coal production in Great Britain and the European countries has been increasing, it is believed that American exports to Europe will not be nearly as large in 1948 as the record for 1947. It is expected, however, that Canada will import approximately as much Pennsylvania anthracite in 1948 as in 1947. Statistics on United States imports and exports are shown in tables 38 and 39.

TABLE 38.—Anthracite imported for consumption in the United States, 1946–47, by countries and customs districts, in net tons

[U. S. Department of Commerce]

Country	1946	1947	Customs district	1946	1947
Canada	9,556	10,293	Alaska	41	
Chile		7	Laredo		50
Mexico		50	Montana and Idaho	9,515	10,293
			New York		7
	9,556	10,350		9,556	10,350

[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.

TABLE 39.—Anthracite exported from the United States, 1946–47, by countries and customs districts, in net tons

[U. S. Department of Commerce]

Country	1946	1947
North America:		
Bermuda	278	557
Canada	4,513,637	4,470,034
Mexico	4,450	8,988
Newfoundland and Labrador	4,538	7,880
West Indies:		
British	157	787
Cuba	51,896	23,794
Other North America	14	40
South America:		
Argentina	8	25,405
Bolivia	34	53
Brazil	67	901
Chile	73	575
Peru	102	----------
Surinam	2	570
Uruguay	250	----------
Other South America	----------	6
Europe:		
Belgium and Luxembourg	777,372	1,367,636
Denmark	----------	40,550
Eire	11	9,177
France	758,226	1,404,785
Italy	240,530	157,945
Netherlands	87,991	41,907
Norway	9,099	201,135
Portugal	280	2,464
Sweden	----------	577,999
Switzerland	24,927	114,851
Yugoslavia	19,825	----------
Other Europe	----------	14
Asia:		
British Malaya	----------	10,044
China	3,476	286
Palestine and Trans-Jordan	----------	28,369
Other Asia	----------	100
Africa:		
Belgian Congo	----------	2,448
Egypt	----------	10,640
Other Africa	2	55
	6,497,245	8,509,995

Customs district	1946	1947
North Atlantic:		
Connecticut	2,987	----------
Maine and New Hampshire	36,661	42,365
Massachusetts	1	38
New York	8,123	787,549
Philadelphia	1,791,142	2,738,308
Rhode Island	----------	3,930
South Atlantic:		
Maryland	124,069	511,904
Puerto Rico	12	10
South Carolina	----------	2
Virginia	173	2,150
Gulf Coast:		
Florida	96	47
Galveston	56,824	5
Mobile	2	570
New Orleans	96	125
Mexican border:		
Arizona	9	23
El Paso	58	13
Laredo	100	7
Pacific Coast:		
Alaska	29	55
San Diego	15	45
San Francisco	103	----------
Washington	3,563	93
Northern border:		
Buffalo	2,428,686	2,639,285
Dakota	5,167	4,383
Duluth and Superior	21,737	8,557
Michigan	2,119	1,454
Ohio	16,357	6,197
Rochester	182,009	153,115
St. Lawrence	1,815,071	1,608,294
Vermont	2,036	1,471
	6,497,245	8,509,995

CANADA

Despite the great demand for coal in Canada, the 1947 production of solid fuels was 15,860,478 net tons, a decline of 11 percent from that of 1946. Nova Scotia bituminous-coal production, which accounted for the greater part of the decrease, was 24 percent less in 1947 than in 1946. Coal and coke statistics for Canada are shown in tables 40 and 41.

TABLE 40.—Coal and coke production and foreign trade of Canada, 1946–47 [1]

[Thousands of net tons]

	Coal								Coke from coal	
	Anthracite		Bituminous and subbituminous		Lignite		Total			
	1946	1947	1946	1947	1946	1947	1946	1947	1946	1947
Production			16,288	[2] 14,291	1,524	1,570	17,812	15,861	3,313	3,501
Imports	4,639	4,464	22,000	25,841	(3)	(3)	26,639	30,305	909	564
Exports			854	706	9	8	863	714	47	107
Available for consumption	4,639	4,464	37,434	39,426	1,515	1,562	43,588	45,452	4,175	3,958

[1] Monthly Coa and Coke Statistics for Canada, December 1947. Production data revised through April 1947.
[2] Decrease in production due to strike in Nova Scotia and New Brunswick, February–June 1947.
[3] Less than 1,000 tons.

TABLE 41.—Canadian coal production, 1946–47, by Provinces and by kinds, in net tons [1]

	Bituminous		Subbituminous		Lignite		Total	
	1946	1947 [2]	1946	1947	1946	1947	1946	1947
Alberta	5,389,418	4,834,632	3,436,893	3,232,435			8,826,311	8,067,067
British Columbia	1,638,424	1,761,436					1,638,424	1,761,436
New Brunswick	370,655	344,409					370,655	344,409
Nova Scotia	5,452,868	4,117,839					5,452,868	4,117,839
Saskatchewan					1,523,489	1,569,727	1,523,489	1,569,727
	12,851,365	11,058,316	3,436,893	3,232,435	1,523,489	1,569,727	17,811,747	15,860,478

[1] Monthly Coal and Coke Statistics for Canada, December 1947. Figures revised through April 1947.
[2] Decrease in production due to strike in Nova Scotia and New Brunswick, February–June 1947.

WORLD PRODUCTION

The United States is by far the largest producer of anthracite in the world. Available data on world production of anthracite, by countries, for 1943–47, are given in table 42.

TABLE 42.—World production of anthracite, 1943–47, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1943	1944	1945	1946	1947
China [2]	(3)	(3)	1,451,000	757,114	750,000
Eire	123,387	130,198	123,468	122,886	(3)
France	8,205,000	4,964,000	(3)	(3)	(3)
Indochina, French	954,500	499,400	217,700	261,696	247,777
Italy	122,075	(3)	53,446	104,989	115,731
Korea	4,157,101	4,530,262	673,796	[4] 1,071,800	[4] 1,815,200
Morocco, French	102,290	134,400	178,600	220,850	268,500
New Zealand	(3)	(3)	2,571	2,308	(3)
Peru	22,716	14,545	36,848	82,089	[4] 80,000
Portugal	368,321	389,638	436,117	379,526	377,000
Rumania	21,476	12,000	17,000	15,994	23,779
Spain	1,151,762	1,516,035	1,529,532	1,457,529	1,411,355
Switzerland	104,150	51,232	101,993	74,544	15,066
United Kingdom	4,196,671	3,652,881	3,213,405	3,582,084	(3)
United States (Pennsylvania)	55,014,679	57,788,602	49,834,944	54,890,625	51,881,632
Total (estimate)	116,414,000	112,535,000	104,010,000	118,152,000	120,279,000

[1] In addition to countries listed, Belgium, Bulgaria, Germany, Japan, and U. S. S. R. produce anthracite, but data of output are not available. Estimates by author of chapter included in total.
[2] Excludes Kwantung Peninsula.
[3] Data not available; estimate by author of chapter included in total.
[4] Estimate.

Cobalt

By HUBERT W. DAVIS

GENERAL SUMMARY

THE demand for cobalt metal was at a high level in 1947, mainly because of larger purchases for the Government stock pile. Demand for cobalt metal in cast cobalt-chromium-tungsten-type alloys, steel, and alloy hard-facing rods and materials was also greater in 1947 than in 1946, but these gains were offset by a substantial decline in the use of cobalt in permanent-magnet alloys. Nevertheless, sales of cobalt metal were 58 percent larger in 1947 than in 1946. Despite the greater need, however, supplies of metal were adequate for requirements. The metal was supplied chiefly by imports which established an all-time high, and by an increase of 36 percent in production in the United States.

The demand for cobalt oxide was also much greater in 1947 than in 1946, chiefly because of increased usage in ground-coat frit for porcelain enamel and in pigments. Although the output of oxide in the United States was 43 percent more than in 1946, it was insufficient for requirements. The deficit was met partly by imports, which however were 30 percent smaller, and partly by withdrawals from consumers' stocks.

Production and shipments of cobalt salts were larger in 1947 than in 1946, but outputs and sales of hydrate and driers were smaller.

The bulk of the cobalt metal, oxide, hydrate, and other cobalt products sold in the United States is made from crude cobalt produced in the Belgian Congo, where output established an all-time high in 1947 to meet the greatly increased requirements. Some of the cobalt products sold are made from domestic and Canadian ores. Output of domestic ore was 24 percent greater than in 1946, and imports of Canadian ore were up 5 percent.

Permanent magnets and magnet steels continued to lead in the postwar demand for cobalt, but the quantity of cobalt employed for these purposes was 31 percent less in 1947 than in 1946, which however was an all-time high. An informative article on magnetic materials has been contributed by Finke,[1] who concluded as follows:

> Modern magnetic materials are contributing their part towards bringing comfort, accuracy, amusement, convenience, power and time to people in all walks of life in today's world. Each year brings many new applications and improvements of old ones. No one can foretell the future, but it is certain that modern magnetic materials will enable engineers and manufacturers to produce new products that will solve old problems and add a few pages to the history of modern scientific developments and the progress of civilization.

[1] Finke, H. E. (General Electric Co.), Modern Magnetic Materials: Materials and Methods, vol. 25, No. 6, June 1947, pp. 72–76.

A new standard line of Alnico permanent-magnet holding assemblies that combine minimum space requirements with maximum holding power was designed to effect economy and efficiency by eliminating the necessity for making each new assembly application to particular specification.[2]

The anticipated peacetime demand for cobalt for cast cobalt-base high-temperature alloys materialized in 1947; as a consequence, the quantity of cobalt employed for this purpose was 22 percent greater than in 1946. Sweeney [3] predicted that 1948 will show a marked increase in the use of precision-cast cobalt-base high-temperature alloys; and, as the demand for materials that will stand higher temperatures and greater stresses continues to grow, some of the better cast alloys, now in the laboratory stage, will begin to be produced commercially. A new cast alloy, designated as "J" alloy, has been developed, using the original Co-Cr-Mo-base vitallium as a starting point.[4] A new material—Elgiloy, an alloy chiefly of cobalt, chromium, nickel, iron, and molybdenum—the first application of which is in long-lived watch springs, has been described.[5]

MINE PRODUCTION AND DEVELOPMENT

Despite the fact that the United States is the largest consumer of cobalt in the world, only a small part of its requirements has been furnished by domestic ore, as is evident from the next table, which shows production and shipments through 1945; the Bureau of Mines is not at liberty to publish figures for 1946 and 1947.

Cobalt ore produced and shipped in the United States through 1945 [1]

Year	Produced		Shipped from mines	
	Gross weight (short tons)	Cobalt content (pounds)	Gross weight (short tons)	Cobalt content (pounds)
Previous to 1921 (partly estimated)	(2)	730,000	(2)	730,000
1921–32 (partly estimated)	93	9,300	41	5,000
1933	20	1,160		
1934	31	2,009		
1935	23	1,995		
1936	6	526		
1937	24	3,023		
1938	16	1,075		
1939	27	1,705		
1940	5,048	133,800	4,500	127,000
1941	19,127	505,377	20,031	521,627
1942	26,241	735,335	23,741	661,657
1943	27,103	732,098	28,541	763,772
1944	18,407	828,515	17,539	556,687
1945	19,770	1,099,654	17,528	1,281,681
	(2)	4,785,572	(2)	4,647,424

[1] Bureau of Mines not at liberty to publish figures for 1946 and 1947.
[2] Data not available.

[2] George, E. E. (General Electric Co.), Progress in Electrical Equipment Continues: Steel, vol. 122, No. 1, Jan. 5, 1948, p. 220.
[3] Sweeney, W. O. (Haynes Stellite Co.), Use of Precision Cast Super Alloys to Increase in 1948: Steel, vol. 122, No. 1, Jan. 5, 1948, p. 221.
[4] Grant, N. J., Cobalt Chromium J Alloy at 1,350 to 1,800° F.: Steel, vol. 121, No. 14, Oct. 6, 1947, p. 114.
[5] Materials and Methods, New Strong, Nonmagnetic Spring Material Has High Corrosion Resistance: Vol. 25, No. 4, April 1947, pp. 94–95.

A complete record of output of cobalt in the United States before 1921 is not available. Nevertheless, it is estimated that about 96 percent of all domestic cobalt produced prior to 1921 was from deposits near Fredericktown, Madison County, Mo., where a complex ore consisting of copper, lead, cobalt, and nickel was worked on a small scale for many years preceding 1869 through 1904 and in 1907–9 and 1919–20. Prior to 1921 several companies had attempted to establish regular production of cobalt in Missouri; and despite the fact that large sums were spent in these endeavors, none of the metallurgical processes developed for treating the complex ore proved entirely satisfactory. It is estimated that the total output in Missouri through 1920 probably did not exceed 700,000 pounds. Prior to 1921, small quantities of cobalt had also been produced in Connecticut, Idaho, Nevada, and Oregon; a record of the exact quantity is not available, but the total probably did not exceed 30,000 pounds. Therefore, the total output of cobalt in the United States before 1921 is estimated at 730,000 pounds.

Most of the output reported for 1921–39 represents cobalt contained in residues recovered at the electrolytic zinc plant of the Sullivan Mining Co., Kellogg, Idaho; none has been marketed, however. During this period Alabama produced a carlot, and a small quantity of concentrate containing cobalt and nickel was recovered as a byproduct of froth flotation of talc at Burlington, Vt.

There was no commercial production of cobalt ore in Missouri during 1921–43. In July 1944, however, the St. Louis Smelting & Refining Co. began producing a cobalt-nickel concentrate at its property near Fredericktown and in 1945 was the chief producer in the United States. In September 1946 the company suspended the production of nickel-cobalt concentrate but has continued to study the problem of making a successful recovery of separate products of cobalt and nickel.

Although cobalt has long been known to occur as a minor constituent of the iron ores at Cornwall, Pa., only during the past several years were experiments made on its recovery. The cobalt is contained in the sulfides that accompany the magnetite, and since 1940 there has been regular production from this source by the Bethlehem Steel Co.

Production and shipments of cobalt ore in the United States were substantially larger in 1947 than in 1946; however, the Bureau of Mines is not at liberty to publish the figures for these years.

The Bethlehem Steel Co. was the only producer of commercial cobalt ore in the United States in 1947, and its output and shipments were 174 and 188 percent, respectively, more than in 1946. The cobalt-bearing material (averaging 1.43 percent cobalt in 1947) is shipped to The Pyrites Co., Wilmington, Del., where it is processed to metal and other cobalt products.

In 1947 the St. Louis Smelting & Refining Co. shipped some raw iron concentrates recovered from earlier operations at its property near Fredericktown, Madison County, Mo. The concentrates contained about 2 percent cobalt and were also shipped to The Pyrites Co.

The Sullivan Mining Co., Kellogg, Idaho, continued to recover cobalt at its electrolytic zinc plant in 1947 but, as in previous years, made no shipments. In 1947 it recovered 101 short tons of residues containing 6,519 pounds of cobalt.

Development was continued in 1947 at the Blackbird mine near Salmon, Idaho, by the Calera Mining Co., a wholly owned subsidiary of the Howe Sound Co. Approximately 4,500 feet of drifting and crosscutting were done in 1947. The ore carries copper and gold, as well as cobalt. According to the Howe Sound Co.:[6]

Active underground development was continued and sufficient ore has now been blocked out to definitely show the commercial possibilities of this mine. Research to determine the best processes for separating the several metals contained in this complex cobalt-copper-gold ore, and for refining the cobalt product, continued favorably but is still incomplete and no decision in regard to building a plant will be made until these studies are concluded. Development and exploratory work will continue during 1948.

The results of Bureau of Mines field work on the Blackbird cobalt deposits[7] and pilot-plant work on recovery of cobalt metal and oxide[8] were described.

RESERVES

The following information on reserves of cobalt in the United States was prepared by the Bureau of Mines and Geological Survey and is quoted from a report on mineral position of the United States, published in the hearings before a subcommittee of the Committee on Public Lands, United States Senate, Eightieth Congress, first session, 1947:

For the purposes of this report, the cobalt deposits of the United States have been divided into those that could be made available under economic and technologic conditions similar to those existing in 1943 (class 1) and those that may become available under increased prices and a considerable advance in technology (class 2). Class 1 includes primarily the deposits at Cornwall, Pa.; Fredericktown, Mo.; and the Blackbird district, Idaho. The Cornwall ores constitute the largest class 1 reserve; they contain only about 0.05 percent of cobalt, which is intimately associated with pyrite. Concentration for the recovery of cobalt is therefore readily effected by separation of the pyrite, which contains a little less than 1.5 percent of cobalt and represents a recovery of about 65 percent of the cobalt in the ore. The complex lead-copper-nickel deposits of Fredericktown, Mo., contain about 0.3 percent of cobalt, and the copper-cobalt ores of Blackbird, Idaho, about 0.5 percent or more.

Class 2 deposits comprise mainly sulfide ores in the Appalachian region that are now of interest chiefly for their copper or sulfur and iron content. These ores contain from a few hundredths to 0.1 percent of cobalt, but data are not as yet available to permit accurate determination of the average content. The problem of recovering the cobalt by present methods of treating these ores has not been solved. Certain low-grade manganese deposits of the southern Appalachians contain small quantities of cobalt, but the technology of their treatment and cobalt recovery has received only experimental attention. Cobalt in manganese ores can be recovered in the electrolytic recovery of manganese; should production of electrolytic manganese be greatly expanded, appreciable quantities of byproduct cobalt might be produced.

Estimated reserves of cobalt in the United States as of 1943, in short tons

Availability	Measured and indicated		Inferred		Total	
	Crude ore	Cobalt content	Crude ore	Cobalt content	Crude ore	Cobalt content
Class 1[1]	45,350,000	30,000	64,300,000	59,000	109,650,000	89,000
Class 2[2]	43,000,000	32,500	125,000,000	75,000	168,000,000	107,500

[1] Reserves that could be made available under such economic and technologic conditions as in 1943.
[2] Reserves that could be made available only under some increase in price over that of 1943 and under considerable advance in technology.

[6] Howe Sound Co., Annual Report: 1947, pp. 3–4.
[7] Reed, G. C., and Herdlick, J. A., Blackbird Cobalt Deposits, Lemhi County, Idaho: Bureau of Mines Rept. of Investigations 4012, 1947, 14 pp.
[8] Shelton, F. K., and others, Electrowinning of Cobalt from Cobaltite Concentrates: Bureau of Mines Rept. of Investigations 4172, 1948, 98 pp.

The total estimated reserve available under such wartime conditions as prevailed in 1943 is 89,000 short tons, equivalent to 100 years' supply at the rate of use during the five prewar years 1935–39, and 38 years' supply at the peak war rate, if it could be produced at any such rate; however, the nature of cobalt occurrence is such that it would be produced chiefly as a byproduct, and for this reason the rate at which it could be produced would be determined largely by factors governing the output of the associated products. The rate of output in the near future, as in the past, will be governed chiefly by operations at Cornwall, Pa. The outlook for new production is very uncertain and will depend upon the outcome of mining and metallurgical developments in the Blackbird, Idaho, and Fredericktown, Mo., areas, in both of which cobalt is associated with other metals.

CONSUMPTION

Refiners or Processors.—Consumption by refiners or processors of cobalt contained in alloy and ore was 2,672,991 pounds in 1947, an increase of 33 percent over 1946. However, usage of cobalt intermediates by refiners or processors was only 3 percent greater. Of the alloy and ore consumed in 1947, about three-fourths was employed in making cobalt metal. The remainder of the alloy and ore and all of the other cobalt raw materials were used in producing the cobalt products shown in the accompanying table.

Cobalt consumed [1] by refiners or processors in the United States, 1945–47

Cobalt material	Pounds of cobalt		
	1945	1946	1947
Alloy and ore	4,808,825	2,009,018	2,672,991
Fines and granules	453,538	499,737	528,544
Rondelles	64,872	148,197	128,937
Hydrate	133,831	128,740	152,102
Carbonate	18,460	19,243	6,904

[1] The fines, granules, rondelles, hydrate, and carbonate consumed originated from alloy and ore; therefore, combining alloy and ore with these materials would result in duplication.

Specified cobalt products [1] produced and shipped in the United States, 1946–47, in pounds

Product	Production		Shipments	
	Gross weight	Cobalt content	Gross weight	Cobalt content
1946 [2]				
Oxide	228,555	159,433	228,584	159,409
Hydrate	480,070	197,092	466,779	193,015
Salts:				
Acetate	209,068	49,416	211,241	50,211
Carbonate	125,769	58,753	126,578	59,285
Sulfate	243,303	49,999	255,321	52,513
Other	25,578	5,639	25,500	5,332
Driers	11,530,340	693,379	11,296,499	675,516
1947				
Oxide	325,442	228,755	315,303	221,278
Hydrate	460,866	182,295	452,316	176,877
Salts:				
Acetate	191,200	45,072	171,351	40,453
Carbonate	165,108	77,361	127,600	59,451
Sulfate	489,321	101,161	381,652	78,703
Other	63,751	14,927	49,107	11,348
Driers	9,792,481	597,612	9,637,876	590,755

[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] Revised figures for all products except oxide.

Industrial Consumers.—Consumption of cobalt by industrial consumers was 4,165,539 pounds in 1947, an increase of 1.5 percent over 1946. The largest single use of cobalt in 1947 was for permanent-magnet alloys, which accounted for 21 percent of the total quantity consumed; however, usage for this purpose was substantially less than in 1946. The second-largest quantity of cobalt was employed in cast cobalt-chromium-tungsten-type alloys, which accounted for 15 percent of the total cobalt consumed; usage for this purpose was 22 percent greater than in 1946. Continuing its upward trend, utilization of cobalt in ground-coat frit for porcelain enamel was 47 percent more in 1947 than in 1946. A noteworthy gain in the use of cobalt in steels, other than high-speed and magnet, was recorded in 1947. Consumption of cobalt in alloy hard-facing rods and materials, cemented carbides, and pigments was also at a higher rate than in 1946, but usage in high-speed steel was slightly lower.

Cobalt consumed in the United States, 1946–47, by uses

Use	Pounds of cobalt	
	1946	1947
Metallic:		
High-speed steel	224,049	223,148
Magnet steel	[1] 1,463,539	121,223
Permanent magnet alloys		894,924
Other steel	201,949	386,354
Cast cobalt-chromium-tungsten-type alloys	526,504	642,452
Alloy hard-facing rods and materials	53,874	71,545
Cemented carbides	[1] 45,100	62,734
Other	81,988	99,476
Total metallic	2,597,003	2,501,856
Nonmetallic (exclusive of salts and driers):		
Ground-coat frit	412,766	607,316
Pigments	170,662	207,928
Other	39,596	51,439
Total nonmetallic	623,024	866,683
Salts and driers: Lacquers, varnishes, paints, inks, pigments, enamels, glazes, feed, electroplating, etc. (estimate)	885,000	797,000
Grand total	4,105,027	4,165,539

[1] Revised figure.

PRICES

Effective July 1, 1947, the price of cobalt metal (97–99 percent, in kegs of 550 pounds) was increased from \$1.50 to \$1.65 a pound delivered east of Chicago. For quantities under 100 pounds the price was advanced from \$1.57 to \$1.72 a pound. The price of oxide to ceramic plants was advanced from \$1.16 a pound to \$1.27½. The former prices had been in effect since October 1939.

FOREIGN TRADE [9]

Imports.—Imports of cobalt into the United States established a new record in 1947; they were 138 percent greater than in 1946 and 40 percent larger than in the previous record year 1943. The Belgian

[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.

Congo continued to be the chief source of imports; in 1947 it supplied 3,177,970 pounds of metal and 3,751,452 pounds of alloy containing 1,640,952 pounds of cobalt. Belgium supplied 2,726,025 pounds of metal and 752,150 pounds of oxide containing 534,029 pounds of cobalt; both the metal and oxide were produced from Belgian Congo alloy. Canada supplied 751,438 pounds of ore containing 77,721 pounds of cobalt, Japan and Sweden 128,837 and 2,240 pounds, respectively, of metal, and the United Kingdom 81 pounds of metal and 626 pounds (gross weight) of salts and compounds.

The duty on cobalt oxide continued to be 10 cents a pound, sulfate 5 cents a pound, linoleate 10 cents, and other salts and compounds 30 percent ad valorem. Cobalt metal and ore entered the United States duty-free.

Cobalt imported for consumption in the United States, 1943–47, by classes

Year	Alloy [1]—Pounds		Ore [2]		
			Pounds		Value
	Gross weight	Cobalt content	Gross weight	Cobalt content	
1943	[3] 10, 110, 879	[3] 4, 357, 335	10, 556, 042	1, 268, 788	$1, 620, 869
1944	8, 500, 516	3, 737, 000	473, 529	61, 123	53, 434
1945	8, 397, 145	3, 616, 000	859, 940	109, 112	91, 554
1946	1, 648, 595	717, 337	657, 787	73, 892	59, 861
1947	3, 751, 452	1, 640, 952	751, 438	77, 721	58, 920

Year	Metal		Oxide		Other salts and compounds	
	Pounds	Value	Pounds (gross weight)	Value	Pounds (gross weight)	Value
1943	266, 670	$373, 948	58, 928	$95, 463	56	$164
1944	73, 088	102, 323	225, 609	400, 356	115	354
1945	946, 475	1, 582, 670	120, 672	215, 563	224	700
1946	1, 935, 582	2, 749, 326	1, 074, 630	1, 450, 236	350	778
1947	[4] 6, 035, 153	[4] 7, 994, 347	752, 150	753, 916	626	1, 947

[1] Reported by importer to Bureau of Mines; not separately classified by U. S. Department of Commerce. Value not available.
[2] Data for 1943, 1944, and 1946 adjusted by Bureau of Mines to exclude alloy.
[3] Excludes 2,384,915 pounds of alloy containing 980,000 pounds of cobalt received in December 1942 but recorded as January 1943 by U. S. Department of Commerce.
[4] Adjusted by Bureau of Mines.

Exports.—Exports of cobalt from the United States are small; 12 pounds of ore and concentrates valued at $72 and 576 pounds of metal and alloys valued at $1,853 were exported in 1947. Somewhat larger quantities of oxide, salts, and driers are also exported, but the figures are not separately recorded by the United States Department of Commerce.

WORLD REVIEW

Five countries—Belgian Congo, Canada, French Morocco, Northern Rhodesia, and the United States—have contributed about 92 percent of the world output of cobalt in recent years. The accompanying table shows world production by countries, 1939–47, insofar as statistics are available.

World mine production of cobalt, 1939–47, by countries, in metric tons [1]

[Compiled by B. B. Mitchell]

Country [1]	Cobalt content								
	1939	1940	1941	1942	1943	1944	1945	1946	1947
Australia	13	12	13	14	15	9	10	11	(2)
Belgian Congo	1,080	2,301	2,256	1,656	2,061	1,877	2,800	2,150	3,500
Bolivia (exports)	------	2	2	(3)	(3)	------	------	------	------
Burma	[4] 229	218	73	(2)	(2)	(2)	(2)	(2)	(2)
Canada	332	360	119	38	80	16	49	34	217
Chile	(2)	(2)	2	(3)	3	5	1	(2)	(2)
Finland	(2)	(2)	(2)	98	79	86	84	(2)	(2)
Italy	(2)	89	81	(2)	(2)	(2)	(2)	(2)	(2)
Japan	------	------	(3)	1	3	15	11	7	(2)
Morocco, French	680	330	65	3	216	243	100	200	320
Northern Rhodesia [4]	1,598	1,223	650	914	943	978	874	552	420
Sweden	------	------	------	------	------	------	9	------	(2)
United States (shipments)	------	58	237	300	346	253	581	(5)	(5)
Total (estimate)	4,500	5,000	4,000	3,500	4,200	3,900	4,700	3,500	5,100

[1] In addition to countries listed, Brazil, China, Germany, and Spain produce cobalt, but production data are not available. Estimate by author of chapter included in total.
[2] Data not available; estimate by author of chapter included in total.
[3] Less than 1 ton.
[4] Year ended June 30 of year stated.
[5] Bureau of Mines not at liberty to publish figure.

Belgian Congo.—The world's premier producer of cobalt continues to be Belgian Congo, where the Union Minière du Haut Katanga is the sole producer. Production of cobalt in Belgian Congo was begun in 1924, when 273 metric tons were produced; since that year output has increased almost without interruption and reached a peak of about 3,500 metric tons in 1947. Total output from 1924 through 1947 has been about 29,000 metric tons. The company has a cobalt mine and a cobalt-concentrating plant at Kabolela and a cobalt mine and ore-treatment plant at Kamoto. At Jadotville it has six single-phase electric furnaces (monthly capacity, about 300 tons) for smelting cobalt-bearing ores and slags. The cobaltiferous red alloy from the electric furnaces is refined in two rotary furnaces; and the resultant crude cobalt, which is cast into ingots, is shipped chiefly to company refining plants at Niagara Falls, N. Y., and Oolen, Belgium, for processing the crude cobalt to metal, oxide, salts, and driers. The solutions used in the electrolytic plants contain cobalt, which is recovered by a special process of precipitation. The precipitates are treated by electrolysis in a refining plant (also at Jadotville) capable of producing about 225 tons a month of granules of high purity and very low carbon content. The total refining capacity of the company plants at Niagara Falls, N. Y., Oolen, Belgium, and Jadotville, Belgian Congo, is about 7,500 tons annually. On the basis of a rate of production of 4,000 metric tons annually, the company reports having developed reserves of cobalt sufficient for 40 to 50 years, and it anticipates that these reserves will increase as a result of further development being done on its copper deposits.

Canada.—Reported production of cobalt (content) in Canada increased to 478,000 pounds in 1947 from 74,902 pounds in 1946. The output in 1947 was derived from the cobalt-silver ore at Cobalt, Ontario, and the nickel-copper ores of the Sudbury district, Ontario. Canadian production figures, however, do not include the cobalt recovered by the Mond Nickel Co. at its Clydach (Wales) nickel refinery from the nickel-copper ores of the Sudbury district.

In 1947 the International Nickel Co. of Canada, Ltd., at its Canadian nickel refinery, began the commercial recovery of cobalt as oxide from the nickel-copper ores of the Sudbury district.

Some cobalt contained in the nickel-copper ores of the Sudbury district is also recovered at the Clydach (Wales) nickel refinery of the Mond Nickel Co., but the quantity so produced has not been made public. The raw material for the Clydach refinery is second Orford bottoms, received in the form of roasted sulfide from Port Colborne, Ontario. Cobalt is precipitated as cobaltic hydroxide from the iron-free liquid by the addition of a nickel peroxide slurry, prepared in a separate plant from nickel sulfate, caustic soda, and sodium hypochlorite.[10] The first cobalt precipitate is purified and passed forward to the chemical salts department at a cobalt : nickel ratio of 70 : 1. The chemical salts department produces cobalt and nickel oxides and salts.

Certain improvements and changes in the nickel refinery of Falconbridge Nickel Mines, Ltd., which also produces nickel-copper ores in the Sudbury district, will permit recovery of the cobalt from the matte.[11]

In the cobalt area of northern Ontario, the Silanco Mining & Refining Co., Ltd. (successor to Silanco Mining & Smelting Corp.), which mines cobalt-silver ores and operates a concentrator, was the chief producer. However, the company suspended mining operations in early 1947. It plans to unwater the Agaunico-Reuthel and Beaver-Temiskaming mines as the initial step in resuming mining operations.[12] The construction of a smelter by this company, noted in the chapter of this series for 1946, was not completed in 1947. J. H. Sutherland and Robert McArthur are building a small concentrator at the Violet mine to treat ore from the Lawson mine, which they lease.[13]

French Morocco.—Production of cobalt ore at the Bou Azzer and Graara mines was 2,660 metric tons in 1947 compared with 1,693 tons in 1946. Moroccan ore, which contains 12 to 15 percent cobalt, as well as nickel and gold, is shipped to French and Belgian processing plants.

Germany.[14]—At the plant of Gebr. Borchers, Goslar, the source of cobalt was mainly the Mansfeld residues (chiefly furnace hearth accretion) which were treated at a maximum rate of 900 tons monthly. The average cobalt content of the residues was 1.5 percent. The precipitation of 85 to 90 percent of the cobalt was effected by the addition of sodium hypochlorite.

At the plant of Duisburger Kupferhutte, Duisburg, the source of the cobalt, which has been produced annually to the extent of 150 metric tons, has been burnt pyrites cinder from Spain and other European countries. It is received as residues from the making of sulfuric acid. This plant has handled as much as 3,000 metric tons of cinder daily but is now handling about 1,000 tons. The average cobalt content of the cinder is about 0.04 percent, of which about 60 percent is recovered.

10 Canadian Mining Journal, vol. 67, No. 5, May 1946, pp. 534-536.
11 Falconbridge Nickel Mines, Ltd., 19th Annual Report: 1947, p. 1.
12 Northern Miner, vol. 33, No. 36, Nov. 27, 1947, p. 16.
13 Northern Miner, vol. 33, No. 21, Aug. 14, 1947, p. 17.
14 Young, L. J., and Bauld, R. H., Some Aspects of Copper, Nickel, and Cobalt Production in Germany: British Intelligence Objectives Subcommittee, Final Rept. 1003, Item 21, ca. 1946, 28 pp.

Japan.—The following information concerning cobalt in Japan is contained in a report prepared by the Supreme Commander for the Allied Powers:[15]

Before World War II Japan imported all cobalt needed for industrial use. When events of the war virtually stopped all imports, attempts were made to develop low-grade domestic deposits, and in 1944 under heavy subsidies, the four producing mines supplied a maximum of 1,534 metric tons of hand-picked concentrates, averaging about 1 percent cobalt.

Most of the cobalt mines are in remote areas and transportation costs are high. The ores are low grade, must be beneficiated before shipment, and estimated reserves are relatively small. It is believed that domestic mines can supply only a minor amount of cobalt to meet Japan's future needs.

Production of hand-picked cobalt concentrates in Japan, 1941–45, by mines, in metric tons

Mine	Cobalt content (percent)	1941	1942	1943	1944	1945	Production, 1941-45	
							Total	Percent of total
Dogatani	1.5	--------	--------	16	330	93	439	14
Naganobori	1.2	10	5	269	1,023	670	1,977	64
Sanyo	1.3	10	55	36	181	110	392	13
Taisho	.8	--------	--------	--------	--------	275	275	9
	----------	20	60	321	1,534	1,148	3,083	100

Northern Rhodesia.—The second largest producer of cobalt in the world is Northern Rhodesia, where the cobalt mineral occurs associated with copper in certain ore found in the copper mines of the Rhokana Corp., which has been producing cobalt since 1933; total output through June 30, 1947, has been 11,686 metric tons. The output of alloy was 1,225 short tons containing 463 tons of cobalt in the year ended June 30, 1947, compared with 1,527 tons containing 609 tons of cobalt in 1946. Inability of Rhodesia Railways to transport coal at a rate sufficient to maintain copper output at capacity was responsible for the smaller 1947 cobalt production, which was the lowest since 1935. The construction of a gravity plant by the company, noted in the chapter of this series for 1945, has been completed and put into operation. In this plant a portion of the middlings in the cobalt concentrate is tabled to give a higher concentrate than is obtained by flotation. The cobalt-containing mineral, carrollite, being heavier than the copper minerals or gangue, can be concentrated by gravity on tables, and although this does not increase the over-all recovery of cobalt, it yields a concentrate containing 7 to 9 percent cobalt compared with 2 to 3 percent in the flotation concentrate. Consequently, the higher cobalt content and lower copper and iron content in the gravity product compared with the flotation concentrate gives a richer feed to the electric furnace and reduces the handling of slags from the converters and reverberatories.

[15] Supreme Commander for the Allied Powers, General Headquarters, Natural Resources Section, Cobalt Resources in Japan: Rept. 54, Aug. 31, 1946, 20 pp.

Coke and Coal Chemicals

By J. A. De CARLO, J. A. CORGAN, and MAXINE M. OTERO

GENERAL SUMMARY

DEMANDS for virtually all consumer goods were at exceptionally high levels in 1947, and enormous volumes of raw materials were required for their manufacture. Responding to these influences, the coke industry produced vitally needed coke and related products in quantities never equaled before in a peacetime year. Total production of coke increased 26 percent over 1946, an achievement made possible by the 24-percent gain in oven-coke output and the 46-percent rise in beehive production. The 26-percent increase compares favorably with the 30-percent rise in output of pig iron and is substantially greater than the improvement in industry generally, which was only 10 percent, according to the Federal Reserve Board index of physical volume of industrial production.

The coke industry suffered no major work stoppages in 1947 and operated at a fairly uniform rate throughout the year. Production of oven coke averaged 183,331 tons per day in the first quarter of the year and, although dropping slightly in the second and third quarters, increased considerably in the last quarter, averaging 189,517 tons per day, the highest rate ever maintained for a corresponding period. The gain in daily rate of production in the last quarter was due principally to the addition of new coke ovens.

The beehive segment of the industry staged a remarkable comeback in 1947, and a number of plants that had closed during and immediately after the end of World War II were rehabilitated and

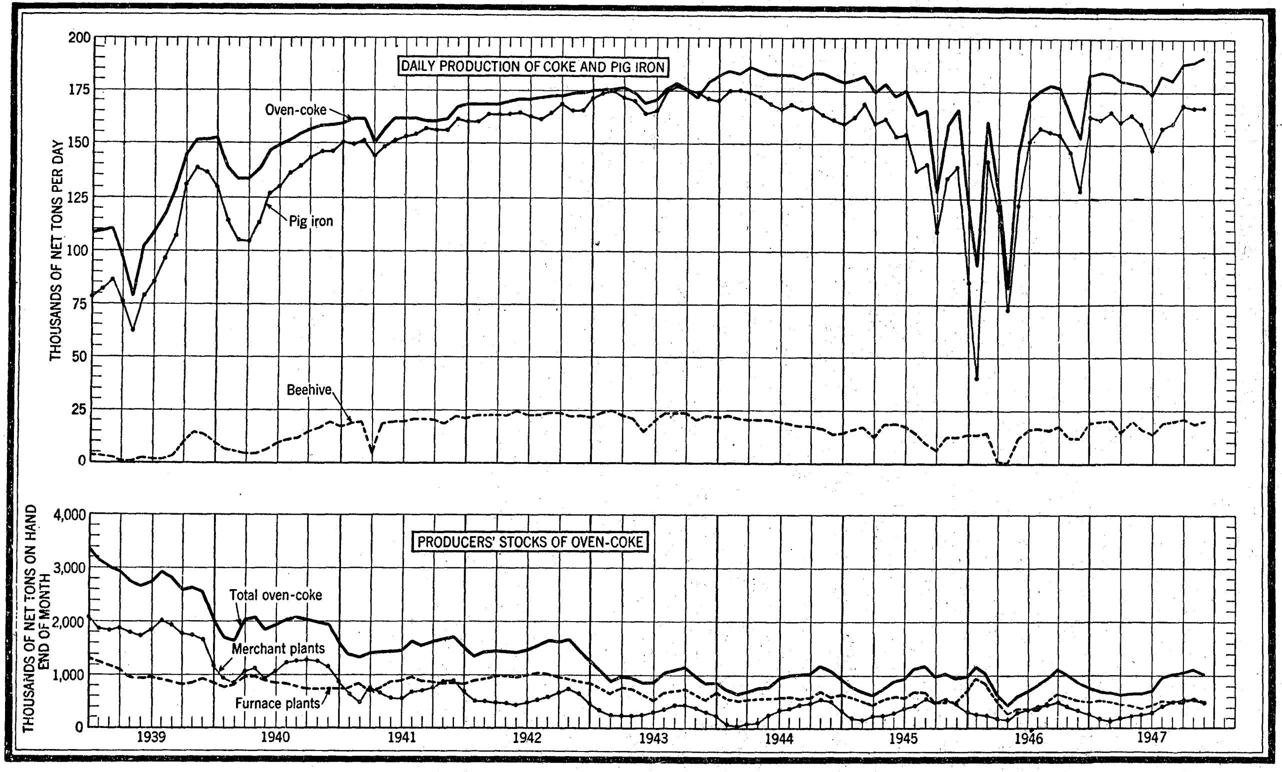

FIGURE 1.—Average daily production of beehive and oven coke and pig iron and producers' stocks of oven coke, 1939–47, by months.

put back in blast. Output of beehive coke climbed to the highest point since 1944 and no doubt would have been greater had more good coking coal been available. The average daily rate of beehive output, although fluctuating more than that of oven coke, was relatively stable throughout the year, reflecting the heavy demand for coke.

The total quantity of coal carbonized in all ovens in 1947 nearly equaled the 1944 record and was 26 percent higher than the 1946 figure. It is to be noted, however, that the amount of coal used in the manufacture of oven coke in 1947 exceeded the 1944 total by 149,441 tons, although coke output was 306,246 tons lower. The decline in coke output was due principally to the poorer quality of coal charged and also to deterioration of a large number of over-age ovens, which have been operated at exceptionally high rates since the beginning of World War II. The poor quality of coal used is reflected in the yield of oven coke, which declined from 71.0 percent in 1944 to 70.6 percent in 1947, although the percentage of breeze recovered per ton of coal carbonized increased from 5.3 percent to 5.8 percent in the same period.

The over-all demand for bituminous coal in 1947, together with increases in mining and transportation costs, caused the average value of coking coal delivered to all coke plants to rise $0.96 per ton or 17 percent above the previous maximum of 1946. The average cost of coal delivered to oven-coke plants advanced $1.01 per ton to $6.78, a new peak. Coal costs for beehive ovens also soared to a new level, rising $0.84 per ton over the 1946 figure.

Supplies of coke were not sufficient to meet increased requirements, and market prices were considerably higher than in 1946. According to trade-journal quotations, prices of foundry coke in five major markets in December 1947 were on the average 31 percent higher than in December 1946 and 69 percent greater than prices at the end of 1939. Spot prices quoted on Connellsville furnace coke showed increases of 40 and 206 percent in the same period. Reports received by the Bureau of Mines from oven- and beehive-coke producers showed substantial gains over 1946 in the price of all coke sold f. o. b. ovens (merchant sales).

The high level of operations in the iron and steel industry in 1947 required enormous tonnages of metallurgical fuel, and 78.6 percent of the total coke distributed was shipped to iron blast furnaces and 5 percent to foundry cupolas. The demand was equally as strong in other industries, and 6.5 percent was earmarked for the manufacture of producer gas and water gas, 4.5 percent for other industrial purposes, and 5.4 percent for domestic or household use. The total tonnage of domestic coke sold by producers in 1947 was the lowest in 23 years and clearly illustrates the insistent demand for industrial coke.

Because of shortages of coke in the United States, shipments to countries outside its continental limits were drastically curtailed. As a consequence, total exports declined sharply and were 32 percent below the 1946 total, according to data compiled by the Bureau of Mines from records of the United States Department of Commerce. Canada, which has always been a part of the natural market for a number of coke producers, received 70 percent of the total foreign shipments. Imports, although doubling in quantity over 1946, were small, representing less than 0.1 percent of the total indicated consumption.

Preliminary data from the Bureau's 1947 annual survey of employment at coke plants show that 20,800 men were employed at oven-coke plants and worked 60,780,000 man-hours, increases over 1946 of 1,894 men and 7,232,953 man-hours. The number of men employed at beehive plants increased from 2,504 in 1946 to 2,900 in 1947, and the man-hours worked increased from 4,163,075 to 5,990,000. The gains in employment in both the oven and the beehive industries were due to reactivation of a number of plants that had been idle for several years. The increases in man-hours worked were attributable to the absences of major work stoppages.

The sharp rise in oven-coke output in 1947 was accompanied by substantial increases over 1946 in the production of crude tar, light oil, ammonia (NH_3 equivalent of all forms), and gas. The output of crude tar, light oil, and ammonia each advanced about 23 percent while gas, because of an improvement in yield, increased about 24 percent.

The active market for all coal products in 1947 influenced prices, and receipts from sales reached new levels. The total realization from the sale of all coal-chemical materials in 1947 increased 41 percent over 1946 and reached $222,093,651. The gross value of all coke, breeze, and coal-chemical materials in 1947 exceeded $1,000,000,000 for the first time and was 55 percent higher than the 1946 figure and 39 percent above the previous maximum of 1944.

TABLE 1.—Salient statistics of the coke industry in the United States in 1947

	Coke ovens	Beehive ovens	Total
Coke produced—			
At merchant plants:			
Net tons	13,897,699	(1)	(1)
Value	$161,906,508		
At furnace plants:			
Net tons	52,860,850		
Value	$549,193,901		
Total:			
Net tons	66,758,549	6,687,301	73,445,850
Value	$711,100,409	$65,305,111	$776,405,520
Screenings or breeze produced:			
Net tons	5,474,113	128,027	5,602,140
Value	$16,165,758	$229,010	$16,394,768
Coal charged into ovens:			
Bituminous:			
Net tons	94,325,132	10,474,536	104,799,668
Value	$639,631,521	$46,419,236	$686,050,757
Average per ton	$6.78	$4.43	$6.55
Anthracite:			
Net tons	262,196		262,196
Value	$1,542,303		$1,542,303
Average per ton	$5.88		$5.88
Total:			
Net tons	94,587,328	10,474,536	105,061,864
Value	$641,173,824	$46,419,236	$687,593,060
Average per ton	$6.78	$4.43	$6.54
Average yield in percent of total coal charged:			
Coke	70.58	63.84	69.91
Breeze (at plants actually recovering)	5.79	1.22	5.68
Ovens:			
In existence Jan. 1	14,494	12,864	27,358
In existence Dec. 31	14,728	13,443	28,171
Dismantled during year	240	243	483
In course of construction Dec. 31	572		572
Annual coke capacity Dec. 31 net tons	72,549,100	8,844,400	81,393,500

See footnotes at end of table.

TABLE 1.—Salient statistics of the coke industry in the United States in 1947—Continued

	Coke ovens	Beehive ovens	Total
Coke used by producer—			
In blast furnaces:			
Net tons	37, 694, 964	291, 766	37, 986, 730
Value	$378, 744, 040	$2, 941, 524	$381, 685, 564
In foundries:			
Net tons	88, 332		88, 332
Value	$948, 273		$948, 273
To make producer gas:			
Net tons	826, 875		826, 875
Value	$7, 234, 535		$7, 234, 535
To make water gas:			
Net tons	1, 541, 471		1, 541, 471
Value	$14, 253, 894		$14, 253, 894
For other purposes:			
Net tons	435, 997	3, 031	439, 028
Value	$4, 212, 078	$29, 272	$4, 241, 350
Coke sold—			
To financially affiliated plants—			
For blast-furnace use:			
Net tons	11, 945, 200	1, 806, 330	13, 751, 530
Value	$136, 337, 047	$15, 056, 934	$151, 393, 981
For foundry use:			
Net tons	30, 265		30, 265
Value	$706, 220		$706, 220
For manufacture of water gas:			
Net tons	725, 066		725, 066
Value	$7, 860, 918		$7, 860, 918
For other purposes:			
Net tons	284, 563	23, 617	308, 180
Value	$3, 002, 361	$255, 848	$3, 258, 209
To other consumers—			
For blast-furnace use:			
Net tons	2, 628, 277	3, 269, 968	5, 898, 245
Value	$28, 788, 099	$32, 218, 058	$61, 006, 157
For foundry use:			
Net tons	3, 115, 577	415, 827	3, 531, 404
Value	$46, 076, 770	$4, 966, 055	$51, 042, 825
For manufacture of water gas:			
Net tons	1, 385, 906	268, 168	1, 654, 074
Value	$14, 990, 610	$2, 950, 701	$17, 941, 311
For other industrial use:			
Net tons	1, 961, 639	572, 458	2, 534, 097
Value	$22, 146, 983	$6, 526, 761	$28, 673, 744
For domestic use:			
Net tons	3, 917, 402	59, 926	3, 977, 328
Value	$43, 835, 479	$603, 567	$44, 439, 046
Disposal of screenings or breeze:			
Used by producer—			
For raising steam:			
Net tons	3, 482, 874	28, 866	3, 511, 740
Value	$9, 662, 237	$55, 000	$9, 717, 237
To make producer or water gas:			
Net tons	43, 877		43, 877
Value	$178, 372		$178, 372
For other purposes:			
Net tons	637, 814	6	637, 820
Value	$1, 809, 970	$73	$1, 810, 043
Sold:			
Net tons	1, 106, 720	65, 063	1, 171, 783
Value	$3, 950, 108	$144, 980	$4, 095, 088
Average receipts per ton sold (merchant sales):			
Furnace coke	$10. 95	$9. 85	$10. 34
Foundry coke	$14. 79	$11. 94	$14. 45
Water-gas coke	$10. 82	$11. 00	$10. 85
Other industrial coke	$11. 29	$11. 40	$11. 32
Domestic coke	$11. 19	$10. 07	$11. 17
Screenings or breeze	$3. 57	$2. 23	$3. 49
Stocks on Jan. 1, 1948:			
Furnace coke net tons	376, 097	10, 181	386, 278
Foundry coke do	12, 362	50	12, 412
Domestic and other coke do	631, 397	2, 150	633, 547
Screenings or breeze do	1, 204, 140	730	1, 204, 870
Exports do	(1)	(1)	835, 059
Imports do	(1)	(1)	104, 093
Indicated consumption do	(1)	(1)	72, 611, 413
Coal-chemical materials produced:			
Tar gallons	736, 174, 480		736, 174, 480
Ammonium sulfate or equivalent pounds	1, 824, 622, 871		1, 824, 622, 871

See footnotes at end of table.

TABLE 1.—Salient statistics of the coke industry in the United States in 1947—Continued

	Coke ovens	Beehive ovens	Total
Coal-chemical materials produced—Continued			
Gas .... M cubic feet..	971, 262, 280	....	971, 262, 280
Burned in coking process .... percent..	37. 71	....	37. 71
Surplus sold or used .... do....	61. 05	....	61. 05
Wasted .... do....	1. 24	....	1. 24
Crude light oil .... gallons..	254, 978, 463	....	254, 978, 463
Yield of coal-chemical materials per ton of coal:			
Tar .... do....	7. 78	....	7. 78
Ammonium sulfate or equivalent .... pounds..	19. 66	....	19. 66
Gas .... M cubic feet..	10. 27	....	10. 27
Crude light oil .... gallons..	2. 75	....	2. 75
Value of coal-chemical materials sold:			
Tar:			
Sold	$30, 981, 953	....	$30, 981, 953
Used by producer	$9, 407, 100	....	$9, 407, 100
Ammonia (sulfate and liquor)	$28, 196, 121	....	$28, 196, 121
Gas (surplus)	$112, 008, 007	....	$112, 008, 007
Crude light oil and derivatives	$34, 783, 301	....	$34, 783, 301
Other coal-chemical materials [2]	$16, 124, 269	....	$16, 124, 269
Total value of coke and breeze produced and coal-chemical materials sold [3]	$958, 766, 918	$65, 534, 121	$1, 024, 301, 039

[1] Not separately recorded.
[2] Includes naphthalene, tar derivatives, and miscellaneous coal-chemical materials.
[3] Includes value of tar used by producer.

TABLE 2.—Statistical trends of the coke industry in the United States, 1937 and 1944–47

	1937	1944	1945	1946	1947
Production:					
Oven coke .... net tons..	49, 210, 748	67, 064, 795	62, 094, 288	53, 929, 447	66, 758, 549
Beehive coke .... do....	3, 164, 721	6, 973, 022	5, 213, 893	4, 568, 401	6, 687, 301
Total .... do....	52, 375, 469	74, 037, 817	67, 308, 181	58, 497, 848	73, 445, 850
Percent oven coke	94. 0	90. 6	92. 3	92. 2	90. 9
Stocks of coke, end of year .... net tons..	2, 595, 287	1, 124, 685	931, 813	928, 766	1, 032, 237
Exports, all coke .... do....	526, 683	866, 835	1, 478, 746	1, 231, 327	835, 059
Imports, all coke .... do....	286, 364	63, 004	51, 964	52, 188	104, 093
Indicated consumption, all coke .... do....	51, 271, 929	72, 971, 401	66, 074, 271	57, 321, 756	72, 611, 413
Disposal, all coke sold or used:					
Furnace coke .... do....	36, 751, 969	57, 481, 353	51, 002, 921	43, 700, 492	57, 636, 505
Foundry coke .... do....	2, 038, 822	2, 511, 854	2, 636, 731	2, 996, 202	3, 650, 001
Other industrial coke (including producer and water gas) .... net tons..	4, 597, 894	6, 978, 062	6, 937, 553	6, 593, 870	8, 028, 791
Domestic coke .... do....	8, 107, 518	6, 717, 543	6, 775, 508	5, 096, 733	3, 977, 328
Carbonizing equipment:					
Coke ovens in existence, end of year	12, 718	14, 580	14, 510	14, 494	14, 728
Beehive ovens in existence, end of year	12, 194	16, 318	12, 179	12, 864	13, 443
Coke ovens under construction, end of year	259	180	335	824	572
Cost of coal charged, oven-coke plants, average per ton	$3. 74	$5. 08	$5. 28	$5. 77	$6. 78
Prices of coke:					
Average spot price of Connellsville furnace coke, f. o. b. ovens	$4. 29	$7. 00	$7. 29	$8. 13	$10. 49
Average realization on oven coke sold (merchant sales):					
Furnace coke	$4. 34	$7. 59	$7. 87	$8. 85	$10. 95
Foundry coke	$8. 47	$11. 03	$11. 48	$12. 62	$14. 79
Other industrial coke (including water gas)..	$6. 08	$8. 12	$8. 35	$9. 58	$11. 13
Domestic coke	$6. 53	$8. 63	$8. 69	$9. 90	$11. 19
Yield of coal-chemical materials per ton of coal charged:					
Tar .... gallons..	8. 67	8. 13	7. 95	7. 82	7. 78
Ammonium sulfate or equivalent .... pounds..	21. 84	20. 29	20. 22	19. 79	19. 66
Crude light oil .... gallons..	2. 86	2. 87	2. 84	2. 77	2. 75
Surplus gas sold or used .... M cubic feet..	6. 66	6. 58	6. 33	6. 29	6. 27
Average gross receipts for coal-chemical materials per ton of coke produced:					
Tar sold and used	$0. 502	$0. 458	$0. 447	$0. 466	$0. 605
Ammonia and its compounds	$0. 326	$0. 324	$0. 356	$0. 361	$0. 423
Crude light oil and its derivatives (including naphthalene)	$0. 435	$0. 552	$0. 503	$0. 467	$0. 566
Surplus gas sold or used	$1. 483	$1. 403	$1. 413	$1. 542	$1. 678
Total coal-chemical materials (including breeze).	$2. 974	$3. 102	$3. 069	$3. 207	$3. 710

TABLE 3.—Coke produced, value, number of ovens, coal charged, and average yield in the United States in 1947, by States

[Exclusive of screenings or breeze]

State	Oven coke: 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
Alabama	7	1,313	8,281,171	70.88	5,869,738	$47,086,856	$8.02
California	1	90	536,708	61.90	332,244	(1)	(1)
Colorado	1	262	1,246,796	68.15	849,697	(1)	(1)
Illinois	8	856	5,359,054	71.01	3,805,374	49,267,806	12.95
Indiana	5	1,863	11,933,222	73.62	8,785,687	117,614,296	13.39
Maryland	1	422	2,747,426	71.89	1,975,201	(1)	(1)
Massachusetts	2	215	1,650,740	72.45	1,196,010	(1)	(1)
Michigan	4	568	3,897,667	72.32	2,818,941	32,406,972	11.50
Minnesota	3	196	1,252,573	71.67	897,739	10,367,425	11.55
New Jersey	2	304	1,987,921	72.05	1,432,210	(1)	(1)
New York	8	1,142	8,069,260	70.27	5,670,333	58,629,308	10.34
Ohio	15	2,309	14,205,640	70.88	10,069,237	98,973,704	9.83
Pennsylvania	13	3,585	23,981,096	68.70	16,474,893	165,391,784	10.04
Tennessee	1	44	325,898	74.23	241,925	(1)	(1)
Texas	2	125	372,298	70.64	263,006	(1)	(1)
Utah	2	308	1,613,308	60.48	975,772	(1)	(1)
Virginia							
West Virginia	5	612	4,034,917	69.95	2,822,381	24,140,981	8.55
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	6	514	3,091,633	73.69	2,278,161	27,043,913	11.87
Undistributed						80,177,364	11.03
Total 1947	86	14,728	94,587,328	70.58	66,758,549	711,100,409	10.65
At merchant plants	32	3,047	19,285,896	72.06	13,897,699	161,906,508	11.65
At furnace plants	54	11,681	75,301,432	70.20	52,860,850	549,193,901	10.39
Total 1946	85	14,494	76,359,486	70.63	53,929,447	450,060,212	8.35

State	Beehive coke: 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	Total: Coke produced (net tons)	Total: Value of coke at ovens
Alabama							5,869,738	$47,086,856
California							332,244	(1)
Colorado	(2)	32,063	67.02	21,489	(1)	(1)	871,186	(1)
Illinois							3,805,374	49,267,806
Indiana							8,785,687	117,614,296
Maryland							1,975,201	(1)
Massachusetts							1,196,010	(1)
Michigan							2,818,941	32,406,972
Minnesota							897,739	10,367,425
New Jersey							1,432,210	(1)
New York							5,670,333	58,629,308
Ohio							10,069,237	98,973,704
Pennsylvania	11,305	9,217,730	64.15	5,913,133	$56,665,562	$9.58	22,388,026	222,057,346
Tennessee							241,925	(1)
Texas							263,006	(1)
Utah	297	127,461	53.11	67,693	(1)	(1)	1,043,465	(1)
Virginia	750	366,993	57.73	211,876	2,508,223	11.84	211,876	2,508,223
West Virginia	896	583,566	64.74	377,825	4,151,739	10.99	3,200,206	28,292,720
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	195	146,723	64.94	95,285	(1)	(1)	2,373,446	(1)
Undistributed					1,979,587	10.73		109,200,864
Total: 1947	13,443	10,474,536	63.84	6,687,301	65,305,111	9.77	73,445,850	776,405,520
1946	12,864	7,167,424	63.74	4,568,401	36,669,170	8.03	58,497,848	486,729,382

[1] Included with "Undistributed."

[2] 160 ovens abandoned in May 1947.

SCOPE OF REPORT

This chapter is based on data supplied to the Bureau of Mines by coke-plant operators in the United States. The statistics are confined to oven and beehive coke and related products. Carbonizing equipment, designed for recovery of the volatile matter from the coal at high temperatures, formerly called "byproduct oven," is referred to in this report as "coke oven." In recent years commercial operation of a few low- and medium-temperature carbonization plants has placed on the market coal products somewhat distinct in character from those mentioned above. The products of these processes are chiefly semicokes, ranging from 3 to 16 percent volatile content and very suitable as smokeless fuel, and tar with a high percentage of light fractions and tar acids. The difference in characteristics of these products compared with those of other carbonizing equipment is attributed to the lower temperature and different coking-chamber and heating-flue design, which cause less alteration of the composition of the volatile matter expelled during carbonization. In order to follow the progress of low- and medium-temperature carbonization proper, a separate table containing salient statistics for this group of plants has been prepared (table 4). Retort coke, as the name infers, is the product made by city gas companies in coal-gas retorts and has limited application to industrial needs. For this reason it is used mainly for heating the retorts, steam raising, gas manufacture, and domestic heating. Pertinent statistics on retort coke are given in table 5. Coke is made by other processes not covered in this report, including the refining of petroleum and of crude tar. Preliminary figures for 1947 indicate that the production of coke at petroleum refineries totaled 2,415,400 net tons and coal-tar pitch coke 101,000 net tons. The standard unit of measurement in the coke industry in the United States is the short or net ton of 2,000 pounds.

MEDIUM- AND LOW-TEMPERATURE COKE

TABLE 4.—Salient statistics of medium- and low-temperature carbonization plants in the United States in 1947

	Quantity	Value
Coke produced...net tons..	148,969	$1,281,400
Coal carbonized...do....	247,982	704,605
Average per ton...	------------	2.84
Average yield of coke in percent of coal carbonized...	60.07	------------
Ovens and retorts:		
In existence December 31...	31	------------
Annual coke capacity December 31...net tons..	188,100	------------
Tar produced...gallons..	2,168,077	------------
Yield per ton of coal...do....	8.74	------------
Value of coke and breeze produced and coal-chemical materials sold...	------------	1,603,628

RETORT COKE

TABLE 5.—Salient statistics of the coal-gas industry in the United States in 1947 [1]

	Horizontal retorts	Vertical retorts and gas ovens	Total
Coke produced:			
Net tons	234,965	429,611	664,576
Value	$2,383,675	$4,115,419	$6,499,094
Screenings or breeze produced...net tons	19,720	57,604	77,324
Coal charged into retorts:			
Net tons	382,881	711,939	1,094,820
Value	$3,265,681	$6,100,276	$9,365,957
Average per ton	$8.53	$8.57	$8.55
Average yield in percent of coal charged:			
Coke	61.37	60.34	60.70
Breeze (at plants actually recovering)	8.24	8.67	8.56
Retorts:			
In existence Dec. 31	1,007	412	1,419
In operation Dec. 31	755	399	1,154
Annual coal capacity...net tons	473,800	799,300	1,273,100
Coke used by producer:			
Net tons	140,483	213,983	354,466
Value	$1,375,903	$1,844,882	$3,220,785
Coke sold to other consumers:			
Net tons	98,550	207,404	305,954
Value	$1,048,223	$2,180,895	$3,229,118
Stocks on Jan. 1, 1948:			
Coke...net tons	18,933	61,388	80,321
Breeze...do	1,461	10,347	11,808
Coal-chemical materials:			
Tar:			
Production...gallons	4,516,103	10,479,971	14,996,074
Sales...do	4,814,795	10,587,635	15,402,430
Value of sales	$269,620	$624,114	$893,734
Stocks on Jan. 1, 1948...gallons	649,207	1,290,900	1,940,107
Per ton of coal charged...do	11.80	14.72	13.70
Ammonia liquor (NH_3 content):			
Production...pounds	------------	951,100	951,100
Sales...do	------------	1,006,617	1,006,617
Value of sales	------------	$25,878	$25,878
Stocks on Jan. 1, 1948...pounds	------------	54,721	54,721
Per ton of coal charged...do	------------	3.04	3.04
Crude light oil: [2]			
Production...gallons	19,494	292,462	311,956
Sales...do	18,121	291,258	309,379
Value of sales	$1,305	$22,867	$24,172
Stocks on Jan. 1, 1948...gallons	10,453	16,821	27,274
Per ton of coal charged...do	0.20	1.18	0.91

[1] Additional data in Production of Coke and Coal Chemicals from Coal-Gas Retorts in 1947, Bureau of Mines Mineral Market Rept. 1594, Apr. 16, 1948.
[2] Includes drip and holder oil.

OVEN AND BEEHIVE COKE AND COKE BREEZE

GROWTH OF INDUSTRY

TABLE 6.—Historical Statistics of the coke industry in the United States, 1880 and 1890–1947

Year	Production (million net tons)			Percent of total production from slot-type ovens	Ovens in existence		Slot-type 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)			
	Oven coke	Beehive coke	Total		Slot type	Beehive					Beehive coke	Oven coke	All coal-chemical materials [1]	Total coke and coal chemical materials
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
1935	34.2	.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
1946	53.9	4.6	58.5	92.2	14,494	12,864	824	83.5	70.0	8.32	37	450	173	660
1947	66.8	6.7	73.5	90.9	14,728	13,443	572	105.0	69.9	10.57	65	711	248	1,024

[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 oven-coke plants is included for those years for which it was reported, namely, 1916, 1917, and 1919–47. For other coal-chemical materials, 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 coal-chemical materials available.

MONTHLY AND WEEKLY PRODUCTION

Tables 7 to 10 summarize weekly and monthly production of coke. Weekly production of beehive coke is estimated from records of carloadings received each week from all coke-carrying railroads. Monthly data on beehive and oven coke are based upon reports from producers. The weekly and monthly figures have been adjusted to the annual total ascertained by direct canvass of the producers.

TABLE 7.—Coke produced in the United States, 1937 and 1945–47, by months and average per day, in net tons [1]

Month	1937		1945		1946		1947	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
Oven coke:								
January	4,360,700	140,700	5,621,100	181,300	3,822,300	123,300	5,650,600	182,300
February	3,992,900	142,600	5,101,000	182,200	2,647,200	94,500	5,158,500	184,300
March	4,495,500	145,000	5,691,100	183,600	5,029,700	162,200	5,690,700	183,600
April	4,350,900	145,000	5,269,200	175,600	3,874,800	129,200	5,413,500	180,400
May	4,479,700	144,500	5,572,900	179,800	2,588,900	83,500	5,561,900	179,400
June	4,024,800	134,200	5,207,500	173,600	4,444,400	148,100	5,352,900	178,400
July	4,423,900	142,700	5,473,700	176,600	5,354,500	172,700	5,403,300	174,300
August	4,573,400	147,500	5,111,300	164,900	5,494,600	177,300	5,664,700	182,700
September	4,427,800	147,600	5,036,900	167,900	5,376,500	179,200	5,426,900	180,900
October	4,035,100	130,200	3,974,100	128,200	5,545,200	178,900	5,833,100	188,200
November	3,222,300	107,400	4,827,900	160,900	4,954,300	165,100	5,682,500	189,400
December	2,823,800	91,100	5,207,600	168,000	4,797,000	154,700	5,920,000	191,000
	49,210,800	134,800	62,094,300	170,100	53,929,400	147,800	66,758,600	182,900
Beehive coke:								
January	274,300	10,600	460,700	14,900	418,500	13,500	594,100	19,100
February	294,600	12,300	456,000	16,300	379,400	13,600	538,200	19,200
March	357,300	13,200	534,800	17,200	478,200	15,500	606,100	19,500
April	309,700	11,900	377,000	12,600	22,100	700	445,800	14,900
May	326,500	12,600	559,900	18,000	27,800	900	611,800	19,800
June	274,800	10,600	561,000	18,700	377,900	12,600	471,100	15,700
July	285,100	11,000	550,800	17,700	482,800	15,600	437,100	14,100
August	259,000	10,000	456,400	14,700	539,900	17,400	588,700	19,000
September	253,900	9,800	297,800	9,900	500,100	16,700	593,600	19,800
October	225,500	8,700	198,100	6,400	573,900	18,500	627,000	20,200
November	168,800	6,500	367,700	12,300	372,100	12,400	559,600	18,700
December	135,200	5,200	393,700	12,700	395,700	12,800	614,200	19,800
	3,164,700	10,200	5,213,900	14,300	4,568,400	12,500	6,687,300	18,300
Total:								
January	4,635,000	151,300	6,081,800	196,200	4,240,800	136,800	6,244,700	201,400
February	4,287,500	154,900	5,557,000	198,500	3,026,600	108,100	5,696,700	203,500
March	4,852,800	158,200	6,225,900	200,800	5,507,900	177,700	6,296,800	203,100
April	4,660,600	156,900	5,646,200	188,200	3,896,900	129,900	5,859,300	195,300
May	4,806,200	157,100	6,132,800	197,800	2,616,700	84,400	6,173,700	199,200
June	4,299,600	144,800	5,768,500	192,300	4,822,300	160,700	5,824,000	194,100
July	4,709,000	153,700	6,024,500	194,300	5,837,300	188,300	5,840,400	188,400
August	4,832,400	157,500	5,567,700	179,600	6,034,500	194,700	6,253,400	201,700
September	4,681,700	157,400	5,334,700	177,800	5,876,600	195,900	6,020,500	200,700
October	4,260,600	138,900	4,172,200	134,600	6,119,100	197,400	6,460,100	208,400
November	3,391,100	113,900	5,195,600	173,200	5,326,400	177,500	6,242,100	208,100
December	2,959,000	96,300	5,601,300	180,700	5,192,700	167,500	6,534,200	210,800
	52,375,500	145,000	67,308,200	184,400	58,497,800	160,300	73,445,900	201,200

[1] Before 1941 daily average production of beehive coke was calculated by subtracting Sundays and holidays in each month: 1942–47 daily average has been calculated by dividing total monthly production by total number of days in month.

TABLE 8.—Oven coke produced in the United States in 1947, by States and months, in net tons

[Based on reports from producers]

State	January	February	March	April	May	June	July
Alabama	485,200	432,700	482,400	477,200	503,600	480,900	477,500
California	26,400	24,800	27,900	27,600	28,800	28,500	28,300
Colorado	64,000	56,500	64,800	63,500	64,300	63,600	63,000
Illinois	328,200	296,800	333,400	315,400	321,100	301,900	304,700
Indiana	757,900	700,900	771,800	713,600	682,000	727,500	739,700
Maryland	168,800	166,700	170,200	162,200	166,600	160,600	167,000
Massachusetts	101,600	93,600	103,700	101,200	102,800	93,700	90,600
Michigan	228,600	217,500	245,500	228,700	248,100	232,700	239,900
Minnesota	77,700	70,900	77,400	75,300	76,200	72,500	72,200
New Jersey	121,400	112,800	127,100	117,900	122,500	116,300	117,200
New York	489,300	436,400	478,500	455,800	463,900	452,600	464,300
Ohio	868,700	781,000	865,200	824,900	850,600	803,800	802,400
Pennsylvania	1,416,500	1,282,000	1,409,900	1,354,700	1,403,900	1,322,800	1,324,200
Tennessee	21,300	20,100	22,200	18,500	20,900	19,700	18,000
Texas	----------	----------	----------	----------	----------	----------	12,000
Utah	69,600	75,100	91,100	79,800	88,200	74,900	70,600
West Virginia	228,800	212,400	224,600	214,200	223,100	217,000	222,700
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	196,600	178,300	195,000	183,000	195,300	183,900	189,000
	5,650,600	5,158,500	5,690,700	5,413,500	5,561,900	5,352,900	5,403,300
At merchant plants	1,185,300	1,086,700	1,199,400	1,126,900	1,178,600	1,124,900	1,132,700
At furnace plants	4,465,300	4,071,800	4,491,300	4,286,600	4,383,300	4,228,000	4,270,600

State	August	September	October	November	December	Total
Alabama	497,800	482,700	518,600	506,800	524,300	5,869,700
California	28,500	27,200	28,600	27,500	28,200	332,300
Colorado	77,900	80,900	82,600	83,000	85,600	849,700
Illinois	321,700	314,800	327,900	316,000	323,500	3,805,400
Indiana	755,300	722,200	745,400	722,900	746,500	8,785,700
Maryland	166,000	159,000	163,400	159,800	164,900	1,975,200
Massachusetts	99,300	100,800	102,800	100,900	105,000	1,196,000
Michigan	238,000	230,100	240,000	228,600	241,300	2,819,000
Minnesota	74,600	74,500	74,100	74,400	77,900	897,700
New Jersey	120,000	117,600	122,200	117,400	119,800	1,432,200
New York	481,300	469,000	497,300	477,900	504,000	5,670,300
Ohio	837,300	808,500	867,500	861,600	897,700	10,069,200
Pennsylvania	1,372,200	1,259,300	1,459,300	1,408,900	1,461,200	16,474,900
Tennessee	20,000	19,800	20,500	19,800	21,100	241,900
Texas	43,700	47,100	53,200	51,900	55,100	263,000
Utah	89,500	80,200	81,400	78,100	97,300	975,800
West Virginia	248,500	246,300	253,800	259,000	272,000	2,822,400
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	193,100	186,900	194,500	188,000	194,600	2,278,200
	5,664,700	5,426,900	5,833,100	5,682,500	5,920,000	66,758,600
At merchant plants	1,176,200	1,143,900	1,189,900	1,158,300	1,194,900	13,897,700
At furnace plants	4,488,500	4,283,000	4,643,200	4,524,200	4,725,100	52,860,900

TABLE 9.—Beehive coke produced in the United States in 1947, by weeks

[Estimated from railroad shipments]

Week ended—	Net tons	Week ended—	Net tons	Week ended—	Net tons
Jan. 4	[1] 61,800	May 10	147,500	Sept. 13	140,900
Jan. 11	126,500	May 17	149,100	Sept. 20	139,800
Jan. 18	133,700	May 24	144,800	Sept. 27	140,100
Jan. 25	126,600	May 31	133,800	Oct. 4	138,500
Feb. 1	132,600	June 7	135,800	Oct. 11	141,200
Feb. 8	126,400	June 14	118,300	Oct. 18	138,700
Feb. 15	134,100	June 21	128,400	Oct. 25	137,800
Feb. 22	129,000	June 28	84,200	Nov. 1	149,000
Mar. 1	138,500	July 5	11,000	Nov. 8	147,200
Mar. 8	137,100	July 12	53,400	Nov. 15	129,000
Mar. 15	148,200	July 19	115,400	Nov. 22	144,300
Mar. 22	144,200	July 26	137,000	Nov. 29	131,700
Mar. 29	145,400	Aug. 2	136,900	Dec. 6	147,600
Apr. 5	50,800	Aug. 9	135,300	Dec. 13	146,900
Apr. 12	68,600	Aug. 16	134,600	Dec. 20	148,900
Apr. 19	130,000	Aug. 23	139,000	Dec. 27	107,900
Apr. 26	149,100	Aug. 30	135,000	Jan. 3	[2] 73,100
May 3	138,200	Sept. 6	124,400		
					6,687,300

[1] 4 days only.
[2] 3 days only.

TABLE 10.—Beehive coke produced in the United States in 1947, by States and and months, in net tons

[Based on reports from producers]

State	January	February	March	April	May	June	July
Colorado	6,600	6,300	4,900	3,100	600		
Kentucky	9,200	7,000	10,800	6,300	9,200	6,600	7,100
Pennsylvania	521,900	475,300	530,600	387,700	538,400	413,500	388,300
Utah	4,800	5,300	6,000	5,500	6,500	4,700	3,400
Virginia	19,700	15,900	19,300	14,100	20,400	15,300	12,300
West Virginia	31,900	28,400	34,500	29,100	36,700	31,000	26,000
	594,100	538,200	606,100	445,800	611,800	471,100	437,100

State	August	September	October	November	December	Total
Colorado						21,500
Kentucky	8,200	7,800	8,000	6,700	8,400	95,300
Pennsylvania	522,900	527,700	558,200	499,700	548,900	5,913,100
Utah	6,600	5,700	5,500	6,800	6,900	67,700
Virginia	17,800	18,500	20,200	18,000	20,400	211,900
West Virginia	33,200	33,900	35,100	28,400	29,600	377,800
	588,700	593,600	627,000	559,600	614,200	6,687,300

PRODUCTION BY FURNACE AND MERCHANT PLANTS

The terms "furnace" and "merchant" plants, as used throughout this report, apply to oven-coke plants only. "Furnace" plants, as the name implies, are plants associated with iron and steel works whose output of coke normally does not enter the open market and is virtually all consumed in nearby blast furnaces. The group of plants classified as nonfurnace or "merchant" includes plants that sell their entire output on the competitive market; plants affiliated with alkali and chemical works; plants that were constructed to supply city gas, although not classed as public utilities, which sell their coke for domestic, industrial, and metallurgical use; and, in addition, several

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plants that are associated with local iron furnaces but produce much more coke than the furnaces can consume and therefore depend on the sale of foundry, domestic, and metallurgical coke.

In recent years the trend in expansion in the oven-coke industry has been almost entirely in the furnace segment of the industry. Since 1937 the number of active furnace plants has risen from 43 to 54 whereas the number of merchant plants declined from 42 to 32. The growth in furnace plants is even more striking when measured by the record of production. In the past 11 years production from furnace plants has increased 46 percent, while output from merchant plants has increased only 6 percent.

TABLE 11.—Number and production of oven-coke plants connected with iron furnaces and of other plants in the United States, 1913, 1918, 1937, and 1945–47

Year	Number of active plants		Coke produced (net tons)		Percent of production	
	Furnace plants	Merchant plants	Furnace plants	Merchant plants	Furnace plants	Merchant 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
1945	53	34	48,695,172	13,399,116	78.4	21.6
1946	53	32	41,540,962	12,388,485	77.0	23.0
1947	54	32	52,860,850	13,897,699	79.2	20.8

TABLE 12.—Monthly and average daily production of oven coke by plants connected with iron furnaces and by other plants in the United States, 1937 and 1946–47, in net tons

Month	1937		1946		1947	
	Furnace plants	Merchant plants	Furnace plants	Merchant plants	Furnace plants	Merchant plants
Monthly production:						
January	3,241,600	1,119,100	2,684,000	1,138,300	4,465,300	1,185,300
February	2,996,500	996,400	1,610,600	1,036,600	4,071,800	1,086,700
March	3,355,000	1,140,500	3,885,700	1,144,000	4,491,300	1,199,400
April	3,310,300	1,040,600	2,930,600	944,200	4,286,600	1,126,900
May	3,375,600	1,104,100	1,920,000	668,900	4,383,300	1,178,600
June	2,917,500	1,107,300	3,502,100	942,300	4,228,000	1,124,900
July	3,316,100	1,107,800	4,250,100	1,104,400	4,270,600	1,132,700
August	3,469,300	1,104,100	4,388,900	1,105,700	4,488,500	1,176,200
September	3,334,700	1,093,100	4,298,700	1,077,800	4,283,000	1,143,900
October	2,910,500	1,124,600	4,452,000	1,093,200	4,643,200	1,189,900
November	2,142,700	1,079,600	3,910,800	1,043,500	4,524,200	1,158,300
December	1,764,400	1,059,400	3,707,400	1,089,600	4,725,100	1,194,900
Total	36,134,200	13,076,600	41,540,900	12,388,500	52,860,900	13,897,700
Average daily production:						
January	104,600	36,100	86,600	36,700	144,100	38,200
February	107,000	35,600	57,500	37,000	145,500	38,800
March	108,200	36,800	125,300	36,900	144,900	38,700
April	110,300	34,700	97,700	31,500	142,900	37,500
May	108,900	35,600	61,900	21,600	141,400	38,000
June	97,300	36,900	116,700	31,400	140,900	37,500
July	107,000	35,700	137,100	35,600	137,800	36,500
August	111,900	35,600	141,600	35,700	144,800	37,900
September	111,200	36,400	143,300	35,900	142,800	38,100
October	93,900	36,300	143,600	35,300	149,800	38,400
November	71,400	36,000	130,300	34,800	150,800	38,600
December	56,900	34,200	119,600	35,100	152,400	38,600
Average	99,000	35,800	113,800	34,000	144,800	38,100

Furnace plants, because of their close relationship with the iron and steel industry, normally follow closely the activity in this industry; and output tends to fluctuate more than that of merchant plants, which, because of their diversified interest, do not plan their operations with regard to the coke market alone. For example, furnace plants, in 1947, accounted for more than 79 percent of the total oven-coke output as compared with less than 54 percent for the depression year 1932 when iron and steel production was low. Tables 11 and 12 summarize statistics on production of both groups of plants.

PRODUCTION BY STATES AND DISTRICTS

The increase in output of oven coke in 1947 was Nationwide, and every one of the 22 States where it is manufactured produced more than in 1946. Percentagewise, Utah led all States, with an increase of 100 percent; Colorado followed, with an advance of 52 percent; Indiana, 32 percent; West Virginia, 31 percent; Pennsylvania, 29 percent; and California, 28 percent. Increases in other States ranged from 4 percent in Minnesota to 26 percent in Alabama. Texas again became a producer of oven coke as the Sheffield Steel Co. coke plant at Houston and the Daingerfield plant of the Lone Star Steel Co. resumed operations during the year. Tonnagewise, the States that reported the largest increases were Pennsylvania, with 3,680,172 tons; Indiana, 2,134,120 tons; Ohio, 1,617,657 tons; and Alabama, 1,203,799 tons. The increased production in these four States accounted for 67 percent of the total gain in output over 1946.

The large gains in tonnage of oven-coke production in Western States in recent years is clearly illustrated in table 14. Production in these States increased from 1 percent of the Nation's total in 1937 to 4 percent in 1947. Although production has increased in this period in the New England and Middle Atlantic regions, the relative proportion of the total output of oven coke has decreased. For example, Connecticut, Massachusetts, and Rhode Island produced about 4 percent of the total in 1937 compared with less than 3 percent in 1947; and Maryland, New Jersey, New York, and Pennsylvania dropped from 43 to 38 percent.

All States in which beehive coke was produced (except Colorado) shared the increased output in 1947. The decrease in output in Colorado was due to closing of the Cokedale plant of the American Smelting & Refining Co. in May. Utah reported a twelve-fold increase in output followed, in order, by West Virginia, with a gain of 71 percent; Pennsylvania, 47 percent; and Virginia, 24 percent. As in all preceding years, Pennsylvania produced the preponderance of the Nation's beehive coke, supplying more than 88 percent.

TABLE 13.—Coke produced in the United States, 1937 and 1944–47, by States, in net tons

[Exclusive of screenings or breeze]

State	1937	1944	1945	1946	1947
Oven coke:					
Alabama	4, 259, 771	5, 727, 612	5, 400, 925	4, 665, 939	5, 869, 738
California		339, 570	256, 092	260, 470	332, 244
Colorado	486, 945	650, 511	639, 099	558, 545	849, 697
Illinois	2, 998, 663	3, 878, 764	3, 681, 516	3, 192, 395	3, 805, 374
Indiana	5, 467, 061	8, 821, 021	7, 814, 247	6, 651, 567	8, 785, 687
Maryland	1, 513, 651	2, 058, 233	2, 024, 609	1, 661, 606	1, 975, 201
Massachusetts	1, 130, 620	1, 177, 850	1, 149, 448	1, 046, 267	1, 196, 010
Michigan	2, 283, 518	3, 005, 424	2, 805, 970	2, 499, 664	2, 818, 941
Minnesota	704, 631	894, 095	825, 620	860, 754	897, 739
New Jersey	1, 015, 073	1, 022, 917	1, 284, 020	1, 258, 854	1, 432, 210
New York	4, 946, 964	6, 102, 560	5, 789, 974	5, 042, 674	5, 670, 333
Ohio	6, 737, 881	10, 338, 913	9, 405, 710	8, 451, 580	10, 069, 237
Pennsylvania	13, 701, 262	16, 976, 574	15, 255, 137	12, 794, 721	16, 474, 893
Tennessee	89, 451	219, 503	236, 979	229, 751	241, 925
Texas		184, 506	140, 254		263, 006
Utah	149, 659	739, 432	731, 306	487, 133	975, 772
Washington	14, 656				
West Virginia	1, 817, 993	2, 637, 591	2, 462, 477	2, 162, 453	2, 822, 381
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1, 892, 949	2, 289, 719	2, 190, 905	2, 105, 074	2, 278, 161
	49, 210, 748	67, 064, 795	62, 094, 288	53, 929, 447	66, 758, 549
Beehive coke:					
Colorado	64, 222	81, 684	72, 678	58, 761	21, 489
Kentucky		68, 076	74, 404	85, 400	95, 285
Pennsylvania	2, 559, 048	6, 170, 897	4, 583, 720	4, 027, 167	5, 913, 133
Tennessee	14, 982	8, 850			
Utah	6, 657	21, 442	4, 205	5, 234	67, 693
Virginia	240, 425	243, 116	191, 032	171, 242	211, 876
West Virginia	279, 387	378, 957	287, 854	220, 597	377, 825
	3, 164, 721	6, 973, 022	5, 213, 893	4, 568, 401	6, 687, 301
Grand total	52, 375, 469	74, 037, 817	67, 308, 181	58, 497, 848	73, 445, 850

TABLE 14.—Production of oven coke, by geographic areas, 1937, 1940, and 1944–47, in net tons

Geographic areas	1937	1940	1944	1945	1946	1947
Connecticut, Massachusetts, and Rhode Island	1, 717, 558	1, 779, 306	1, 909, 637	1, 855, 396	1, 663, 316	1, 890, 973
Maryland, New Jersey, New York, and Pennsylvania	21, 176, 950	22, 641, 242	26, 160, 284	24, 353, 740	20, 757, 855	25, 552, 637
Ohio	6, 737, 881	7, 897, 929	10, 338, 913	9, 405, 710	8, 451, 580	10, 069, 237
Illinois, Indiana, and Missouri	8, 730, 680	9, 660, 017	12, 983, 611	11, 763, 201	10, 109, 231	12, 868, 508
Michigan, Minnesota, and Wisconsin	3, 589, 795	3, 944, 410	4, 506, 051	4, 236, 020	3, 970, 174	4, 342, 188
Alabama, Kentucky, Tennessee, and West Virginia	6, 606, 624	7, 328, 908	9, 252, 280	8, 713, 470	7, 671, 143	9, 614, 287
California, Colorado, Texas, Utah, and Washin ton	651, 260	762, 497	1, 914, 019	1, 766, 751	1, 306, 148	2, 420, 719
	49, 210, 748	54, 014, 309	67, 064, 795	62, 094, 288	53, 929, 447	66, 758, 549

TABLE 15.—Oven coke produced in the United States in 1947, by steel-producing districts

District	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens	
						Total	Per ton
Eastern	22	3,448	23,144,081	71.12	16,461,133	$176,255,587	$10.71
Pittsburgh-Youngstown	21	4,312	29,326,659	68.81	20,180,328	191,248,187	9.48
Cleveland-Detroit	10	1,652	10,005,783	71.89	7,192,951	78,322,773	10.89
Chicago	19	3,174	19,734,626	72.93	14,391,755	189,575,511	13.17
Southern	10	1,482	8,979,367	70.99	6,374,669	53,336,108	8.37
Western	4	660	3,396,812	63.52	2,157,713	22,362,243	10.36
	86	14,728	94,587,328	70.58	66,758,549	711,100,409	10.65

TABLE 16.—Coke produced in Pennsylvania in 1947, 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	Per ton
Oven coke:							
Eastern [1]	5	796	4,900,595	71.36	3,496,995	$38,001,903	$10.87
Western [2]	8	2,789	19,080,501	68.02	12,977,898	127,389,881	9.82
	13	3,585	23,981,096	68.70	16,474,893	165,391,784	10.04
Beehive coke:							
Fayette County	40	8,305	6,772,851	64.15	4,344,504	39,974,795	9.20
Westmoreland County	19	2,253	1,610,112	64.79	1,043,180	11,348,538	10.88
Other counties [3]	4	747	834,767	62.95	525,449	5,342,229	10.17
	63	11,305	9,217,730	64.15	5,913,133	56,665,562	9.58
Grand total	76	14,890	33,198,826	67.44	22,388,026	222,057,346	9.92

[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] Beaver, Greene, and Indiana Counties.

NUMBER AND TYPE OF OVENS

Coke Ovens.—At the end of 1947, 14,728 coke ovens of all types were in existence, and in addition, 572 new ovens were under construction. During 1947, 606 new ovens (including 132 ovens entirely rebuilt to replace old existing ovens) were placed in operation. The enormous requirements of metallurgical coke during and since World War II have made it necessary for coke-plant operators to conduct a vigorous rehabilitation and expansion program to meet the rising demand. Since the close of 1941, 2,194 new ovens (not including 702 completely rebuilt) have been placed in operation. However, this does not represent the net gain, as a number of plants discontinued operations and in some instances old batteries have been demolished at plants now active so that the industry has actually gained only 1,712 additional ovens. This indicates that a large number of new ovens constructed since 1941 have been replacements; the reason for this is fairly obvious when the length of service of many batteries is considered. Of all ovens in existence at the end of 1947, 13 percent were more than 30 years old; 27 percent more than 25 years; 12 percent more than 20; 12 percent more than 15; 4 percent more than 10; 12 percent more than 5; and 20 percent less than 5. As the average life of a coke oven is estimated at about 20 years, the relatively high percentage of over-age ovens indicates that failures of old ovens may seriously hinder coke production in the future unless extensive repair and rebuilding work is continued. Of the total number of ovens reported in existence on December 31, 1947, 41 percent were Koppers-Becker; 36 percent, Koppers; 11 percent, Semet-Solvay; 11 percent, Wilputte; and the remaining 1 percent miscellaneous other types.

Beehive Ovens.—The total number of beehive ovens in existence at the end of 1947, as reported by operators, increased 579 over 1946 and totaled 13,443. This change is not significant, however, as operators may consider certain ovens in existence one year and not the next, according to general economic conditions. The active market for coke in 1947 focused attention on the Connellsville beehive-coke region as a possible source of supply, and a number of plants that had been idle were reactivated. Thus the number of active beehive ovens, which averaged 10,764 in January 1947, increased to 11,476 in December.

TABLE 17.—Ovens completed and abandoned in the United States in 1947 and total number in existence at end of year, by States

State	Plants in existence Dec. 31	Ovens: In existence Dec. 31		Ovens: New		Ovens: Abandoned during year	Ovens: Under construction Dec. 31	
		Number	Annual coke capacity (net tons)	Number	Annual coke capacity (net tons)		Number	Annual coke capacity (net tons)
Oven coke:								
Alabama	7	1,313	6,663,000	63	443,500	240		
California	1	90	340,000					
Colorado	1	262	972,300	74	327,000			
Connecticut	1	70	(1)					
Illinois	8	856	3,845,300					
Indiana	5	1,863	9,341,800				77	400,000
Kentucky	1	120	(1)					
Maryland	1	422	2,124,000				61	396,000
Massachusetts	2	215	1,289,800					
Michigan	4	568	2,984,500					
Minnesota	3	196	989,000					
Missouri	1	64	(1)					
New Jersey	2	304	1,427,000					
New York	8	1,142	6,249,400					
Ohio	15	2,309	11,014,200	210	954,700			
Pennsylvania	13	3,585	17,635,200	21	82,300		328	1,588,200
Rhode Island	1	65	(1)					
Tennessee	1	44	242,000					
Texas	2	125	713,000					
Utah	2	308	1,202,800					
West Virginia	5	612	3,170,000	106	630,000		106	574,400
Wisconsin	2	195	(1)					
Undistributed			2,345,800					
	86	14,728	72,549,100	[2] 474	2,437,500	240	572	2,958,600
At merchant plants	32	3,047	14,599,200	8	45,700	240		
At furnace plants	54	11,681	57,949,900	466	2,391,800		572	2,958,600
Beehive coke:								
Colorado						160		
Kentucky	1	195	172,000					
Pennsylvania	63	11,305	7,668,300	[3] 761	524,700	3		
Utah	1	297	147,000					
Virginia	5	750	376,200					
West Virginia	7	896	480,900	[3] 61	16,600	80		
	77	13.443	8,844.400	[3] 822	541,300	243		

[1] Included with "Undistributed."
[2] Does not include 45 ovens in New York nor 87 in Pennsylvania which were completely rebuilt in 1947.
[3] Old ovens rehabilitated.

TABLE 18.—Coke ovens, by kinds, in the United States, at end of 1947, by States

State	Koppers	Koppers-Becker	Semet-Solvay	Wilputte	All others [1]	Total
Alabama	459	549	180	125		1,313
California		90				90
Colorado	116	146				262
Connecticut		70				70
Illinois	375	198	120	163		856
Indiana	406	812	161	484		1,863
Kentucky			120			120
Maryland	300	122				422
Massachusetts		160		55		215
Michigan		222	346			568
Minnesota	155	41				196
Missouri	56				8	64
New Jersey	165	139				304
New York	150	608	180	152	52	1,142
Ohio	1,238	456	293	322		2,309
Pennsylvania	1,550	1,695	88	132	120	3,585
Rhode Island	40	25				65
Tennessee			24	20		44
Texas		125				125
Utah		308				308
West Virginia	154	313		145		612
Wisconsin	100	15	80			195
	5,264	6,094	1,592	1,598	180	14,728
At merchant plants	741	1,113	722	337	60	2,973
At furnace plants	4,523	4,981	870	1,261	120	11,755

[1] Comprises 52 American Foundation, 120 Cambria, and 8 Piette.

TABLE 19.—Average number of beehive ovens active in the United States in 1947, by months

Month	Number	Month	Number	Month	Number
January	10,764	May	11,037	September	11,214
February	10,903	June	11,002	October	11,068
March	11,063	July	11,052	November	11,331
April	11,084	August	11,165	December	11,476

CAPACITY OF OVEN-COKE PLANTS

In establishing the coke capacity of the industry, the Bureau of Mines requests the operators 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." Capacity as thus stated is subject to change from year to year, depending on the age and condition of ovens, the character and quality of coal available, and economic and labor conditions. This capacity, therefore, differs from the rated capacity of the ovens estimated by the builders at the time the ovens were first built. The reported maximum capacity of all ovens is seldom attained because of the reasons outlined above. The rate of coke production for 1947 averaged 90.5 percent of capacity compared with 73.8 percent in 1946, when operations were hampered because of strikes. However, it was well below the 1942–44 wartime average of 95.2 percent and may be attributed principally to the deterioration of old ovens and to the scarcity and poorer quality of coal. The ability of the coke industry to increase or even maintain the 1947 operating rate of coke production in future will depend to a large degree on the extent of improvement in coking-coal quality and the rehabilitation or rebuilding of old ovens.

The oven-coke industry placed 474 new ovens, with an annual coke capacity of 2,437,500 net tons (exclusive of rebuilt ovens), in operation in 1947 but lost 1,001,000 tons because of the demolition of 240 ovens by the Semet-Solvay Division, Allied Chemical & Dye Corp., at Ensley, Ala., and also to the reduced operating rates at several plants having old ovens, with the result that the industry's potential maximum capacity increased only 1,436,500 tons or 2 percent over the 1946 figure. Since the end of 1944, capacity lost because of old oven failures has almost equaled that added by the construction of new ovens. For example, the total annual coke capacity placed in operation in this period amounted to 3,427,000 tons, yet the net gain was but 218,900 tons (table 20). Ovens under construction at the end of 1947 should add 2,958,600 more tons of coke per year, but the capacity that will be lost in the near future cannot be determined precisely, although some loss is certain.

TABLE 20.—Potential maximum annual coke capacity of all oven-coke plants in existence in the United States, 1937 and 1943–47

Year	Plants	Ovens	Potential maximum annual coke capacity (net tons)	Percent of change from 1937
1937	87	12,718	62,727,100	
1943	92	14,253	71,378,400	+13.8
1944	89	14,580	72,330,200	+15.3
1945	88	14,510	71,399,100	+13.8
1946	87	14,494	71,112,600	+13.4
1947	86	14,728	72,549,100	+15.7

TABLE 21.—Relationship of production to potential maximum capacity [1] at oven-coke plants in the United States, 1937 and 1944–47, by months, in percent

Month	1937	1944	1945	1946	1947	Month	1937	1944	1945	1946	1947
January	83.0	95.8	89.1	61.8	91.0	August	86.0	91.1	82.4	88.4	90.5
February	83.5	96.6	89.6	47.4	92.0	September	86.1	89.8	84.0	89.4	89.3
March	84.9	95.7	90.2	81.3	91.7	October	76.0	91.1	64.1	89.2	91.3
April	84.9	96.2	86.3	64.6	90.1	November	62.8	90.8	80.5	82.4	91.9
May	84.6	95.5	88.4	41.7	89.6	December	53.1	89.7	83.2	77.2	92.6
June	78.6	94.3	85.3	73.9	89.1						
July	83.2	91.5	88.3	86.2	86.9	Year	78.8	93.1	84.3	73.8	90.5

[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

Coke ovens rank second to railroads in the consumption of bituminous coal in the United States and normally account for about one-sixth of the annual output. The high operating rate maintained throughout the year, particularly in the oven-coke segment of the industry, resulted in a 26-percent increase in the tonnage of coal consumed. In 1947 beehives used 46 percent more coal than in 1946, and the tonnage charged into slot-type coke ovens was the highest on record. The exhaustion of good coking coal at a number of beehive installations in the Connellsville district of Pennsylvania limited the quantity of coal consumed in beehives in 1947. In addition to the general scarcity of good coking coal, consumption at oven-coke plants was also affected by railroad-car shortage.

Pennsylvania, as in previous years, was the leading State in coking-coal consumption, accounting for 25 percent of the total compared with 24 percent in 1946. Following Pennsylvania, in order, were: Ohio, 15 percent; Indiana, 13 percent; New York and Alabama, 9 percent each; and Illinois, 6 percent.

The average cost per ton of delivered coal used in the manufacture of oven coke in 1947 increased for the seventh consecutive year and was nearly 18 percent higher than the 1946 peak. This sharp increase in coal costs was due largely to increases in mining costs resulting from the wage agreement concluded between the miners and the coal producers in July 1947. The increase in freight rates granted to the railroads by the Interstate Commerce Commission in 1947 was also a factor in raising the cost of delivered coal.

Coal costs at beehive plants which, of course, are not as great as those at oven-coke plants because the coal is seldom transported any great distance, soared to a new all-time high in 1947. The average cost of $4.43 per ton was more than 23 percent higher than 1946. Tables 22 to 25 summarize statistics in quantity and costs of coals carbonized.

TABLE 22.—Coal consumed in coke ovens in the United States, 1937 and 1946–47, by months, in net tons

Month	1937			1946			1947		
	Coke oven	Beehive	Total	Coke oven	Beehive	Total	Coke oven	Beehive	Total
January	6,198,700	426,600	6,625,300	5,415,600	656,400	6,072,000	7,961,500	929,100	8,890,600
February	5,679,900	458,500	6,138,400	3,765,900	595,000	4,360,900	7,244,600	841,700	8,086,300
March	6,387,000	556,800	6,943,800	7,116,500	749,700	7,866,200	8,031,800	948,300	8,980,100
April	6,183,800	480,800	6,664,600	5,519,300	34,500	5,553,800	7,665,800	698,000	8,363,800
May	6,368,500	509,700	6,878,200	3,670,900	44,600	3,715,500	7,865,400	957,500	8,822,900
June	5,729,200	430,500	6,159,700	6,330,200	593,600	6,923,800	7,593,500	738,700	8,332,200
July	6,217,200	441,700	6,658,900	7,565,100	757,300	8,322,400	7,703,900	684,400	8,388,300
August	6,425,800	401,100	6,826,900	7,795,600	847,000	8,642,600	8,035,800	923,200	8,959,000
September	6,220,700	392,800	6,613,500	7,587,400	784,400	8,371,800	7,666,300	930,300	8,596,600
October	5,664,800	351,600	6,016,400	7,828,500	899,900	8,728,400	8,289,500	982,400	9,271,900
November	4,527,000	264,000	4,791,000	7,001,100	583,700	7,584,800	8,101,600	877,800	8,979,400
December	3,972,800	212,700	4,185,500	6,763,400	621,300	7,384,700	8,427,600	963,200	9,390,800
	69,575,400	4,926,800	74,502,200	76,359,500	7,167,400	83,526,900	94,587,300	10,474,600	105,061,900

TABLE 23.—Quantity and value at ovens of coal used in manufacturing coke in the United States in 1947, by States

State	Coal used (net tons)	Cost of coal		Coal per ton of coke	
		Total	Average per ton	Net tons	Cost
Oven coke:					
Alabama	8,281,171	$46,166,032	$5.57	1.41	$7.87
California	536,708	(1)	(1)	1.62	(1)
Colorado	1,246,796	(1)	(1)	1.47	(1)
Illinois	5,359,054	42,896,818	8.00	1.41	11.27
Indiana	11,933,222	95,581,868	8.01	1.36	10.88
Maryland	2,747,426	(1)	(1)	1.39	(1)
Massachusetts	1,650,740	(1)	(1)	1.38	(1)
Michigan	3,897,667	26,447,425	6.79	1.38	9.38
Minnesota	1,252,573	10,436,794	8.33	1.40	11.63
New Jersey	1,987,921	(1)	(1)	1.39	(1)
New York	8,069,260	62,615,897	7.76	1.42	11.04
Ohio	14,205,640	96,007,777	6.76	1.41	9.53
Pennsylvania	23,981,096	140,669,051	5.87	1.46	8.54
Tennessee	325,898	(1)	(1)	1.35	(1)
Texas	372,298	(1)	(1)	1.42	(1)
Utah	1,613,308	(1)	(1)	1.65	(1)
West Virginia	4,034,917	19,034,108	4.72	1.43	6.74
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	3,091,633	23,686,180	7.66	1.36	10.40
Undistributed		77,631,874	7.41	1.44	10.68
	94,587,328	641,173,824	6.78	1.42	9.60
At merchant plants	19,285,896	143,173,468	7.42	1.39	10.30
At furnace plants	75,301,432	498,000,356	6.61	1.42	9.42
Beehive coke:					
Colorado	32,063	(1)	(1)	1.49	(1)
Kentucky	146,723	(1)	(1)	1.54	(1)
Pennsylvania	9,217,730	40,931,725	4.44	1.56	6.92
Utah	127,461	(1)	(1)	1.88	(1)
Virginia	366,993	1,589,305	4.33	1.73	7.50
West Virginia	583,566	2,492,164	4.27	1.54	6.60
Undistributed		1,406,042	4.59	1.66	7.62
	10,474,536	46,419,236	4.43	1.57	6.94

[1] Included with "Undistributed."

TABLE 24.—Average cost per net ton of coal carbonized at oven-coke plants in the United States, 1937 and 1943–47, by States

State	1937	1943	1944	1945	1946	1947
Alabama	$2.33	$3.60	$4.03	$4.47	$4.96	$5.57
Illinois	4.62	5.62	6.04	6.16	6.70	8.00
Indiana	4.71	5.85	6.11	6.23	6.75	8.01
Michigan	4.16	4.57	5.39	5.55	5.97	6.79
Minnesota	5.24	6.02	6.35	6.52	6.86	8.33
New York	4.55	5.59	5.88	6.04	6.71	7.76
Ohio	3.76	4.73	5.03	5.27	5.72	6.76
Pennsylvania	2.98	3.96	4.28	4.40	4.79	5.87
West Virginia	2.54	3.19	3.32	3.56	3.84	4.72
Other States [1]	4.53	5.59	5.72	5.94	6.51	7.46
United States average	3.74	4.75	5.08	5.28	5.77	6.78
Cost of coal per ton of coke	5.27	6.70	7.16	7.45	8.17	9.60

[1] California, Colorado, Connecticut, Kentucky, Maryland, Massachusetts, Missouri, New Jersey, Rhode Island, Tennessee, Texas, Utah, and Wisconsin.

TABLE 25.—Cost of coal and value of products per net ton of coke produced in the United States, 1918, 1929, 1937, and 1943–47

Year	Oven coke				Beehive coke	
	Cost of coal per ton of coke	Value per ton of coke produced			Cost of coal per ton of coke	Value per ton
		Coke	Coal-chemical materials [1]	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
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
1946	8.17	8.35	3.20	11.55	5.63	8.03
1947	9.60	10.65	3.71	14.36	6.94	9.77

[1] Includes value of breeze produced.

YIELD OF COKE PER TON OF COAL

TABLE 26.—Yield of coke from coal in the United States, 1937 and 1945–47, by States, in percent

State	1937		1945		1946		1947	
	Oven coke	Beehive coke	Oven coke	Beehive coke	Oven coke	Beehive coke	Oven coke	Beehive coke
Alabama	72.37		71.62		71.45		70.88	
California			58.27		61.97		61.90	
Colorado	67.36	55.71	65.18	64.96	67.10	64.69	68.15	67.02
Illinois	70.54		70.83		70.86		71.01	
Indiana	72.04		73.48		72.31		73.62	
Maryland	72.62		73.16		72.36		71.89	
Massachusetts	69.99		70.85		69.87		72.45	
Michigan	71.05		71.42		72.00		72.32	
Minnesota	70.27		71.33		72.17		71.67	
New Jersey	70.78		71.29		72.39		72.05	
New York	71.75		70.40		70.93		70.27	
Ohio	71.61		71.26		70.87		70.88	
Pennsylvania	68.83	65.50	70.14	64.46	68.80	64.07	68.70	64.15
Tennessee	69.00	53.89	74.34		73.09		74.23	
Texas			69.55				70.64	
Utah	56.67	54.25	57.33	52.93	60.32	45.30	60.48	53.11
Virginia		58.33		58.75		58.67		57.73
Washington	56.11							
West Virginia	70.67	61.74	70.09	62.64	70.38	62.23	69.95	64.74
United States average	70.73	64.23	70.94	64.10	70.63	63.74	70.58	63.84

PREPARATION AND SOURCE OF COAL

Washed and Unwashed Coal.—The manufacture of coke requires coal of the highest quality, and preparation and upgrading of coals before charging them into ovens are receiving more attention because of deterioration in the quality of coals available for carbonization. The increase in ash, sulfur, and other impurities of the run-of-mine coal is due to a number of factors, the most important being: (1) Increased output of coal by mechanical mining and loading; (2) interruption in the installation of coal-preparation plants, due principally to shortages of building materials during the war; (3) the great demand for coal which results in the distribution of coal of inferior quality; and (4) the working of poorer-quality seams than the older ones now exhausted. Poor-quality coal results in poor-quality coke and affects economic working of the blast furnace (the largest consumer of coke) more than any other factor. Depending on the type of ore being smelted, the coke in the furnace occupies 50 percent to over 60 percent of the total furnace charge. This fact indicates that coke of inferior physical and chemical quality will result in poor furnace operation, low output of iron, and high fuel consumption. Furthermore, the continuous nature of the blast-furnace process calls for close limits in the degree of coke quality and makes it necessary to clean the coal in many areas for the production of satisfactory coke.

Although the proportion of washed coal carbonized in 1947 did not change from 1946, the tonnage cleaned increased 28 percent. All coal mined in Colorado and used for the manufacture of coke was washed; most of Tennessee's and Alabama's, and about one-third of Pennsylvania's was also washed before being charged into ovens. Data in table 27 include coal cleaned at the mines by coal producers as well as that cleaned at the coke plant by coke-plant operators. Coal cleaned at the mines was used by 40 oven- and 6 beehive-coke plants and comprised 64 percent of the total washed coal carbonized; the remainder—10,200,413 tons—was washed in cleaning installations at the ovens at 6 plants.

TABLE 27.—Washed and unwashed coal used in manufacturing coke in the United States in 1947, by States in which used, in net tons

State	Coke ovens				Beehive ovens		
	Bituminous		Anthracite	Total	Bituminous		
	Washed	Unwashed			Washed	Unwashed	Total
Alabama	8,056,683	224,488		8,281,171			
California	483,119	53,589		536,708			
Colorado	1,246,796			1,246,796	32,063		32,063
Illinois	1,101,281	4,235,841	21,932	5,359,054			
Indiana	107,000	11,826,222		11,933,222			
Maryland		2,747,426		2,747,426			
Massachusetts		1,650,740		1,650,740			
Michigan	130,446	3,667,564	99,657	3,897,667			
Minnesota	30,364	1,222,209		1,252,573			
New Jersey		1,987,921		1,987,921			
New York	624,974	7,399,919	44,367	8,069,260			
Ohio	4,433,508	9,755,748	16,384	14,205,640			
Pennsylvania	9,271,935	14,663,383	45,778	23,981,096	1,332,808	7,884,922	9,217,730
Tennessee	136,134	189,764		325,898			
Texas	224,155	148,143		372,298			
Utah		1,613,308		1,613,308		127,461	127,461
Virginia						366,993	366,993
West Virginia	1,388,083	2,638,011	8,823	4,034,917		583,566	583,566
Connecticut, Kentucky, Missouri, Rhode Island and Wisconsin	94,788	2,971,590	25,255	3,091,633		146,723	146,723
	27,329,266	66,995,866	262,196	94,587,328	1,364,871	9,109,665	10,474,536
At merchant plants	1,603,745	17,626,006	56,145	19,285,896			
At furnace plants	25,725,521	49,369,860	206,051	75,301,432			

Sources.—Expansion of the oven-coke industry in the past decade has increased sharply the demand for high-quality coking coal, and sources of supply have attained particular importance. The principal source of coking coal in the United States is the Appalachian region, extending from Alabama to Pennsylvania. States in this region supplied almost 95 percent of all coal purchased for the manufacture of oven coke in 1947. Pennsylvania and West Virginia are by far the largest producers; in 1947 each accounted for 35 percent of the total, followed by Kentucky with 14 percent, and Alabama with 9 percent. Virginia supplied 2,076,318 and Tennessee 154,910 tons. The blending of high-volatile midwestern coals with high-rank eastern coals (both high-volatile and low-volatile) is receiving more attention, and 505,099 tons of Illinois coal and 128,931 tons of Indiana coals were purchased by oven-coke-plant operators in 1947. States west of the Mississippi River, which supplied less than 2 percent of the total in 1937, furnished over 4 percent in 1947. This sharp increase is attributed to the wartime expansion in coal-carbonizing capacity in Texas, Colorado, Utah, and California.

Many of the coke-producing companies, especially those connected with the iron and steel industry, own or control the mines ("captive") that supply them with coking coal.

For many years the Bureau has asked oven-coke producers to report the approximate percentage of coking coal obtained from captive mines. In 1947, returns indicated that about 59 percent of the total tonnage received was obtained from such mines. Plants connected with the iron and steel industry or those classified by the Bureau as "furnace" obtained 77,542,465 tons of coal in 1947, of which 67 percent came from captive mines. For the nonfurnace or merchant segment of the oven-coke industry only 29 percent of the 19,783,000 tons of coal purchased came from captive mines. Tables 28 to 30 present statistics on the origin of coal used and where it was consumed in 1947.

Blending.—Blending a variety of coking coals before charging into slot-type ovens is widely practiced in the coke industry and is employed primarily to improve the quality of the coke and to utilize coals that would yield inferior coke if carbonized separately. In addition, the mixing of coals provides a means of controlling the quality and strength of the coke and the yield of the coal-chemical materials and permits flexible operation of oven-coke plants with reference to the supply of coking coal.

In 1947, of the 86 active plants, 76 carbonized coals of different volatile content. High- and low-volatile coals were carbonized by 46 plants; high-, medium-, and low-volatile by 25 plants; medium- and low-volatile by 3 plants; and high- and medium-volatile by 2 plants. Of the plants that did not blend their coals, 7 plants used straight high-volatile and 3 medium-volatile. At plants where blending is practiced, the proportion of the different kinds of coals mixed before charging into ovens varies widely from plant to plant according to local conditions. Classification of all coal purchased for coking in slot-type ovens in 1947 showed, however, that 65 percent was high-volatile, 14 percent medium-volatile, and 21 percent low-volatile.

TABLE 28.—Coal purchased for manufacturing oven coke in the United States in 1947, by fields of origin

State and district where coal was produced	Quantity purchased (net tons)	States where coal was consumed, in order of importance
Alabama	8,255,050	Alabama and Texas.
Arkansas	179,338	California, Colorado, Texas, Illinois, and Utah.
Colorado	906,407	Colorado and Utah.
Illinois	505,099	Illinois, Indiana, Minnesota, and Missouri.
Indiana	128,931	Illinois, Wisconsin, and Indiana.
Kentucky:		
Elkhorn	6,837,173	Indiana, Michigan, Ohio, New York, Illinois, New Jersey, Massachusetts, Minnesota, Pennsylvania, Connecticut, and West Virginia.
Harlan	6,216,891	Indiana, Illinois, Ohio, Minnesota, Pennsylvania, New York, and Maryland.
Hazard	31,985	Ohio and Minnesota.
Kenova-Thacker	569,804	Ohio, Wisconsin, and Pennsylvania.
Southern Appalachian	108,408	Tennessee and Ohio.
Williamson	137,207	Ohio.
Maryland	42,115	Pennsylvania.
New Mexico	588,395	Colorado and Texas.
Oklahoma	363,306	Texas and Colorado.
Pennsylvania:		
Anthracite	263,913	Michigan, Pennsylvania, New York, Ohio, Missouri, Illinois, West Virginia, and Wisconsin.
Bituminous:		
Central Pennsylvania:		
High-volatile	699,306	New York and Pennsylvania.
Medium-volatile	462,091	New York, Pennsylvania, and Maryland.
Low-volatile	2,845,535	Pennsylvania, New York, Ohio, and Minnesota.
Connellsville	14,060,679	Pennsylvania, Ohio, New York, Illinois, Indiana, Maryland, and West Virginia.
Cumberland - Piedmont	54	New York.
Freeport	2,560,540	Ohio, West Virginia, Michigan, New York, Pennsylvania, and Minnesota.
Pittsburgh	11,065,378	Pennsylvania, New York, Ohio, West Virginia, and Michigan.
Somerset	671,209	Pennsylvania, West Virginia, New York, Ohio, and Maryland.
Westmoreland	1,587,181	Pennsylvania, New York, Ohio, Wisconsin, and New Jersey.
Tennessee	154,910	Tennessee, Minnesota, and Ohio.
Utah	2,121,856	Utah and California.
Virginia:		
Clinch Valley	9,879	Pennsylvania and Ohio.
Grundy	618,763	Michigan, Ohio, Indiana, Massachusetts, Wisconsin, and New York.
Pocahontas	1,091,184	Indiana, New York, Tennessee, and New Jersey.
Southwestern	314,735	New Jersey, New York, Maryland, and Illinois.
Williamson	41,757	Ohio.
West Virginia:		
Cumberland-Piedmont	500,019	Maryland.
Fairmont	4,794,358	Pennsylvania, Maryland, West Virginia, Michigan, New York, Ohio, Massachusetts, New Jersey, and Connecticut.
Greenbrier	38,523	Pennsylvania, Illinois, and New York.
Kanawha	7,203,174	Ohio, Illinois, Kentucky, Indiana, New Jersey, Massachusetts, West Virginia, Wisconsin, Connecticut, Pennsylvania, Michigan, Missouri, Rhode Island, Minnesota, and New York.
Logan	2,916,675	New Jersey, Ohio, New York, Indiana, Pennsylvania, Michigan, Illinois, Massachusetts, Connecticut, Minnesota, and West Virginia.
New River:		
High-volatile	800,045	New York, New Jersey, Rhode Island, Illinois, and Connecticut.
Medium-volatile	165,600	Ohio, New York, Illinois, and Pennsylvania.
Low-volatile	748,850	Maryland, Michigan, Minnesota, Pennsylvania, Illinois, New York, and Kentucky.
Pocahontas	12,355,018	Indiana, Ohio, Illinois, Pennsylvania, Michigan, New York, Minnesota, Maryland, Wisconsin, Missouri, Connecticut, Alabama, West Virginia, Rhode Island, and Kentucky.
Preston-Taylor	68,599	Pennsylvania.
Randolph-Barbour	94,563	Ohio, Pennsylvania, and New York.
Tug River	431,256	Kentucky, Maryland, and New York.
Webster-Gauley	1,247,882	Pennsylvania, New York, Maryland, Ohio, and New Jersey.
Williamson	153,112	Massachusetts, Ohio, Connecticut, New York, and Michigan.
Winding Gulf	2,368,712	Massachusetts, Ohio, New Jersey, Michigan, New York, Illinois, Rhode Island, Kentucky, and Pennsylvania.
	97,325,465	

TABLE 29.—Coal purchased for manufacturing oven coke in the United States in 1947, by States where produced and where consumed and by merchant and furnace plants, in net tons

State where coal was consumed	Coal produced in—														Total
	Alabama	Arkansas	Colorado	Illinois	Indiana	Kentucky	Maryland	New Mexico	Oklahoma	Pennsylvania	Tennessee	Utah	Virginia	West Virginia	
Alabama:															
Merchant plants	1,147,563													114,017	1,261,580
Furnace plants	7,100,079													8,733	7,108,812
Total Alabama	8,247,642													122,750	8,370,392
California:															
Furnace plant		58,776										508,822			567,598
Colorado:															
Furnace plant		58,317	906,315					537,300	51,417						1,553,349
Illinois:															
Merchant plants						54,805				14,766				593,479	663,050
Furnace plants		5,075		226,873	64,291	1,954,976				197,500			19,752	2,168,285	4,636,752
Total Illinois		5,075		226,873	64,291	2,009,781				212,266			19,752	2,761,764	5,299,802
Indiana:															
Merchant plants					16,082								86,185	1,062,160	1,164,427
Furnace plants				225,907	154	5,682,305				107,000			980,303	4,589,321	11,584,990
Total Indiana				225,907	16,236	5,682,305				107,000			1,066,488	5,651,481	12,749,417
Maryland:															
Furnace plant						9,815				65,987			30,857	2,701,850	2,808,509
Massachusetts:															
Merchant plants						90,124							52,779	1,514,976	1,657,879
Michigan:															
Merchant plants						4,696				248,667			182,331	687,858	1,123,552
Furnace plants						1,297,180				272,521			67,363	1,327,588	2,964,652
Total Michigan						1,301,876				521,188			249,694	2,015,446	4,088,204
Minnesota:															
Merchant plant				30,364		49,862				10,461	17,310			319,213	427,210
Furnace plants						486,803								381,092	867,895
Total Minnesota				30,364		536,665				10,461	17,310			700,305	1,295,105
New Jersey:															
Merchant plants						188,773				2,027			153,159	1,696,229	2,040,188

TABLE 29.—Coal purchased for manufacturing oven coke in the United States in 1947, by States where produced and where consumed and by merchant and furnace plants, in net tons—Continued

State where coal was consumed	Coal produced in—														Total
	Alabama	Arkansas	Colorado	Illinois	Indiana	Kentucky	Maryland	New Mexico	Oklahoma	Pennsylvania	Tennessee	Utah	Virginia	West Virginia	
New York:															
Merchant plants						319, 335				1, 808, 149			107, 656	1, 898, 193	4, 133, 333
Furnace plants						635, 144				2, 673, 652			75, 029	776, 302	4, 160, 127
Total New York						954, 479				4, 481, 801			182, 685	2, 674, 495	8, 293, 460
Ohio:															
Merchant plants						188, 936							189, 948	1, 365, 876	1, 744, 760
Furnace plants						2, 345, 355				5, 834, 275	1, 466		66, 382	4, 370, 739	12, 618, 217
Total Ohio						2, 534, 291				5, 834, 275	1, 466		256, 330	5, 736, 615	14, 362, 977
Pennsylvania:															
Merchant plants						45, 238				13, 011				814, 760	873, 009
Furnace plants						275, 509	42, 115			20, 494, 439			5, 290	3, 043, 788	23, 861, 141
Total Pennsylvania						320, 747	42, 115			20, 507, 450			5, 290	3, 858, 548	24, 734, 150
Tennessee:															
Furnace plant						90, 000					136, 134		43, 687		269, 821
Texas:															
Furnace plants	7, 408	56, 988						51, 095	311, 889						427, 380
Utah:															
Furnace plants		182	92									1, 613, 034			1, 613, 308
West Virginia:															
Merchant plants										12, 470				1, 451, 688	1, 464, 158
Furnace plants						16, 860				2, 409, 331				73, 723	2, 499, 914
Total West Virginia						16, 860				2, 421, 801				1, 525, 411	3, 964, 072
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin:															
Merchant plants				21, 955	48, 404	165, 752				51, 630			15, 597	2, 926, 516	3, 229, 854
	8, 255, 050	179, 338	906, 407	505, 099	128, 931	13, 901, 468	42, 115	588, 395	363, 306	34, 215, 886	154, 910	2, 121, 856	2, 076, 318	33, 886, 386	97, 325, 465
At merchant plants	1, 147, 563			52, 319	64, 486	1, 107, 521				2, 161, 181	17, 310		787, 655	14, 444, 965	19, 783, 000
At furnace plants	7, 107, 487	179, 338	906, 407	452, 780	64, 445	12, 793, 947	42, 115	588, 395	363, 306	32, 054, 705	137, 600	2, 121, 856	1, 288, 663	19, 441, 421	77, 542, 465

TABLE 30.—Coal purchased for manufacturing oven coke in the United States in 1947, by States where consumed and by volatile content [1]

State where coal was consumed	High-volatile		Medium-volatile		Low-volatile		Total coal purchased (net tons)
	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total	
Alabama:							
Merchant plants	142,582	11.3	1,004,981	79.7	114,017	9.0	1,261,580
Furnace plants	270,734	3.8	6,829,345	96.1	8,733	.1	7,108,812
Total Alabama	413,316	4.9	7,834,326	93.6	122,750	1.5	8,370,392
California: Furnace plant	508,822	89.6			58,776	10.4	567,598
Colorado: Furnace plant	1,443,615	92.9			109,734	7.1	1,553,349
Illinois:							
Merchant plants	56,141	8.5	380,782	57.4	226,127	34.1	663,050
Furnace plants	3,180,157	68.6			1,456,595	31.4	4,636,752
Total Illinois	3,236,298	61.1	380,782	7.1	1,682,722	31.8	5,299,802
Indiana:							
Merchant plants	549,441	47.2	128,635	11.0	486,351	41.8	1,164,427
Furnace plants	6,409,415	55.3			5,175,575	44.7	11,584,990
Total Indiana	6,958,856	54.6	128,635	1.0	5,661,926	44.4	12,749,417
Maryland: Furnace plant	1,412,156	50.3	510,618	18.2	885,735	31.5	2,808,509
Massachusetts: Merchant plants	962,521	58.1	376,982	22.7	318,376	19.2	1,657,879
Michigan:							
Merchant plants	441,233	39.3	182,331	16.2	499,988	44.5	1,123,552
Furnace plants	2,352,733	79.4			611,919	20.6	2,964,652
Total Michigan	2,793,966	68.3	182,331	4.5	1,111,907	27.2	4,088,204
Minnesota:							
Merchant plant	289,983	67.9	38,421	8.9	98,806	23.2	427,210
Furnace plants	486,803	56.1			381,092	43.9	867,895
Total Minnesota	776,786	60.0	38,421	3.0	479,898	37.0	1,295,105
New Jersey: Merchant plants	1,036,596	50.8	610,379	29.9	393,213	19.3	2,040,188
New York:							
Merchant plants	3,025,794	73.2	654,185	15.8	453,354	11.0	4,133,333
Furnace plants	2,758,063	66.3	430,859	10.4	971,205	23.3	4,160,127
Total New York	5,783,857	69.7	1,085,044	13.1	1,424,559	17.2	8,293,460
Ohio:							
Merchant plants	1,057,357	60.6	159,761	9.2	527,642	30.2	1,744,760
Furnace plants	8,828,985	70.0	341,505	2.7	3,447,727	27.3	12,618,217
Total Ohio	9,886,342	68.8	501,266	3.5	3,975,369	27.7	14,362,977
Pennsylvania:							
Merchant plants	338,401	38.8	407,818	46.7	126,790	14.5	873,009
Furnace plants	20,291,395	85.0	455,050	1.9	3,114,696	13.1	23,861,141
Total Pennsylvania	20,629,796	83.4	862,868	3.5	3,241,486	13.1	24,734,150
Tennessee: Furnace plant	107,794	40.0	118,340	43.9	43,687	16.1	269,821
Texas: Furnace plants	139,571	32.7	287,093	67.2	716	.1	427,380
Utah: Furnace plants	1,613,126	100.0			182	(2)	1,613,308
West Virginia:							
Merchant plants	1,368,416	93.5			95,742	6.5	1,464,158
Furnace plants	2,324,282	93.0			175,632	7.0	2,499,914
Total West Virginia	3,692,698	93.2			271,374	6.8	3,964,072
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin: Merchant plants	1,939,919	60.1	499,196	15.4	790,739	24.5	3,229,854
	63,336,035	65.1	13,416,281	13.8	20,573,149	21.1	97,325,465
At merchant plants	11,208,384	56.7	4,443,471	22.5	4,131,145	20.8	19,783,000
At furnace plants	52,127,651	67.2	8,972,810	11.6	16,442,004	21.2	77,542,465

[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.

COKE BREEZE

TABLE 31.—Coke breeze recovered at coke plants in the United States in 1947, 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		
Oven coke:											
Alabama	3.90	323,029	$1,598,961	140,888	$512,460	35,435	$174,844	124,802	$808,994		36,341
California	5.33	28,631	[2]			23,987	[2]	6,422	[2]		31,161
Colorado	8.03	100,079	[2]	16,421	[2]	50,802	[2]	29,473	[2]		5,528
Illinois	6.69	358,648	959,426	160,197	381,020	16,380	47,156	151,760	455,985		110,821
Indiana	5.81	693,457	1,724,983	358,317	947,175	103,577	225,497	194,124	450,262	2,316	84,034
Maryland	7.44	204,444	[2]	79,203	[2]	28,748	[2]	62,966	[2]		277,111
Massachusetts	7.14	117,929	[2]	97,817	[2]	5,558	[2]	18,474	[2]		5,322
Michigan	5.87	228,729	883,974	129,842	454,838	24,713	90,495	71,810	335,972		28,055
Minnesota	7.84	98,259	332,289	52,106	151,503	7,863	[2]	44,589	168,934		63,989
New Jersey	6.01	119,552	[2]	121,976	[2]			4,977	[2]		3,286
New York	5.55	448,125	1,485,685	322,625	1,027,993	71,300	269,949	43,308	152,424		64,271
Ohio	5.90	838,490	2,545,218	505,726	1,434,678	208,397	597,846	124,392	528,959	2,484	146,712
Pennsylvania	5.73	1,373,199	3,335,505	1,153,306	2,792,402	35,662	84,310	104,458	271,822	314	266,628
Tennessee	3.35	10,927	[2]	7,727	[2]			2,331	[2]		2,000
Texas	4.15	15,467	[2]			2,785	[2]	2,798	[2]		9,885
Utah	10.28	165,860	[2]	66,777	[2]	20,417	[2]	49,239	[2]		36,401
West Virginia	4.41	177,966	483,254	118,437	337,335	46,067	[2]	42,861	99,762		23,198
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5.54	171,322	644,964	151,509	537,125			27,936	125,100		9,397
Undistributed			2,171,499		1,085,708		498,245		551,894		
Total 1947	5.79	5,474,113	16,165,758	3,482,874	9,662,237	681,691	1,988,342	1,106,720	3,950,108	5,114	1,204,140
At merchant plants	5.44	1,048,613	3,697,631	765,229	2,402,988	45,681	175,196	235,891	1,098,930		142,808
At furnace plants	5.88	4,425,500	12,468,127	2,717,645	7,259,249	636,010	1,813,146	870,829	2,851,178	5,114	1,061,332
Total 1946	5.54	4,232,252	11,717,566	3,134,177	8,454,978	596,961	1,581,497	1,023,587	3,049,084	3,486	712,252
Beehive coke:											
Colorado	1.86	596	[2]					596	[2]		
Pennsylvania	3.47	119,085	193,348	28,866	55,000			59,367	115,085	35,476	494
Utah	2.36	3,005	[2]					2,789	[2]		216
Virginia	.92	2,317	24,945			6	73	2,311	24,872		20
West Virginia	2.01	3,024	[2]							3,024	
Undistributed			10,717						5,023		
Total 1947	3.21	128,027	229,010	28,866	55,000	6	73	65,063	144,980	[3] 38,500	730

[1] Computed by dividing production of breeze by coal charged at plants actually recovering.
[2] Included with "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.

SHIPMENTS BY RAIL, WATER, AND TRUCK

Roughly two-thirds of all oven coke is consumed by the producers in adjacent industrial operations and therefore is not loaded for shipment outside the producing plants. In 1947 total shipments of oven coke amounted to 39 percent of the total output. Railroads transported about 88 percent of the total shipments compared with 86 percent in 1946. In spite of the increased coke output and record production of trucks, the movement by truck declined 6 percent from 1946 and represented 8 percent of the total movement. Shipments by water, which are normally small in comparison with the annual output, accounted for the remaining tonnage or 4 percent.

Unlike oven coke, the bulk of the beehive-coke output is produced near the coal mines and must be loaded for shipment to centers of consumption. Total shipments of beehive coke amounted to 6,416,294 tons, or roughly 96 percent of the entire output. Railroads haul the bulk of all beehive transported from producing plants, accounting for 98 percent of all deliveries in 1947. The remaining 2 percent was moved by boat and truck. Tables 32 and 33 contain detailed statistics on the methods of moving coke in 1947.

TABLE 32.—Coke and breeze sold and loaded at plants in the United States for shipment in 1947, in net tons

State	Coke				Breeze			
	In railroad cars	In boats	In trucks	Total	In railroad cars	In boats	In trucks	Total
Oven coke:								
Alabama	1,203,879		19,186	1,223,065	124,802			124,802
California	3,277			3,277	4,937		1,485	6,422
Colorado	44,194		1,704	45,898	29,443		30	29,473
Illinois	1,928,653		16,981	1,945,634	150,046		1,714	151,760
Indiana	2,593,659		77,969	2,671,628	193,952		172	194,124
Maryland					42,301	20,665		62,966
Massachusetts	518,427	75,904	451,430	1,045,761	7,092	6,478	4,904	18,474
Michigan	1,263,323	56,118	114,932	1,434,373	58,126	13,661	23	71,810
Minnesota	346,326		34,223	380,549	44,589			44,589
New Jersey	490,127	363,283	296,312	1,149,722	48	4,779	150	4,977
New York	2,494,231	16,409	391,768	2,902,408	41,991	1,073	244	43,308
Ohio	2,141,364	129,184	121,928	2,392,476	114,796	6,087	3,509	124,392
Pennsylvania	7,114,801	280,130	171,964	7,566,895	97,172	5,338	1,948	104,458
Tennessee	140,760			140,760	2,331			2,331
Texas	81,724			81,724	2,796		2	2,798
Utah	78,193		7,327	85,520	49,239			49,239
West Virginia	889,153		4,958	894,111	42,741		120	42,861
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,625,063	67,894	337,137	2,030,094	18,583	3,188	6,165	27,936
	22,957,154	988,922	2,047,819	25,993,895	1,024,985	61,269	20,466	1,106,720
At merchant plants	8,928,190	553,952	1,772,419	11,254,561	194,534	25,881	15,476	235,891
At furnace plants	14,028,964	434,970	275,400	14,739,334	830,451	35,388	4,990	870,829
Beehive coke:								
Colorado	24,039			24,039	596			596
Kentucky	95,285			95,285				
Pennsylvania	5,536,562	96,605	6,975	5,640,142	44,599	14,563	205	59,367
Utah	66.335		1,347	67,682	2,756		33	2,789
Virginia	211,774		97	211,871	2,311			2,311
West Virginia	377,275			377,275				
	6,311,270	96,605	8,419	6,416,294	50,262	14,563	238	65,063

TABLE 33.—Beehive coke loaded for shipment on originating railroads, waterways, and trucks in the United States in 1947, by routes, as reported by producers

Route	Producing State	Net tons: By States	Net tons: Total	Percent of total
Railroads:				
Baltimore & Ohio	Pennsylvania	1,215,333	1,437,447	22.4
	West Virginia	222,114		
Chesapeake & Ohio	Kentucky	95,285	140,559	2.2
	West Virginia	45,274		
Denver & Rio Grande Western	Colorado	24,039	90,374	1.4
	Utah	66,335		
Interstate	Virginia	182,724	182,724	2.8
Louisville & Nashville	do	180	180	(1)
Monongahela	Pennsylvania	1,609,491	1,609,491	25.1
New York Central	West Virginia	100,825	100,825	1.6
Norfolk & Western	Virginia	28,870	28,870	0.5
Pennsylvania	Pennsylvania	2,650,098	2,650,098	41.3
Pittsburgh & Lake Erie	do	61,640	61,640	1.0
Western Maryland	West Virginia	9,062	9,062	0.1
Total railroad shipments		6,311,270	6,311,270	98.4
Waterways:				
Monongahela & Ohio Rivers	Pennsylvania	96,605	96,605	1.5
Trucks	(2)	8,419	8,419	0.1
Grand total		6,416,294	6,416,294	100.0

1 Less than 0.05 percent.
2 Pennsylvania, Utah, and Virginia.

DISTRIBUTION OF OVEN AND BEEHIVE COKE

The accompanying table shows the quantity of coke and breeze distributed in each State in 1947, with a break-down of large coke according to principal end uses. This summary was compiled from detailed information submitted by producing companies and indicates the size and nature of the market for coke in a given State. Total distribution of large coke for all uses in the United States in 1947 increased 26 percent over 1946 and fell 280,256 tons short of equaling the 1944 record figure. Shipments of coke to iron blast furnaces increased 32 percent over 1946 and were equivalent to 78.6 percent of all coke deliveries. Foundry-coke shipments were the highest in 30 years, accounting for 5 percent of the total shipments. The increased demand for coke for gas making, both for use as fuel and for chemical synthesis, resulted in a 20-percent gain in shipments of coke for producer-gas and water-gas manufacture. The total tonnage shipped for gas making was equivalent to 6.5 percent of the total. Coke used for other industrial purposes accounted for 4.5 percent of total shipments and deliveries to the domestic coke trade 5.4 percent, the lowest proportion since 1923.

Furnace coke was used in 18 States in 1947, 1 more than in 1946. However, 78 percent of the total tonnage was used in 5 States—Pennsylvania, Ohio, Indiana, Illinois, and Alabama. All States except Nevada and Wyoming used coke in foundry cupolas, with Michigan alone accounting for almost one-sixth of the total foundry-coke shipments. Among the 10 States that used coke for the manufacture of producer gas, New York consumed 39 percent. New York and West Virginia together received about 50 percent of the total coke delivered to 31 States for water-gas manufacture. Only one State did not receive any coke for "other industrial use," indicating widespread usage of coke under this classification. Coke was used for household or domestic heating in all but nine States in 1947; New York, Massachusetts, New Jersey, and Michigan accounted for 54 percent of the total shipments.

Pennsylvania, the leading coke-producing State, likewise led in tonnage consumed within its borders, with 27 percent of the total. Ohio was next, using 17 percent; followed by Indiana, with 9 percent; New York, 8 percent; Illinois, 8 percent; and Alabama, 7 percent.

TABLE 34.—Oven and beehive coke and breeze distributed to each State in 1947, in net tons

[Based upon reports from all United States producers showing destination of coke used by producer or sold in 1947. Does not include imported coke which totaled 104,093 tons in 1947]

Consuming State	Coke							Coke breeze
	Furnace use	Foundry use	Making producer gas	Making water gas	Other industrial use	Domestic use	Total	
Alabama	4,878,979	211,721		646	196,946	84,515	5,372,807	220,460
Arizona		4,921			751		5,672	
Arkansas		1,009			108	36	1,153	
California	325,570	70,078			82,824		478,472	32,760
Colorado	792,469	16,259			44,795	828	854,351	97,131
Connecticut		53,631	60,805	126,172	36,341	127,166	404,115	36,451
Delaware		4,267		303	3,261	395	8,226	1,317
District of Columbia		64		22,362	25		22,451	
Florida		2,098		43,772	2,375	2,506	50,751	3,524
Georgia		21,993		12,570	17,150	10,630	62,343	2,943
Idaho		103			3,371	340	3,814	64
Illinois	5,195,610	316,499	11,909	42,060	120,336	197,628	5,884,042	336,167
Indiana	6,060,216	181,229	24,375	44,710	220,650	182,527	6,713,707	504,061
Iowa		70,269		1,178	26,814	3,314	101,575	8,011
Kansas		15,711			895	211	16,817	4,447
Kentucky	693,967	29,650		73,177	18,118	39,892	854,804	49,366
Louisiana		9,928			50,059	2,209	62,196	62
Maine		9,583		14,132		33,139	56,854	
Maryland	2,328,795	39,298		429	119,131	730	2,488,383	173,308
Massachusetts	185,963	75,433	112,806	178,675	31,232	537,289	1,121,398	121,947
Michigan	1,272,467	626,143		27,542	314,323	389,926	2,630,401	215,892
Minnesota	540,485	44,275	6,144	11,187	53,996	178,808	834,895	104,558
Mississippi		1,528			347	627	2,502	40
Missouri		86,204		7,040	45,427	22,173	160,844	9,074
Montana		1,596			19,015		20,611	28,114
Nebraska		5,042		7,300	3,380	453	16,175	74
Nevada					6,811		6,811	
New Hampshire		6,968		63	90	34,607	41,728	
New Jersey		118,996	96,874	388,217	112,629	406,721	1,123,437	130,546
New Mexico		330			3,442		3,772	
New York	3,471,176	172,990	320,502	1,024,942	420,984	693,287	6,103,881	466,809
North Carolina		15,980		2,951	3,146	4,261	26,338	599
North Dakota		153			415	606	1,174	
Ohio	10,892,890	358,625		281,087	281,136	198,788	12,012,526	805,504
Oklahoma		4,460			78	35	4,573	17,120
Oregon		5,885			14,059		19,944	
Pennsylvania	18,034,062	416,535	87,221	236,881	369,125	219,603	19,363,427	1,347,511
Rhode Island		14,584	33,615	16,851	1,124	87,954	154,128	20,938
South Carolina		5,647		1,920	2,233	6,293	16,093	3,965
South Dakota		243			216	1,059	1,518	
Tennessee	107,285	111,385		3,466	104,715	6,947	333,798	143,706
Texas	148,879	49,299		1,226	79,483	79	278,966	7,879
Utah	861,136	11,955			64,569	4,357	942,017	106,611
Vermont		7,526		2,503	1,764	13,699	25,492	
Virginia	72,192	48,336		353,669	98,252	351	572,800	1,145
Washington		7,613			6,219		13,832	
West Virginia	1,765,282	47,069		925,951	110,717	951	2,849,970	204,022
Wisconsin		179,523	72,624	66,825	21,780	251,072	591,824	126,673
Wyoming					2,006		2,006	
	57,627,423	3,482,634	826,875	3,919,807	3,116,663	3,746,012	72,719,414	5,332,799
Exported	9,082	167,367		804	164,642	231,316	573,211	32,421
	57,636,505	3,650,001	826,875	3,920,611	3,281,305	3,977,328	73,292,625	5,365,220

TABLE 35.—Comparative tonnage of oven and beehive coke consumed in each State, by regions, 1940 and 1947, in net tons

[Exclusive of imported coke and of screenings or breeze]

Consuming region and State	Furnace use		Foundry use		Other industrial		Domestic use		Total		
	1940	1947	1940	1947	1940	1947	1940	1947	1940	1947	Increase or decrease
New England:											
Maine			2, 956	9, 583	2, 181	14, 132	49, 473	33, 139	54, 610	56, 854	+2, 244
New Hampshire			1, 443	6, 968	1, 616	153	55, 709	34, 607	58, 768	41, 728	−17, 040
Vermont			5, 433	7, 526	3, 291	4, 267	32, 587	13, 699	41, 311	25, 492	−15, 819
Massachusetts	88, 830	185, 963	48, 872	75, 433	162, 598	322, 713	933, 356	537, 289	1, 233, 656	1, 121, 398	−112, 258
Connecticut			34, 847	53, 631	128, 140	223, 318	203, 534	127, 166	366, 521	404, 115	+37, 594
Rhode Island			10, 199	14, 584	24, 424	51, 590	154, 770	87, 954	189, 393	154, 128	−35, 265
	88, 830	185, 963	103, 750	167, 725	322, 250	616, 173	1, 429, 429	833, 854	1, 944, 259	1, 803, 715	−140, 544
Middle Atlantic:											
New York	2, 615, 108	3, 471, 176	141, 372	172, 990	1, 383, 937	1, 766, 428	1, 563, 584	693, 287	5, 704, 001	6, 103, 881	+399, 880
New Jersey			86, 161	118, 996	433, 524	597, 720	488, 890	406, 721	1, 008, 575	1, 123, 437	+114, 862
Pennsylvania	14, 319, 836	18, 034, 062	219, 232	416, 535	313, 431	693, 227	537, 204	219, 603	15, 389, 703	19, 363, 427	+3, 973, 724
Delaware			2, 758	4, 267	1, 962	3, 564	2, 326	395	7, 046	8, 226	+1, 180
Maryland	1, 849, 917	2, 328, 795	23, 891	39, 298	57, 437	119, 560	28, 050	730	1, 959, 295	2, 488, 383	+529, 088
District of Columbia			395	64	64, 505	22, 387	2, 430		67, 330	22, 451	−44, 879
	18, 784, 861	23, 834, 033	473, 809	752, 150	2, 254, 796	3, 202, 886	2, 622, 484	1, 320, 736	24, 135, 950	29, 109, 805	+4, 973, 855
Ohio	8, 619, 762	10, 892, 890	304, 373	358, 625	192, 476	562, 223	460, 339	198, 788	9, 576, 950	12, 012, 526	+2, 435, 576
Michigan	1, 076, 370	1, 272, 467	333, 791	626, 143	253, 488	341, 865	1, 135, 694	389, 926	2, 799, 343	2, 630, 401	−168, 942
Illinois-Indiana:											
Illinois	3, 332, 028	5, 195, 610	172, 455	316, 499	174, 023	174, 305	683, 630	197, 628	4, 362, 136	5, 884, 042	+1, 521, 906
Indiana	4, 305, 518	6, 060, 216	106, 063	181, 229	137, 587	289, 735	380, 826	182, 527	4, 929, 994	6, 713, 707	+1, 783, 713
	7, 637, 546	11, 255, 826	278, 518	497, 728	311, 610	464, 040	1, 064, 456	380, 155	9, 292, 130	12, 597, 749	+3, 305, 619
Missouri Valley:											
Missouri			34, 426	86, 204	63, 769	52, 467	269, 036	22, 173	367, 231	160, 844	−206, 387
Iowa			33, 721	70, 269	31, 186	27, 992	10, 915	3, 314	75, 822	101, 575	+25, 753
Nebraska			2, 320	5, 042	20, 177	10, 680	819	453	23, 316	16, 175	−7, 141
Kansas			7, 510	15, 711	2, 787	895	50	211	10, 347	16, 817	+6, 470
			77, 977	177, 226	117, 919	92, 034	280, 820	26, 151	476, 716	295, 411	−181, 305

Lake dock:											
Wisconsin			99, 327	179, 523	120, 925	161, 229	432, 778	251, 072	653, 030	591, 824	−61, 206
Minnesota	225, 569	540, 485	15, 684	44, 275	42, 003	71, 327	331, 682	178, 808	614, 938	834, 895	+219, 957
North Dakota				153	267	415	1, 491	606	1, 758	1, 174	−584
South Dakota			181	243	501	216	1, 767	1, 059	2, 449	1, 518	−931
	225, 569	540, 485	115, 192	224, 194	163, 696	233, 187	767, 718	431, 545	1, 272, 175	1, 429, 411	+157, 236
Southeast:											
Virginia	52, 715	72, 192	31, 258	48, 336	374, 841	451, 921	8, 957	351	467, 771	572, 800	+105, 029
West Virginia	787, 694	1, 765, 282	12, 657	47, 069	474, 713	1, 036, 668	4, 369	951	1, 279, 433	2, 849, 970	+1, 570, 537
North Carolina			13, 410	15, 980	6, 353	6, 097	4, 169	4, 261	23, 932	26, 338	+2, 406
South Carolina			3, 613	5, 647	2, 736	4, 153	3, 160	6, 293	9, 509	16, 093	+6, 584
Georgia			13, 765	21, 993	10, 957	29, 720	15, 478	10, 630	40, 200	62, 343	+22, 143
Florida			1, 017	2, 098	30, 290	46, 147	4, 961	2, 506	36, 268	50, 751	+14, 483
Kentucky	221, 698	693, 967	20, 341	29, 650	12, 532	91, 295	41, 993	39, 892	296, 564	854, 804	+558, 240
Tennessee	54, 312	107, 285	59, 724	111, 385	44, 455	108, 181	18, 658	6, 947	177, 149	333, 798	+156, 649
Alabama	4, 099, 434	4, 878, 979	123, 394	211, 721	42, 982	197, 592	99, 102	84, 515	4, 364, 912	5, 372, 807	+1, 007, 895
Mississippi			821	1, 528		347	1, 385	627	2, 206	2, 502	+296
	5, 215, 853	7, 517, 705	280, 000	495, 407	999, 859	1, 972, 121	202, 232	156, 973	6, 697, 944	10, 142, 206	+3, 444, 262
Southwest, Mountain, and Pacific:											
Louisiana			2, 883	9, 928	21, 656	50, 059	7, 374	2, 209	31, 913	62, 196	+30, 283
Arkansas			1, 444	1, 009	567	108	38	36	2, 049	1, 153	−896
Oklahoma			2, 205	4, 460	172	78	19	35	2, 396	4, 573	+2, 177
Texas		148, 879	15, 991	49, 299	31, 409	80, 709	225	79	47, 625	278, 966	+231, 341
New Mexico			1, 018	330	219	3, 442			1, 237	3, 772	+2, 535
Arizona			4, 053	4, 921	140	751	155		4, 348	5, 672	+1, 324
Colorado	521, 698	792, 469	11, 604	16, 259	12, 391	44, 795	201	828	545, 894	854, 351	+308, 457
Utah	163, 790	861, 136	10, 337	11, 955	55, 234	64, 569	2, 113	4, 357	231, 474	942, 017	+710, 543
Nevada			28		29	6, 811			57	6, 811	+6, 754
Wyoming					2, 470	2, 006	2		2, 472	2, 006	−466
Montana			2, 060	1, 596	22, 733	19, 015			24, 793	20, 611	−4, 182
Idaho			69	103	3, 831	3, 371		340	3, 900	3, 814	−86
Washington			3, 089	7, 613	1, 609	6, 219	21		4, 719	13, 832	+9, 113
Oregon			2, 821	5, 885	1, 788	14, 059			4, 609	19, 944	+15, 335
California		325, 570	36, 426	70, 078	30, 266	82, 824	988		67, 680	478, 472	+410, 792
	685, 488	2, 128, 054	94, 028	183, 436	184, 514	378, 816	11, 136	7, 884	975, 166	2, 698, 190	+1, 723, 024

CONSUMPTION OF COKE

Allowing for imports, exports, and changes in producers' stocks, the indicated consumption of coke in the United States in 1947 increased 27 percent over 1946 and approached the peak year 1944. The extremely high rate of operations in the steel industry in 1947 required enormous tonnages of coke for smelting iron ore; consequently, blast furnaces consumed 79 percent of the indicated consumption. As shown in table 37, the consumption of coke per ton of metal produced in iron blast furnaces continued the upward trend started during the war years and reached the highest point since 1924. W. S. Tower,[1] president of the American Iron and Steel Institute, in an address in New York in January 1948 before a meeting of the New York section, American Institute of Mining and Metallurgical Engineers, said:

> One of the major problems which has cropped up along the steel industry's assembly line of materials is unsatisfactory quality of coal. The main defects, as reflected in blast furnace coke, are higher ash content, more sulfur, and poorer mechanical properties. The chief effect of inferior quality in coking coal is lessened output from blast furnaces, and resulting loss of tonnage of hot metal for steel making.
>
> Some recent figures given us by several representative companies reveal that the average loss of pig iron production by the several reporting companies was 8 percent or 80 tons per day for a 1,000-ton furnace. When spread over the whole industry, that scale of lessened supply of iron directly due to poorer coal, means a substantial handicap on steel production.

Based on information furnished by the American Iron and Steel Institute, blast furnaces used 154.8 pounds more coke to produce 1 ton of pig iron in 1947 than in 1941. This indicates that, with all other conditions the same, approximately 4,528,000 tons more coke were required to supply the needs of blast furnaces in 1947 than would have been necessary if the furnaces had operated at the 1941 rate of fuel efficiency.

The quantity of coke consumed in other ways (in foundries, for manufacturing producer gas and water gas, for nonferrous smelting, for various industrial and chemical processes, and for household heating) increased 9 percent over 1946, but the proportion to the total indicated that consumption declined from 24.7 to 21.3 percent. This decrease was due to a further curtailment in domestic coke sales because of diversion of household coke to the metallurgical industries.

TABLE 36.—Coke consumed in manufacture of pig iron and for other purposes in the United States, 1913, 1918, 1937, and 1945–47, 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	37,599,911	73.3	13,672,018	26.7
1945	67,308,181	51,964	1,478,746	−192,872	66,074,271	50,653,221	76.7	15,421,050	23.3
1946	58,497,848	52,188	1,231,327	−3,047	57,321,756	(4) 43,178,789	(4) 75.3	(4) 14,142,967	(4) 24.7
1947	73,445,850	104,093	835,059	+103,471	72,611,413	57,147,644	78.7	15,463,769	21.3

[1] Production plus imports minus exports, plus or minus net changes in stocks.
[2] American Iron and Steel Institute; figures include coke consumed in manufacture of ferro-alloys.
[3] Data not available. [4] Revised figure.

[1] Blast Furnace and Steel Plant, vol. 36, No. 2, February 1948, pp. 235–236.

TABLE 37.—Coke and coking coal consumed per net ton of pig iron made in the United States, 1913, 1918, 1937, and 1945–47

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	1945	1,870.0	70.4	2,656.3
1918	2,120.7	66.4	3,193.8	1946	1,894.0	70.0	2,705.7
1937	1,830.6	70.3	2,604.0	1947	1,926.0	69.9	2,755.4

[1] 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, 1,840.0 in 1945, 1,868.0 in 1946, and 1,900.0 in 1947.

The accompanying tables summarize the disposal of coke in 1947 according to principal end uses. Statistics on the disposal of coke are indicative of market trends and valuable in planning future expansions. The smelting of iron ore in blast furnaces is the principal branch of coke consumption in the United States, the bulk of which is supplied by furnace oven-coke and beehive plants. Coke used in iron foundries, for gas making, for miscellaneous industrial and chemical processes, and for domestic heating is supplied mainly by merchant oven-coke plants. Expansion since 1940 in coke-making facilities by furnace interests has increased the proportion of blast-furnace coke supplied by these plants. For example, shipments of blast-furnace coke from this group amounted to 91 percent of all deliveries of oven coke to blast furnaces in 1940 compared with 96 percent in 1947. The tremendous demand for foundry coke during 1947 resulted in the movement of 3,145,842 net tons of oven coke to foundry cupolas, the largest quantity on record (first compiled in 1918). Merchant plants supplied 78 percent of this tonnage, and when measured in terms of tonnage the volume was nearly double that of 1940. As the production of oven coke at merchant plants during this period increased only 11 percent, this increase in tonnage shipped to foundries in 1947 had to be withdrawn from some other market and was diverted largely from the domestic coke trade. The increase in tonnage of coke required for gas making and for other industrial purposes also absorbed some of the oven coke diverted from the domestic coke channel by the merchant operators. As a consequence, shipments of oven coke to the domestic coke trade by furnace and merchant operators dropped to the lowest figure since 1924.

The pattern of beehive-coke disposal in 1947 followed, in general, that of previous years, and 79 percent of all shipments went to iron blast furnaces. Shipments of beehive coke to iron foundries increased 17 percent over 1946, and a gain of 17 percent was registered by other industrial coke. Beehive-coke deliveries to the domestic house-heating trade declined 60 percent.

TABLE 38.—Oven coke produced and sold or used by producer in the United States in 1947, by States

[Exclusive of screenings or breeze]

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	5,869,738	$47,086,856	4,625,100	$33,161,955	17,679	$123,965	257,759	(3)
California	332,244	(3)	325,570	(3)	200	(3)	----------	----------
Colorado	849,697	(3)	792,469	(3)	4,955	(3)	----------	----------
Illinois	3,805,374	49,267,806	1,792,678	20,341,212	51,294	489,658	1,365,251	$19,925,968
Indiana	8,785,687	117,614,296	5,978,032	78,332,089	177,640	2,183,166	1,865,696	27,193,467
Maryland	1,975,201	(3)	1,973,545	(3)	310	(3)	----------	----------
Massachusetts	1,196,010	(3)	----------	----------	127,652	(3)	185,963	(3)
Michigan	2,818,941	32,406,972	1,215,338	(3)	171,316	1,752,241	318,599	(3)
Minnesota	897,739	10,367,425	524,663	(3)	21,658	111,366	61,613	(3)
New Jersey	1,432,210	(3)	----------	----------	277,156	(3)	25,712	(3)
New York	5,670,333	58,629,308	1,558,123	(3)	1,169,579	10,464,914	1,722,019	16,231,865
Ohio	10,069,237	98,973,704	7,606,972	73,643,890	96,477	1,048,265	1,032,233	9,978,518
Pennsylvania	16,474,893	165,391,784	8,686,509	79,809,172	182,114	1,520,897	6,687,323	72,728,949
Tennessee	241,925	(3)	102,769	(3)	----------	----------	7,599	(3)
Texas	263,006	(3)	148,879	(3)	----------	----------	----------	----------
Utah	975,772	(3)	860,530	(3)	1,836	(3)	606	(3)
West Virginia	2,822,381	24,140,981	1,503,787	(3)	409,841	2,926,265	330,658	2,488,134
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	2,278,161	27,043,913	----------	----------	182,968	1,797,000	712,446	6,380,997
Undistributed	----------	80,177,364	----------	93,455,722	----------	4,231,043	----------	10,197,248
Total 1947	66,758,549	711,100,409	37,694,964	378,744,040	2,892,675	26,648,780	14,573,477	165,125,146
At merchant plants	13,897,699	161,906,508	----------	----------	2,483,320	22,754,570	2,150,138	23,666,098
At furnace plants	52,860,850	549,193,901	37,694,964	378,744,040	409,355	3,894,210	12,423,339	141,459,048
Total 1946	53,929,447	450,060,212	29,705,380	242,177,121	2,651,950	20,552,803	10,700,676	74,558,929

State	Sold—Continued: Foundry [4]		Other industrial (including water gas)[5]		Domestic		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Alabama	474,235	$6,062,002	365,553	$4,036,119	125,518	(3)	1,223,065	$13,771,520
California	----------	----------	3,277	(3)	----------	----------	3,277	(3)
Colorado	2,924	(3)	41,711	(3)	1,263	(3)	45,898	(3)
Illinois	354,850	5,818,957	92,143	1,030,487	133,390	$1,468,458	1,945,634	28,243,870
Indiana	459,826	(3)	128,895	(3)	217,211	1,880,615	2,671,628	37,737,104
Maryland	----------	----------	----------	----------	----------	----------	----------	----------
Massachusetts	103,368	(3)	230,400	(3)	526,030	(3)	1,045,761	(3)
Michigan	567,823	(3)	210,295	2,413,060	337,656	3,403,787	1,434,373	18,239,740
Minnesota	16,726	(3)	101,003	(3)	201,207	2,679,917	380,549	5,241,731
New Jersey	58,146	(3)	514,367	(3)	551,497	(3)	1,149,722	(3)
New York	----------	----------	460,850	5,021,529	719,539	7,299,706	2,902,408	28,553,100
Ohio	284,042	3,608,445	845,545	8,776,689	230,656	2,181,973	2,392,476	24,545,625
Pennsylvania	234,201	3,647,968	396,530	4,453,660	248,841	2,743,123	7,566,895	83,573,700
Tennessee	37,259	(3)	95,902	(3)	----------	----------	140,760	(3)
Texas	41,927	(3)	39,797	(3)	----------	----------	81,724	(3)
Utah	----------	----------	80,217	(3)	4,697	(3)	85,520	(3)
West Virginia	99,450	(3)	398,738	3,185,733	65,265	(3)	894,111	7,694,507
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	411,065	6,536,582	351,951	4,303,290	554,632	7,158,084	2,030,094	24,378,953
Undistributed	----------	21,109,036	----------	14,780,305	----------	15,019,816	----------	31,764,637
Total 1947	3,145,842	46,782,990	4,357,174	48,000,872	3,917,402	43,835,479	25,993,895	303,744,487
At merchant plants	2,457,091	37,021,730	3,565,989	39,769,352	3,081,343	36,885,988	11,254,561	137,343,168
At furnace plants	688,751	9,761,260	791,185	8,231,520	836,059	6,949,491	14,739,334	166,401,319
Total 1946	2,573,668	32,457,550	3,271,477	30,772,262	4,947,085	48,977,854	21,492,906	186,766,595

[1] Comprises 88,332 tons valued at $948,273 used in foundries; 826,875 tons, $7,234,535 to make producer gas; 1,541,471 tons, $14,253,894 to make water gas; and 435,997 tons, $4,212,078 for other purposes.
[2] Includes 11,945,200 tons valued at $136,337,047 sold to financially affiliated plants.
[3] Included with "Undistributed."
[4] Includes 30,265 tons valued at $706,220 sold to financially affiliated plants.
[5] Includes 725,066 tons valued at $7,860,918 for manufacture of water gas and 284,563 tons, $3,002,361 for other industrial use sold to financially affiliated plants; and 1,385,906 tons, $14,990,610 for manufacture of water gas sold to other consumers.

TABLE 39.—Beehive coke produced and sold or used by producer in the United States in 1947, 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	21,489	(2)						
Kentucky	95,285	(2)					73,950	(2)
Pennsylvania	5,913,133	$56,665,562	291,766	$2,941,524	2,997	$28,959	4,759,854	$43,989,521
Utah	67,693	(2)						
Virginia	211,876	2,508,223					68,891	(2)
West Virginia	377,825	4,151,739			34	313	173,603	1,758,250
Undistributed		1,979,587						1,527,221
Total: 1947	6,687,301	65,305,111	291,766	2,941,524	3,031	29,272	5,076,298	47,274,992
1946	4,568,401	36,669,170	51,367	581,918	1,079	10,770	3,243,069	24,753,998

State	Sold—Continued							
	Foundry		Other industrial (including water gas) [3]		Domestic		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Colorado	112	(2)	23,927	(2)			24,039	(2)
Kentucky	1,721	(2)	19,614	(2)			95,285	(2)
Pennsylvania	315,445	$3,704,246	507,351	$5,643,577	57,492	$578,692	5,640,142	$53,916,036
Utah	604	(2)	67,078	(2)			67,682	(2)
Virginia	28,023	369,643	113,062	1,331,012	1,895	(2)	211,871	2,508,665
West Virginia	69,922	(2)	133,211	1,517,169	539	(2)	377,275	4,146,077
Undistributed		892,166		1,241,552		24,875		2,007,146
Total: 1947	415,827	4,966,055	864,243	9,733,310	59,926	603,567	6,416,294	62,577,924
1946	353,995	3,302,073	737,903	6,482,629	149,648	1,186,250	4,484,615	35,724,950

[1] Includes 1,806,330 tons valued at $15,056,934 sold to financially affiliated plants for blast-furnace use.
[2] Included with "Undistributed."
[3] Includes 23,617 tons valued at $255,848 sold to financially affiliated plants for other industrial use and 268,168 tons, $2,950,701 for manufacture of water gas.

STOCKS OF COKE AND COKING COAL

Coke.—As a general rule, stocks of coke at producers' plants decline when pig-iron and coke production increase. However, the 1947 year-end stocks at oven-coke plants were an exception to the rule and were higher by 126,943 tons than the reserve carried at the end of 1946. This was due to a gain of 196,812 tons (45 percent) in reserves of "domestic and other coke" principally at merchant plants, as stocks of furnace coke declined 69,666 tons (16 percent). The total tonnage of oven coke at producers' plants at the end of the year was equivalent to only 5.3 days' production at the December 1947 rate. Producers' stocks of beehive coke, which normally are very small, decreased from 35,853 to 12,381 tons, or 65 percent, during 1947. This quantity was equivalent to less than 1 day's production at the prevailing rate.

Coal.—Adequate stocks of coking coal at oven-coke plants are essential because any disruption in the flow of coal to the plants may cause serious consequences to the ovens. Sudden cooling of the ovens because of a lack of coal could cause serious damage to the brickwork or walls of the oven and would require much time and a great deal of expense to repair. For this reason coke-plant operators attempt to carry stocks adequate to tide them over any emergency that might arise.

TABLE 40.—Summary of total stocks of coke on hand at all coke plants in the United States on January 1, 1937 and 1944–48, in net tons

[Exclusive of screenings or breeze]

	1937	1944	1945	1946	1947	1948
Oven-coke plants:						
Furnace	282, 144	517, 452	478, 133	425, 438	445, 763	376, 097
Foundry	8, 981	21, 490	18, 265	24, 509	12, 565	12, 362
Domestic and other	1, 408, 350	286, 671	590, 048	477, 052	434, 585	631, 397
	1, 699, 475	825, 613	1, 086, 446	926, 999	892, 913	1, 019, 856
Beehive-coke plants:						
Furnace	5, 622	30, 740	33, 649	2, 455	30, 750	10, 181
Foundry	8, 508	482	766	270	1, 508	50
Domestic and other	18, 461	5, 265	3, 824	2, 089	3, 595	2, 150
	32, 591	36, 487	38, 239	4, 814	35, 853	12, 381
Total:						
Furnace	287, 766	548, 192	511, 782	427, 893	476, 513	386, 278
Foundry	17, 489	21, 972	19, 031	24, 779	14, 073	12, 412
Domestic and other	1, 426, 811	291, 936	593, 872	479, 141	438, 180	633, 547
	1, 732, 066	862, 100	1, 124, 685	931, 813	928, 766	1, 032, 237

TABLE 41.—Stocks of furnace, foundry, and domestic coke and of breeze in the United States on January 1, 1948, by States, in net tons

State	Coke				Breeze
	Furnace	Foundry	Domestic and other	Total	
Oven coke:					
Alabama	51, 921	1, 306	16, 218	69, 445	36, 341
California	6, 131		1, 600	7, 731	31, 161
Colorado	9, 135			9, 135	5, 528
Illinois	32, 274	1, 136	971	34, 381	110, 821
Indiana	23, 345	1, 094	11, 299	35, 738	84, 034
Maryland	29, 144			29, 144	277, 111
Massachusetts	637	260	87, 078	87, 975	5, 322
Michigan	4, 081	1, 100	5, 699	10, 880	28, 055
Minnesota	976	138	6, 914	8, 028	63, 989
New Jersey			45, 110	45, 110	3, 286
New York	38, 810	40	191, 424	230, 274	64, 271
Ohio	57, 716	880	10, 566	69, 162	146, 712
Pennsylvania	103, 950	794	53, 091	157, 835	266, 628
Tennessee	1, 810	165		1, 975	2, 000
Texas	377	4, 896	27, 130	32, 403	9, 885
Utah	12, 328		44, 397	56, 725	36, 401
West Virginia	2, 614	143	28, 869	31, 626	23, 198
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	848	410	101, 031	102, 289	9, 397
	376, 097	12, 362	631, 397	1, 019, 856	1, 204, 140
At merchant plants	7, 171	4, 672	497, 404	509, 247	142, 808
At furnace plants	368, 926	7, 690	133, 993	510, 609	1, 061, 332
Beehive coke:					
Pennsylvania	9, 036	30	1, 214	10, 280	494
Utah			500	500	216
Virginia	480	14	376	870	20
West Virginia	665	6	60	731	
	10, 181	50	2, 150	12, 381	730

In 1947, there was some improvement in the stocks of coal from the critical position that existed in 1946, but these were still short of the stocks normally carried. Stocks during the first 6 months of 1947 remained fairly constant, ranging from a low of 21.2 days' supply in April to a high of 29.0 days' supply at the end of March. Stocks dropped sharply in July because of the slump in bituminous-coal production on account of the miners' vacations but increased steadily thereafter, reaching 33.6 days' supply on December 31, 1947. The day's supply, as calculated by the Bureau of Mines, is based on the average daily rate of consumption prevailing.

TABLE 42.—Stocks of oven coke at furnace and merchant plants in the United States on first of each month, 1946–47, in net tons

[Includes furnace, foundry, and domestic, but not breeze]

Month	Furnace plants		Merchant plants		Total	
	1946	1947	1946	1947	1946	1947
January	498, 835	542, 208	428, 164	350, 705	926, 999	892, 913
February	671, 589	523, 439	298, 772	273, 582	970, 361	797, 021
March	940, 316	527, 103	220, 585	188, 929	1, 160, 901	716, 032
April	813, 555	503, 735	202, 506	171, 886	1, 016, 061	675, 621
May	441, 606	460, 302	178, 262	191, 369	619, 868	651, 671
June	292, 195	444, 576	172, 477	225, 924	464, 672	670, 500
July	360, 380	400, 298	255, 881	268, 163	616, 261	668, 461
August	361, 157	458, 311	347, 783	314, 609	708, 940	772, 920
September	397, 698	544, 175	408, 831	437, 892	806, 529	482, 067
October	502, 514	508, 688	446, 437	520, 400	948, 951	1, 029, 088
November	652, 935	513, 346	467, 326	549, 921	1, 120, 261	1, 063, 267
December	602, 497	588, 949	431, 576	562, 152	1, 034, 073	1, 151, 101

TABLE 43.—Stocks of bituminous coal at oven-coke plants in the United States at end of each month, 1937 and 1945–47, in net tons

Month	1937	1945	1946	1947
January	8, 030, 871	5, 694, 501	5, 665, 131	5, 919, 455
February	8, 687, 389	5, 610, 111	6, 392, 605	6, 644, 699
March	9, 638, 317	5, 452, 042	8, 269, 360	7, 516, 564
April	8, 543, 774	4, 456, 204	4, 116, 899	5, 417, 111
May	8, 187, 883	4, 428, 452	2, 565, 010	6, 454, 434
June	7, 770, 256	5, 128, 071	3, 629, 535	7, 095, 832
July	7, 432, 741	4, 752, 624	3, 871, 156	4, 803, 819
August	7, 455, 932	4, 502, 647	5, 229, 600	5, 483, 859
September	7, 760, 533	4, 624, 488	5, 925, 815	6, 216, 127
October	8, 066, 938	3, 665, 833	6, 593, 083	7, 300, 931
November	8, 114, 094	4, 607, 047	6, 355, 321	8, 206, 627
December	7, 273, 403	4, 873, 546	5, 238, 762	9, 147, 808

VALUE AND PRICE

The term "value," as applied to coke in this report, represents the value at ovens as reported by producers. For the part of the output that is sold, the value is the amount received for the coke f. o. b. ovens. However, the greatest part of the coke produced in the United States is made in ovens operated by corporations that not only mine the coal used in the manufacture of coke but also operate blast furances and steel mills that consume the entire output of their ovens. Under such conditions, fixing a value for coal charged and for coke produced is purely arbitrary. For example, at some plants the cost of coke to the furnace department equals the cost of production; at others a margin of profit is added, or the reported value is based on what the coke would cost if purchased. Among such affiliated interests the line between sales and interdepartmental transfers is difficult to draw, and a large part of the furnace coke reported as sold actually goes to iron furnaces that are in some way connected with the coke producers. The average value per ton of all coke produced, measured in this way, increased $2.25 or 27 percent over 1946, reaching $10.57. This is the highest figure ever recorded, not excepting the year 1920, when the average value was calculated on the basis of the proportion of the output that was sold.

The average receipts per ton of coke sold f. o. b. ovens (merchant sales) in 1947 reached a new record and were 32 percent above the 1946 average. Table 45 shows the average receipts from sales classified according to uses for which the coke was intended according to States. It will be noted that receipts vary notably with the distances from the mines. Thus, the highest average receipts are those reported for the New England and Lake Dock States, where the coal must be hauled great distances.

TABLE 44.—Average value per net ton of coke produced and average receipts per net ton from coke sold in the United States, 1937, and 1943–47

Year	Value per ton produced			Receipts per ton sold		
	Oven coke	Beehive coke	Total	Oven coke	Beehive coke	Total
1937	$5.03	$4.31	$4.98	$6.11	$4.23	$5.83
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
1946	8.35	8.03	8.32	8.69	7.97	8.56
1947	10.65	9.77	10.57	11.69	9.75	11.30

TABLE 45.—Average receipts per net ton of coke sold (merchant sales) in the United States in 1947, by States

State	Oven coke				Beehive coke			
	Furnace	Foundry	Other industrial including water gas	Domestic	Furnace	Foundry	Other industrial including water gas	Domestic
Alabama	(1)	$12.78	$11.04	(1)	-------	-------	-------	-------
California, Colorado, Texas, and Utah.	-------	15.13	12.50	$10.46	-------	(1)	(1)	-------
Connecticut, Massachusetts, and Rhode Island.	-------	15.75	12.24	12.91	-------	-------	-------	-------
Illinois	$12.97	15.70	11.21	11.01	-------	-------	-------	-------
Indiana	12.05	(1)	(1)	8.66	-------	-------	-------	-------
Kentucky, Missouri, and Tennessee	8.27	14.62	11.50	11.39	(1)	(1)	(1)	-------
Maryland	-------	-------	-------	-------	-------	-------	-------	-------
Michigan, Minnesota, and Wisconsin.	12.92	15.70	12.06	11.70	-------	-------	-------	-------
New Jersey and New York	12.06	(1)	(1)	10.85				
Ohio	9.30	12.71	10.25	9.46	-------	-------	-------	-------
Pennsylvania	11.16	15.64	11.31	11.02	$9.80	$11.74	$11.12	$10.07
Virginia	-------	-------	-------	-------	(1)	13.19	11.77	(1)
West Virginia	(1)	(1)	7.99	(1)	10.13	(1)	11.39	(1)
Undistributed	10.20	15.14	11.56	9.37	10.69	12.33	11.33	10.22
United States average	10.95	14.79	11.09	11.19	9.85	11.94	11.27	10.07
At merchant plants	10.84	14.96	11.29	11.97	-------	-------	-------	-------
At furnace plants	11.25	14.19	10.37	8.31	-------	-------	-------	-------

[1] Included with "Undistributed."

FOREIGN TRADE [2]

Exports.—Total shipments of coke to foreign countries in 1947 decreased 32 percent in quantity and 15 percent in value from 1946. Exports would have been much greater had more coke been available in this country, as the supply in virtually all foreign countries was far short of requirements. Over 70 percent of the total export movement was destined to Canada, for the most part moving through the Buffalo and Michigan customs districts. Exports to Europe dropped 61 percent but shipments to South American countries increased 333 percent over 1946 and were the highest since 1918.

Imports.—Imports of coke supply a very small part of the Nation's requirements and are restricted to a few localities. Canada supplied all of the coke imported, the bulk of which entered through the Montana-Idaho and Wisconsin customs districts.

TABLE 46.—Coke exported from the United States, 1945–47, by countries and customs districts

[U. S. Department of Commerce]

	1945		1946		1947	
	Net tons	Value	Net tons	Value	Net tons	Value
COUNTRY						
North America:						
Canada	1,305,390	$10,519,110	875,110	$8,182,362	585,965	$6,701,624
Mexico	8,115	60,471	5,496	50,761	16,108	216,419
Panama, Republic of	3	89	10	244	66	1,856
West Indies:						
Cuba	27,971	341,794	13,810	171,204	21,429	351,903
Trinidad and Tobago	435	6,788			77	1,749
Other North America	1,069	25,575	833	19,330	1,304	39,552
South America:						
Argentina	2,384	21,323	471	9,198	41,872	875,217
Bolivia	609	12,887	727	16,900	682	19,597
Brazil	6,287	110,492	9,536	186,711	24,435	721,806
Chile	7,043	130,160	5,005	91,518	8,189	214,413
Peru	1,033	27,444	622	14,475	2,186	63,540
Uruguay	463	5,680	1,285	26,388	3,009	74,302
Venezuela	1,016	25,920	1,047	25,188	938	29,469
Other South America	225	3,965	216	5,752	529	13,304
Europe:						
Belgium and Luxembourg					3,745	65,877
Denmark	15,462	178,423	868	9,829	32	614
Eire					7,388	137,540
Finland			15,200	203,148		
France	10,411	106,564	125	3,198	10,479	85,902
Italy	7,514	36,006	7,482	80,414	104	1,945
Netherlands			5,456	103,363		
Norway					55,425	432,802
Portugal	2,109	31,413	8,948	113,779	37	406
Sweden	78,829	939,479	254,190	3,016,325	37,316	431,218
Switzerland	1,631	18,739	1,010	11,550	6,539	72,919
Yugoslavia			21,771	232,449		
Other Europe			6	402	404	14,033
Asia:						
China			766	18,105	752	7,376
Philippines, Republic of	135	4,920	1,336	42,964	2,474	107,587
Other Asia					62	2,765
Africa:						
Morocco, French	608	7,449				
Portuguese Guinea and Angola					3,360	48,715
Other Africa	4	80			153	3,155
Oceania: French Pacific Islands			1	36		
	1,478,746	12,614,771	1,231,327	12,635,593	835,059	10,737,605

[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.

TABLE 46.—Coke exported from the United States, 1945–47, by countries and customs districts—Continued

	1945		1946		1947	
	Net tons	Value	Net tons	Value	Net tons	Value
CUSTOMS DISTRICT						
Buffalo	718,940	$5,236,382	600,443	$5,322,030	287,029	$2,872,216
Chicago	21,601	144,597	9,015	80,871	3,400	30,600
Dakota	18,324	179,803	11,929	121,830	18,757	242,159
Duluth and Superior	8,916	92,778	10,081	105,766	6,153	83,782
Florida	1,805	25,404	5,914	74,530	4,348	81,524
Laredo	2,582	29,996	1,914	24,061	11,859	181,501
Maryland	34,902	425,592	209,234	2,431,856	131,133	1,561,401
Michigan	298,258	2,819,844	215,659	2,299,621	239,253	3,083,378
Mobile	37,105	446,198	7,159	86,413	2,002	30,644
New Orleans	18,385	316,559	29,856	503,974	36,043	903,951
New York	2,587	62,264	3,258	79,772	5,002	177,918
Ohio	38,183	301,685	11,182	77,760	5,223	77,009
Philadelphia	60,319	628,768	65,730	802,597	10,455	193,786
Sabine					26,258	499,522
St. Lawrence	183,341	1,640,091	11,949	120,821	13,578	161,008
San Diego	180	2,696	414	6,960	512	8,438
San Francisco	159	5,743	1,816	59,191	2,077	86,835
Vermont	610	5,060	2,946	31,161	9,286	101,952
Virginia	10,136	128,905	27,819	369,663	15,555	284,506
Other districts	22,413	122,406	5,009	36,716	7,136	75,475
	1,478,746	12,614,771	1,231,327	12,635,593	835,059	10,737,605

TABLE 47.—Coke imported for consumption in the United States, 1945–47, by countries [1] and customs districts

[U. S. Department of Commerce]

Customs district	1945		1946		1947	
	Net tons	Value	Net tons	Value	Net tons	Value
Buffalo	19,367	$322,570	9,951	$167,434	129	$2,300
Dakota			34	343		
Hawaii					33	368
Maine and New Hampshire	350	3,147	544	5,419	314	4,026
Michigan			179	1,305	15,948	121,385
Minnesota			220	441		
Montana and Idaho	30,614	236,808	40,428	309,307	61,993	544,695
New York			683	21,097		
Ohio	1	7				
St. Lawrence					57	599
Vermont	118	1,087	116	1,130	120	1,371
Washington	1,514	11,396	33	308	35	398
Wisconsin					25,464	87,585
Total [1]	51,964	575,015	52,188	506,784	104,093	762,727

[1] All from Canada, 1945–47.

TECHNOLOGIC DEVELOPMENTS

The twelfth annual report of research and technologic work conducted by the Bureau of Mines on coal and coal products from July 1, 1946, to July 1, 1947, was released early in 1948.[3] This report gives a brief résumé of the special studies made by Bureau engineers on the carbonizing properties, plasticity, expansion, and oxidation of coal. For details concerning the individual studies, the report lists the original publications and, in addition, presents results of research that have not been already published.

Daniel Petit, a French engineer, described a method of constructing coke ovens that reduces the expansion of the ovens and allows them to be stopped and restarted without detriment to the oven walls.[4]

[3] Fieldner, A. C., and Ambrose, P. M., Annual Report of Research and Technologic Work on Coal: Bureau of Mines Inf. Circ. 7446, 1948, 113 pp.

[4] Petit, Daniel, Une Technique Nouvelle dans la Construction des Fours à Coke: Chaleur et Industrie (Paris), vol. 28, No. 260, March 1947, pp. 68–76.

The trial installation at Pont-a-Vendin, Pas de Calais, was subjected to intermittent operation under exceptionally severe conditions, and when it was dismantled to make room for a new battery of ovens was found to be in excellent state. It is claimed that this method of construction is adaptable to the modern underjet as well as other types of ovens.

The Koppers Co., Inc., erected a new plant [5] at its Seaboard coke works for recovering pure liquid hydrogen cyanide as a marketable product. The acidic gases, hydrogen cyanide and hydrogen sulfide, are absorbed in a water solution of soda ash, the solution is heated under vacuum, and the effluent gases pass through another water solution which absorbs the HCN. The residual sulfide passes to a burner of the sulfuric acid unit.

The potentialities of coke-oven gas as a source of ethylene for the production of chemicals have been clearly recognized for a long time, and the development of a new process that produces ethylene of 97 percent purity was described.[6] It is claimed that economical ethylene production should be possible from any source of coke-oven gas of more than 8,500,000 cubic feet a day. However, the situation of plant locations would depend very largely upon the chemical derivatives to be made as ethylene itself has, of course, only minor industrial interest.

The American Society for Testing Materials announced that an important change will be made in the methods of sampling and analysis of coal and coke (D271), which will speed up considerably the work of commercial sampling through the use of a new riffle sampler.[7] The new riffle has been adopted following a study of several designs made by the committee during 1947.

WORLD PRODUCTION

World production of coke increased about 24 percent in 1947 and was equivalent to 84 percent of the record wartime output in 1943. The decline from 1943 was due largely to the great drop in German output. In 1938, Germany (excluding the Saar) led all countries, producing about 29 percent of the total world output. Although German production in 1947 (excluding French and Russian zones of occupation) increased substantially over 1946, it constituted but 9 percent of the indicated world total. The United States, after relinquishing world leadership to Germany in 1938, regained it in 1939 and has continued to dominate the field, accounting for 46 percent of the 1947 total. Precise data on Russian output in recent years are not available, but it is known that this country has substantial coal-carbonizing capacity and may rank second to the United States in metallurgical coke production. The 10 other ranking countries and the proportion of the indicated world total each contributed in 1947 were as follows: Great Britain, 9.2 percent; Germany, 9.1; France, 4.0; Belgium, 3.2; Czechoslovakia, 2.8; Poland, 1.9; Canada, 1.8; Japan, 1.3; Italy, 1.1; and Netherlands, 1.0. Of these, Belgium, Czechoslovakia, France, Germany, and Poland experienced substantial gains, whereas Great Britain showed a slight decrease. Production increased 25.6 percent over 1946 in the United States and 22.3 percent for all other countries combined.

[5] Koppers News, vol. 19, No. 6, September 1947, p. 8.
[6] Schuftan, P. M., A New Process for the Recovery of Ethylene from Coke-Oven Gas: Chemistry and Industry (London), No. 7, February 1948, pp. 99-104.
[7] American Society for Testing Materials Bulletin, No. 151, March 1948, p. 26.

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TABLE 48.—Coke produced in principal countries of the world, 1938 and 1941–47, in metric tons [1] [2]

[Compiled by P. Roberts]

Country	1938	1941	1942	1943	1944	1945	1946	1947
Australia:								
New South Wales	1,153,670	1,738,864	1,644,897	1,592,325	1,402,310	1,061,822	(3)	(3)
Queensland	31,481	30,991	22,529	15,304	14,637	15,903	13,757	18,261
Austria	(3)	(3)	(3)	(3)	618,949	69,600	138,000	319,609
Belgium	4,398,520	3,662,400	3,588,190	3,497,450	1,456,240	1,346,610	2,840,320	[4] 4,729,520
Brazil	----	21,068	10,267	19,845	[5] 16,000	[5] 20,000	133,542	[5] 200,000
Bulgaria	3,923	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Canada	1,808,588	2,431,942	2,536,165	2,709,354	3,118,481	3,023,248	2,585,493	2,697,404
China	[6] 11,630	[7] 318,445	[7] 388,734	[7] 379,822	[7] 302,466	44,000	95,910	109,000
Czechoslovakia	2,766,000	3,696,000	3,889,000	4,280,000	4,528,000	1,900,557	2,249,859	4,139,676
France	7,636,150	4,892,860	5,008,360	4,989,580	2,908,655	2,505,972	4,959,889	5,852,000
Germany	40,404,082	[8] 47,636,121	[8] 47,996,026	[8] 47,804,000	[8] 41,596,000	(3)	[9] 9,756,537	[10] 13,239,000
Saar	3,107,000	3,264,830	3,241,439	(3)	(3)	(3)	(3)	(3)
Great Britain [11]	13,031,396	14,780,479	15,139,145	14,683,955	14,307,360	14,210,170	14,211,085	13,400,000
Hungary	53,092	(3)	(3)	(3)	(3)	(3)	(3)	(3)
India	1,738,178	1,999,436	1,882,533	1,578,137	1,406,299	(3)	(3)	(3)
Indochina, French	3,503	----	4,357	5,293	2,064	----	----	(3)
Italy	1,739,417	1,833,388	1,668,188	[5] 2,000,000	(3)	(3)	(3)	1,626,480
Japan	[12] 3,724,000	[12] 5,222,000	[12] 5,842,000	[12] 4,801,000	[12] 3,759,000	(3)	(3)	1,841,570
Korea	377,937	399,860	582,918	851,307	733,216	69,106	[13] 2,657	[13] 6,644
Mexico	(3)	(3)	(3)	(3)	(3)	(3)	(3)	530,400
Netherlands	3,158,065	2,256,423	2,048,819	2,163,444	1,575,371	(3)	(3)	1,527,520
New Caledonia	49,875	99,700	83,661	(3)	(3)	(3)	(3)	(3)
Norway	(3)	89,092	101,226	110,406	78,558	----	----	(3)
Peru	----	(3)	(3)	(3)	(3)	18,046	----	[5] 16,000
Poland	2,290,925	2,556,382	3,170,076	3,250,344	(3)	1,743,239	2,146,852	[5] 2,750,000
Rumania	86,030	84,741	86,115	84,212	(3)	(3)	(3)	73,267
Southern Rhodesia	47,986	81,016	71,402	78,566	79,857	85,103	85,820	(3)
Spain	571,469	753,108	814,355	801,122	862,574	770,714	783,014	809,318
Sweden	112,107	(3)	(3)	81,617	32,175	----	14,592	(3)
Turkey	85,348	170,696	178,114	182,974	208,623	[14] 182,281	[14] 221,531	323,029
Union of South Africa	163,315	226,503	232,498	240,724	176,524	208,147	(3)	(3)
U. S. S. R.	20,700,000	(3)	[5] [15] 6,085,000	[5] [15] 7,801,000	[5] 9,915,000	[5] 13,000,000	(3)	(3)
United States	29,479,553	59,135,960	64,018,735	65,023,091	67,165,627	61,060,636	53,068,078	66,628,606
Total [16]	139,608,000	167,452,000	171,405,000	173,655,000	163,599,000	118,245,000	117,817,000	145,822,000

[1] Gas-house coke not included (except for Belgium in 1947).
[2] In addition to countries listed, coke is produced in New Zealand, but data are not available.
[3] Data not available; estimate by author of chapter included in total.
[4] Includes gas-house coke.
[5] Estimate.
[6] Exports.
[7] Data represent areas designated as Free China during the period of Japanese occupation.
[8] Silesian production included.
[9] Excludes French zone.
[10] Excludes French and Russian zones.
[11] In Great Britain production of gas-house coke, not included, is especially important; it was 10,770,130 tons in 1938 and averaged 11,000,000 tons per year for 1941 to 1945, inclusive. Corresponding data for 1946 and 1947 are not available.
[12] Preliminary data for fiscal year ended March 31 of year following that stated.
[13] South Korea only.
[14] Subject to revision.
[15] Production of Siberia and Urals only.
[16] Estimated by author of chapter; excludes estimates for New Zealand.

COAL-CHEMICAL MATERIALS

GENERAL SUMMARY

The soaring requirements for virtually all coal products during and since World War II gave impetus to their recovery, and consequently outputs of coke-oven gas, tar, ammonia, and light oil in 1947 nearly equaled the 1944 peaks. Production of coke-oven gas in 1947 increased 24 percent over 1946; crude tar, 23 percent; ammonia, 23 percent; and crude light oil, 23 percent. Although coke-oven gas is a potential source of chemical raw materials, such as hydrogen, ethylene, etc., it is not being processed to any appreciable extent in this country, and virtually all of the production is used as fuel both for industrial purposes and domestic heating. Expanding markets for products made from ammonia, tar, and crude light oil stimulated interest in their manufacture, and coke-plant operators engaged in developing special technical processes, equipment, and operating technique for their economical production. Thus, output of the refined products advanced steadily, although yields of the basic crude materials—gas, tar, ammonia, and crude light oil—per ton of coal carbonized have been declining. This is clearly illustrated in the accompanying graph and is due principally to deterioration in quality of coal and condition of old ovens. The heavy demands for coal chemicals that prevailed in 1947 caused prices to advance sharply, and the gross financial returns from sales reached a new peak. The total realization exceeded the previous record year of 1944 by $36,098,409, or 19 percent, and was equivalent to 29 percent of the value of the coke produced. The greatest dollar increase was registered from the sales of surplus gas, which increased 35 percent over 1946. The downward trend in the revenue obtained from the sale of ammonia (sulfate and liquor), which started after the advent of the synthetic ammonia process in the United States, was temporarily arrested and the average value received per pound of sulfate was the highest since 1930. Crude-tar receipts per gallon were the highest on record, exceeding the previous maximum of 1946 by 36 percent. The rising demand for pure benzol caused further curtailment in the production of "motor benzol" in 1947. It is to be noted that, although this grade of benzol is still classified as "motor benzol," it is not to be construed that it is being utilized as motor fuel. It is known that a large part of this benzol is processed further outside the coke industry into the refined grades, and only a portion of it finds its way into motor fuel. The accompanying tables summarize data on the production, sales, value, and stocks of the various coal-chemical materials at oven-coke plants.

TABLE 49.—Coal-chemical materials obtained from coke-oven operations in the United States in 1947 [1]

[Exclusive of screenings or breeze]

Product	Production	Sales			On hand Dec. 31
		Quantity	Value		
			Total	Average	
Tar..........gallons..	736,174,480	407,973,125	$30,981,953	$0.076	30,778,666
Tar derivatives:					
Creosote oil, distillate as such..........do....	27,495,624	27,752,373	4,508,951	.162	414,860
Creosote oil, in coal-tar solution..........do....	13,002,593	11,697,444	1,796,099	.154	587,154
Tar acid oil..........do....	13,201,290	12,927,441	2,321,345	.180	662,162
Pitch of tar:					
Soft [2]..........net tons..	405,810	4,190	93,923	22.416	10,089
Hard [3]..........do....	251,636	----------	----------	------	121
Other tar derivatives [4]..........	----------	----------	2,828,831	------	----------
Ammonia:					
Sulfate [5]..........pounds..	1,618,879,699	1,624,498,995	26,724,821	.016	57,435,750
Liquor (NH_3 content)..........do....	51,435,793	47,238,610	1,471,300	.031	1,822,645
	----------	----------	28,196,121	------	----------
Sulfate equivalent of all forms..........do....	1,824,622,871	1,813,453,435	----------	------	64,726,330
NH_3 equivalent of all forms..........do....	456,155,718	453,363,359	----------	------	16,181,583
Gas:					
Used under boilers, etc..........M cubic feet..	[6] 971,262,280	37,957,353	4,477,300	.118	----------
Used in steel or affiliated plants..........do....		348,322,970	48,535,351	.139	----------
Distributed through city mains..........do....		167,865,453	54,029,125	.322	----------
Sold for industrial use..........do....		38,799,524	4,966,231	.128	----------
	[6] 971,262,280	592,945,300	112,008,007	.189	----------
Crude light oil..........gallons..	[7] 254,978,463	15,147,476	1,681,043	.111	4,136,019
Light-oil derivatives:					
Benzol:					
Motor..........do....	15,802,689	15,936,607	1,850,109	.116	609,923
All other grades..........do....	145,057,916	141,092,678	23,112,327	.164	7,194,058
Toluol, crude and refined..........do....	26,396,449	27,322,475	5,254,902	.192	1,172,651
Xylol, crude and refined..........do....	7,130,332	7,099,796	1,516,333	.214	475,589
Solvent naphtha..........do....	5,647,563	5,366,054	769,778	.143	406,022
Other light-oil products [8]..........do....	8,369,231	6,220,469	598,809	.096	428,467
	208,404,180	203,038,079	33,102,258	.163	10,286,710
Naphthalene, crude..........pounds..	98,378,875	98,364,997	3,021,152	.031	2,340,219
Pyridine:					
Crude bases (dry basis)..........gallons..	415,973	401,970	320,599	.798	82,347
Refined, or 2°..........pounds..	1,028,597	1,000,399	477,449	.477	44,056
Sodium phenolate..........gallons..	2,617,052	2,545,998	192,367	.076	199,365
Other coal-chemical materials [9]..........	----------	----------	563,553	------	----------
Value of all coal-chemical materials sold..........	----------	----------	222,093,651	------	----------

[1] Includes products of tar distillation conducted by coke-oven operators under same corporate name.
[2] Softening point less than 110° F. Includes some medium pitch-of-tar reported by two producers.
[3] Softening point over 160° F.
[4] Cresylic acid, cresols, crude anthracene, fuel oil, phenol, pitch coke, road tar, tar paint, and topped tar.
[5] Excludes production of 22,139,230 pounds and sales of 21,838,703 pounds valued at $570,182 from purchased synthetic ammonia.
[6] Includes gas used for heating ovens and gas wasted.
[7] Refined on premises to make derived products shown: 241,379,524 gallons.
[8] Includes benzol still residue, dicyclopentadiene, carbon disulfide, and vented vapors.
[9] Ammonium thiocyanate, cyanogen sludge, crude phenol, picolines, secondary oil, sodium prussiate, and sulfur.

TABLE 50.—Coal equivalent of coal-chemical materials produced at oven-coke plants in the United States, 1913, 1914, 1918, 1937, and 1945–47

Year	Quantity of coal-chemical materials				Estimated equivalent in heating value (billion B. t. u.)					Coal equivalent	
	Coke breeze (thousand net tons)	Surplus gas (billion cubic feet)	Tar produced (thousand gallons)	Light oil produced (thousand gallons)	Coke breeze	Surplus gas	Tar	Light oil	Total	Net tons	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
1945	4,629	554	696,307	245,687	92,580	304,700	104,446	31,939	533,665	20,369,000	21.3
1946	4,232	480	596,869	206,914	84,640	264,000	89,530	26,899	465,069	17,751,000	21.3
1947	5,474	593	736,174	254,978	109,480	326,150	110,426	33,147	579,203	22,107,000	21.0

TABLE 51.—Value of coal-chemical materials and of coke, including breeze, per ton of coke produced in the United States, 1937 and 1944–47

Product	1937	1944	1945	1946	1947
Ammonia and its compounds	$0.326	$0.324	$0.356	$0.361	$0.423
Light oil and its derivatives (including naphthalene)	.435	.552	.503	.467	.566
Surplus gas sold or used	1.483	1.403	1.413	1.542	1.678
Tar sold	.375	.327	.352	.395	.464
Miscellaneous products	.066	.167	.148	.154	.196
	2.685	2.773	2.772	2.919	3.327
Tar used, not sold	.127	.131	.095	.071	.141
Breeze produced	.162	.198	.202	.217	.242
	2.974	3.102	3.069	3.207	3.710
Value of coke produced	5.026	7.140	7.572	8.345	10.652
Total value of coke and coal-chemical materials	8.000	10.242	10.641	11.552	14.362

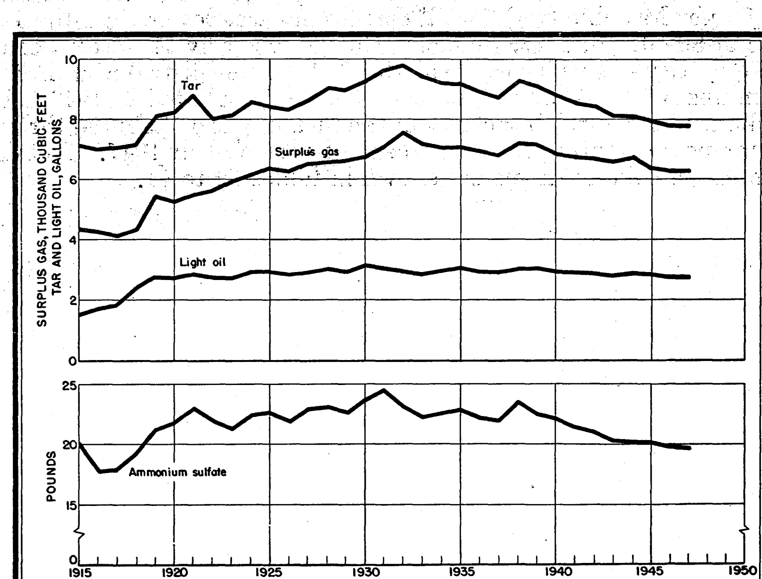

FIGURE 2.—Average yield of principal coal-chemical materials per net ton of coal carbonized in coke ovens, 1915–47. Yields of light oil and ammonium-sulfate equivalent represent average for plants recovering these products.

COKE-OVEN GAS

Modern coke ovens are primarily producers of specialized forms of fuel. In addition to the main product, coke, they make another major fuel, gas. At some plants its importance ranks scarcely second to the coke itself. When coal is carbonized in coke ovens approximately 17 percent by weight is recovered in the form of fuel gas. Usually about 37 percent of the total volume of gas produced is used to heat the ovens, and the remainder (surplus gas) is piped to affiliated metallurgical works and neighboring industries and through city mains for public distribution. The yield of gas, which had been declining steadily since the beginning of World War II, increased slightly in 1947 over the 1946 figure and averaged 10.27 M cubic feet per ton of coal carbonized. Total production, however, increased 24 percent over 1946 because of the high level of operations maintained throughout the year. This gain made available a greater quantity of surplus gas, and the total used or sold for industrial purposes and distributed through city mains increased 23 percent in volume and 35 percent in value over 1946. There have been only minor changes since 1940 in the relative proportions of surplus gas distributed for the purposes classified in table 54, and in 1947 producers used 6 percent under boilers and other coke-plant equipment (exclusive of ovens) and 59 percent in integrated metallurgical works, 7 percent was sold to neighboring industries, and 28 percent was sold for distribution through city mains.

Gas distributed through city mains generally commands higher prices than the balance, virtually all of which is sold or used by producers for industrial purposes, and influences the average unit value reported by the industry. For example, the average unit values for each of the groups (except for industrial purposes) classified in table 54 were the highest since 1924 but the composite or average unit value ($0.189 per M cubic feet) for all surplus gas was lower than the 1934 figure of $0.191 per M cubic feet. However, nearly 47 percent of the total quantity of surplus gas available in 1934 was distributed through city mains, whereas only 28 percent was so distributed in 1947. The merchant plants furnish the bulk of the surplus gas distributed through city mains accounting for 68 percent of the total in 1947. Detailed statistics on coke-oven gas are shown in tables 52 to 54.

TABLE 52.—Coke-oven gas produced and sold in the United States in 1947, by States, in thousands of cubic feet

State	Active plants	Produced	Used in heating ovens	Surplus sold or used: Quantity	Surplus sold or used: Value: Total	Surplus sold or used: Value: Average	Wasted
Alabama	7	84,331,666	39,325,816	43,311,093	$4,382,761	$0.101	1,694,757
California	1	6,055,088	505,658	5,322,238	(1)	(1)	227,192
Colorado	1	14,229,601	7,549,583	6,566,218	(1)	(1)	113,800
Illinois	8	52,641,285	17,518,502	34,357,275	5,044,230	.147	765,508
Indiana	5	116,701,626	51,358,314	63,130,679	12,394,999	.196	2,212,633
Maryland	1	27,292,128	9,391,101	16,880,532	(1)	(1)	1,020,495
Massachusetts	2	17,382,821	3,496,730	13,852,461	(1)	(1)	33,630
Michigan	4	37,956,354	6,278,138	31,596,951	4,840,455	.153	81,265
Minnesota	3	12,906,231	5,581,667	7,279,468	2,247,952	.309	45,096
New Jersey	2	21,676,626	5,890,339	15,786,287	(1)	(1)	----------
New York	8	86,221,348	24,277,057	61,015,919	19,439,006	.319	928,372
Ohio	15	141,491,374	63,798,558	76,282,057	11,305,431	.148	1,410,759
Pennsylvania	13	248,333,485	103,773,037	143,638,429	22,644,786	.158	922,019
Tennessee	1	3,172,540	1,363,397	1,800,823	(1)	(1)	8,320
Texas	2	4,095,232	1,523,633	1,501,145	(1)	(1)	1,070,454
Utah	2	18,763,734	4,670,186	13,468,369	(1)	(1)	625,179
West Virginia	5	44,739,978	14,326,965	29,873,050	3,994,346	.134	539,963
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	6	33,271,163	5,629,119	27,282,306	7,767,571	.285	359,738
Undistributed	-----	----------	----------	----------	17,946,470	.239	----------
Total 1947	86	971,262,280	366,257,800	592,945,300	112,008,007	.189	12,059,180
At merchant plants	32	199,401,275	48,440,115	148,477,515	46,850,004	.316	2,483,645
At furnace plants	54	771,861,005	317,817,685	444,467,785	65,158,003	.147	9,575,535
Total 1946	85	783,637,016	293,685,525	480,489,586	83,184,679	.173	9,461,905

[1] Included with "Undistributed."

TABLE 53.—Coke-oven gas and other kinds of gas used in heating ovens in 1947, by States, in thousands of cubic feet [1]

State	Coke-oven gas	Producer gas	Blue-water gas	Blast-furnace gas	Other gases	Total coke-oven gas equivalent
Alabama	39,325,816	----------	----------	----------	[2] 246,058	39,571,874
California	505,658	----------	----------	1,900,368	----------	2,406,026
Colorado	7,549,583	----------	----------	----------	----------	7,549,583
Illinois	17,518,502	249,223	----------	4,286,960	[3] 2,689,183	24,743,868
Indiana	51,358,314	1,188,704	515,747	----------	[3] 87,512	53,150,277
Maryland	9,391,101	----------	----------	2,413,729	----------	11,804,830
Massachusetts	3,496,730	3,800,461	----------	----------	----------	7,297,191
Michigan	6,278,138	----------	----------	9,026,581	----------	15,304,719
Minnesota	5,581,667	126,090	45,639	----------	[4] 152,012	5,905,408
New Jersey	5,890,339	3,109,032	----------	----------	----------	8,999,371
New York	24,277,057	11,002,609	1,144,230	685,362	----------	37,109,258
Ohio	63,798,558	----------	----------	14,939,924	----------	78,738,482
Pennsylvania	103,773,037	2,022,347	54,519	2,177,236	[5] 654,276	108,681,415
Tennessee	1,363,397	----------	----------	----------	----------	1,363,397
Texas	1,523,633	----------	----------	----------	[3] 6,272	1,529,905
Utah	4,670,186	----------	----------	3,061,533	----------	7,731,719
West Virginia	14,326,965	----------	----------	3,039,086	[6] 830,500	18,196,551
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5,629,119	6,154,054	----------	----------	[7] 2,007,899	13,791,072
	366,257,800	27,652,520	1,760,135	41,530,779	6,673,712	443,874,946
At merchant plants	48,440,115	27,261,276	1,659,977	----------	6,624,378	83,985,746
At furnace plants	317,817,685	391,244	100,158	41,530,779	49,334	359,889,200

[1] Corrected to 550 B. t. u. per cubic foot.
[2] Natural and oil gas.
[3] Natural gas.
[4] Butane air gas.
[5] Oil gas.
[6] Spillage gas.
[7] Butane air, gasoline, natural, and propane air gases.

TABLE 54.—Disposal of surplus coke-oven gas in the United States in 1947, by States, in thousands of cubic feet

State	Used by producer—						Sold					
	Under boilers			In steel or other affiliated plant			Distributed through city mains			For industrial purposes		
	Quantity	Value		Quantity	Value		Quantity	Value		Quantity	Value	
		Total	Average		Total	Average		Total	Average		Total	Average
Alabama	6,662,610	$480,054	$0.072	27,347,345	$2,900,023	$0.106	4,332,751	(1)	(1)	4,968,387	(1)	(1)
California	----	----	----	5,322,238	(1)	(1)	----	----	----	----	----	----
Colorado	----	----	----	6,566,218	(1)	(1)	----	----	----	----	----	----
Illinois	6,505,680	785,791	.121	6,734,448	(1)	(1)	20,245,939	$2,952,769	$0.146	871,208	(1)	(1)
Indiana	4,276,799	(1)	(1)	48,459,914	7,245,704	.150	8,635,127	4,056,038	.470	1,758,839	(1)	(1)
Maryland	----	----	----	10,631,382	(1)	(1)	6,249,150	(1)	(1)	----	----	----
Massachusetts	4,620	(1)	(1)	----	----	----	13,732,328	(1)	(1)	115,513	(1)	(1)
Michigan	4,962,228	(1)	(1)	24,943,654	3,613,483	.145	----	----	----	1,691,069	(1)	(1)
Minnesota	80,569	5,718	.071	2,144,839	(1)	(1)	5,054,060	(1)	(1)	----	----	----
New Jersey	----	----	----	483	(1)	(1)	15,785,804	(1)	(1)	----	----	----
New York	1,743,001	213,994	.123	16,992,115	2,728,721	.161	40,670,422	16,094,627	.396	1,610,381	$401,664	$0.249
Ohio	4,936,281	700,025	.142	54,623,397	7,974,119	.146	4,782,883	1,151,660	.241	11,939,496	1,479,627	.124
Pennsylvania	4,284,852	(1)	(1)	108,987,127	14,187,500	.130	23,530,020	7,297,186	.310	6,836,430	(1)	(1)
Tennessee	199,199	(1)	(1)	----	----	----	1,601,624	(1)	(1)	----	----	----
Texas	1,189,168	(1)	(1)	311,977	(1)	(1)	----	----	----	----	----	----
Utah	1,080,514	(1)	(1)	11,433,433	(1)	(1)	833,193	(1)	(1)	121,229	(1)	(1)
West Virginia	865,588	(1)	(1)	23,824,400	3,406,900	.143	----	----	----	5,183,062	(1)	(1)
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,166,244	(1)	(1)	----	----	----	22,412,152	7,292,238	.325	3,703,910	(1)	(1)
Undistributed	----	2,291,718	.127	----	6,478,901	.150	----	15,184,607	.319	----	3,084,940	.122
Total 1947	37,957,353	4,477,300	.118	348,322,970	48,535,351	.139	167,865,453	54,029,125	.322	38,799,524	4,966,231	.128
At merchant plants	7,521,967	797,611	.106	6,735,333	925,872	.137	113,512,038	42,273,402	.372	20,708,177	2,853,119	.138
At furnace plants	30,435,386	3,679,689	.121	341,587,637	47,609,479	.139	54,353,415	11,755,723	.216	18,091,347	2,113,112	.117
Total 1946	29,473,813	3,307,201	.112	265,545,711	31,172,118	.117	157,234,511	44,928,697	.286	28,235,551	3,776,663	.134

[1] Included with "Undistributed."

CRUDE COAL TAR

In 1947 the average yield of crude coal tar per ton of coal carbonized was the lowest since 1918. In spite of the poor performance from the standpoint of yield, the large tonnage of coal carbonized resulted in a gain of 23 percent over 1946 in total output and fell but 31,632,691 gallons, or 4 percent, short of the 1944 record. Tar may be used as a fuel or it may be processed into various useful tar products according to business and economic factors. In the early days of the coke industry, virtually all of the tar produced was used as a fuel. With development of the organic chemicals industry and the attendant expansion of markets for tar products, larger and larger quantities were processed, reaching a point in 1946 where only about 13 percent of the tar produced was burned in its crude form. However, the shortage of fuel oil in 1947 made it necessary for a number of furnace plants once more to divert a part or in some cases virtually all of their production to affiliated metallurgical operations. This diversion to the metallurgical industries increased markedly the proportion of tar sold or used as fuel. Thus, the percentage of crude tar used as fuel increased from 13 percent of the total output in 1946 to 21 percent in 1947. Although tar refineries, operated independently of coke plants, received about the same quantity of tar in 1947 as in 1946, the increased supply at coke plants resulted in a gain of 29 percent over 1946 in quantity processed by coke-oven operators. The price of tar, which is influenced to a large extent by the price of fuel oil, increased $0.02 per gallon, or 36 percent, over 1946 and reached the highest figure on record.

Creosote oil, a tar derivative used in the United States mainly for wood preservation, is the principal product made by coke-plant operators and usually represents more than 50 percent of the revenue obtained by coke-plant operators from the sale of all tar derivatives. The volume of creosote oil produced (distillate as such and in coal-tar solution) in 1947 increased 30 percent over 1946 and the value of sales was 68 percent higher. Tar-acid oil increased 2 percent in output and 44 percent in value of sales. Production and sales of phenol, cresols, cresylic acid, anthracene, and other derivatives cannot be disclosed because less than three producers are involved and publication would reveal individual operations. Pitch output, which comprises 50 to 80 percent of the tar processed, increased 29 percent. As in previous years, very little of the pitch produced was marketed, and virtually all of it was used by the producers. The soft- or medium-melting-point pitches are cut back (usually with virgin tar) to the desired viscosity and used as metallurgical fuel; the hard pitch produced at several plants is pulverized and mixed with the coal and charged into the ovens to improve the quality of the coke.

TABLE 55.—Coke-oven tar produced, used by producer, and sold in the United States in 1947, 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	64,866,672	7.83	1,863,666	693,593	28,716,874	173,949		32,203,562	32,203,562	$2,485,467	$0.077	3,758,200
California	5,449,208	10.15	5,278,717									286,154
Colorado	12,105,000	9.71	11,015,937		1,172,258			10,056	10,056	(2)	(2)	242,987
Illinois	35,153,526	6.56		4,950			7,601,271	27,077,475	34,678,746	2,651,650	.076	1,511,857
Indiana	67,206,555	5.63	16,707,652		8,542,498	1,329,139	5,324,533	35,098,170	40,422,703	3,138,166	.078	3,720,642
Maryland	19,238,266	7.00			329,110			18,300,668	18,300,668	(2)	(2)	2,049,508
Massachusetts	12,309,554	7.46					494,733	11,782,390	12,277,123	(2)	(2)	123,909
Michigan	27,049,788	6.94			6,091,303	10		20,086,839	20,086,839	1,515,447	.075	1,397,524
Minnesota	7,465,747	5.96			1,753,525			5,686,217	5,686,217	412,112	.072	779,917
New Jersey	15,183,457	7.64						15,129,908	15,129,908	(2)	(2)	660,549
New York	62,947,806	7.80	16,230,543			21,011	2,149,651	45,080,131	47,229,782	3,434,560	.073	1,635,635
Ohio	97,744,430	6.88	2,771,460	167,370	15,640,383	436,790	3,493,464	75,006,780	78,500,244	6,364,500	.081	3,834,712
Pennsylvania	220,727,746	9.20	146,605,677		40,837,939	268,025	283,487	32,406,835	32,690,322	2,339,942	.072	7,912,135
Tennessee	2,492,790	7.65						2,479,530	2,479,530	(2)	(2)	34,521
Texas	2,426,061	6.52						2,150,681	2,150,681	(2)	(2)	275,380
Utah	18,617,720	11.54			13,261,505		30	5,447,402	5,447,432	(2)	(2)	876,747
West Virginia	42,580,793	10.55			4,336,795		12,728,611	25,372,113	38,100,724	3,344,054	.088	723,539
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	22,609,361	7.31				605		22,578,588	22,578,588	1,491,386	.066	954,750
Undistributed										3,804,669	.068	
Total 1947	736,174,480	7.78	200,473,652	865,913	120,682,190	2,229,529	32,075,780	375,897,345	407,973,125	30,981,953	.076	30,778,666
At merchant plants	149,768,406	7.77	1,863,666			7,177	494,733	146,646,790	147,141,523	9,967,993	.068	5,033,531
At furnace plants	586,406,074	7.79	198,609,986	865,913	120,682,190	2,222,352	31,581,047	229,250,555	260,831,602	21,013,960	.081	25,745,135
Total 1946	596,868,745	7.82	155,061,221	1,055,469	64,697,730	2,780,646	10,961,798	367,036,784	377,998,582	21,284,137	.056	26,728,081

[1] Comprises 19,843,352 gallons sold to affiliated plants and 12,232,428 gallons to other purchasers.
[2] Included with "Undistributed."

AMMONIA

The total production of ammonia (NH_3 equivalent of all forms) in 1947 increased 23 percent over 1946. Ammonia is recovered at coke plants either as its water solution (ammonia liquor) or as a crystallized ammonium sulfate. The bulk of the total ammonia recovered is converted to ammonium sulfate—89 percent in 1947—and virtually all is sold as a fertilizer material. Shortages in supplies of nitrogenous fertilizers throughout the world since the war have created an extremely heavy demand for sulfate. In order to alleviate the shortage of sulfate, a number of coke plants purchased synthetic anhydrous ammonia in 1947 and converted it into sulfate in their facilities. Most of this added production was exported. The Bureau of Mines, in an effort to preserve the continuity of its series on coke-oven sulfate, asked the producers involved to report the production and sales of sulfate from purchased anhydrous ammonia separately from the sulfate made from the ammonia recovered from their own coke ovens. Data for the production of synthetic sulfate at coke ovens in 1947 are shown in footnote 5 of table 49. Exports of nitrogenous materials, including coke-oven sulfate, were placed under Public Law 188 in July 1947, and allocations and priorities were under the jurisdiction of the Office of Materials Distribution, United States Department of Commerce. The price of sulfate advanced sharply in 1947 and reached the highest unit value in 18 years. Data on production and sales of coke-oven ammonia in 1947 are shown in table 56.

CRUDE LIGHT OIL AND DERIVATIVES

The recovery of crude light oil is widely practiced in the coke industry and only 8 of the 86 plants active in 1947 failed to remove it from the gas. The general method of recovering crude light oil in the United States is by scrubbing the coke-oven gas (freed from tar and ammonia) with a petroleum oil generally called "straw oil" or benzol wash oil. Between 90 and 95 percent of the "total light oil" produced in coke ovens is recovered by scrubbing the gas, less than 5 percent is found in the tar, and the balance passes out with the scrubbed gas. The potential yield of crude light oil per ton of coal carbonized varies widely, depending on the quality of coal charged, design and condition of ovens, oven temperatures, coking time, and kind of scrubbing equipment. In 1947 the yield per ton of coal carbonized at individual plants recovering light oil ranged from 0.15 gallon to 4.32 gallons and averaged 2.75 gallons, compared with 2.77 gallons in 1946. The bulk of the light oil produced at coke plants is refined by the producers in adjacent refining facilities and in 1947 more than 95 percent of the total output was processed for the recovery of benzol, toluol, xylol, solvent naphtha, and naphthalene. Total production of crude light oil increased 23 percent over 1946; benzol production (all grades), the principal constituent, increased 17 percent. Production of motor benzol dropped 42 percent from 1946 because of the increased demand for the pure grades and as a consequence, the proportion of "motor" to all other grades decreased from 20 percent in 1946 to 10 percent in 1947. As mentioned pre-

TABLE 56.—Coke-oven ammonia produced and sold in the United States in 1947, by States, in pounds

State	Active plants	Sulfate equivalent of all forms		Produced as—		Sold as—				On hand Dec. 31	
		Quantity	Per ton of coal coked	Sulfate	Liquor (NH_3 content)	Sulfate		Liquor (NH_3 content)		Sulfate	Liquor (NH_3 content)
						Quantity	Value	Quantity	Value		
Alabama	7	185,824,523	22.44	180,020,039	1,451,121	176,337,562	$2,910,784	1,500,464	(1)	4,975,056	28,628
California	1	14,916,095	27.79	14,916,095		14,970,260	(1)			97,800	
Colorado	1	25,874,939	20.75	25,874,939		28,126,260	(1)			552,840	
Illinois	7	90,797,115	18.90	90,797,115		89,969,885	1,415,728			3,798,604	
Indiana	5	195,302,814	16.37	170,154,294	6,287,130	170,999,403	2,650,306	5,827,463	$170,106	8,852,967	583,178
Maryland	1	55,887,813	20.34	55,887,813		57,681,589	(1)			260,041	
Massachusetts	2	27,668,868	16.76	27,074,800	148,517	26,783,780	(1)	154,217	(1)	882,200	10,090
Michigan	4	78,715,613	20.20	27,456,637	12,814,744	28,923,481	(1)	10,895,066	(1)	57,556	284,819
Minnesota	3	18,812,512	15.02	18,812,512		20,483,750	328,325			909,258	
New Jersey	2	36,239,770	18.23	36,239,770		35,612,353	(1)			1,529,657	
New York	8	145,559,093	18.04	117,135,565	7,105,882	113,579,730	1,931,777	6,881,458	220,042	6,806,698	164,284
Ohio	15	257,859,336	18.15	204,404,492	13,363,711	203,753,192	3,258,170	11,889,304	378,743	4,671,160	340,418
Pennsylvania	13	510,491,251	21.29	508,376,895	528,589	513,428,537	8,337,157	524,327	(1)	21,607,307	38,364
Tennessee	1	7,339,880	22.52	7,339,880		7,308,015	(1)			159,737	
Texas	2	8,108,680	21.78	8,108,680		7,884,520	(1)			224,160	
Utah	2	42,286,510	26.21	42,286,510		42,632,843	(1)			912,220	
West Virginia	3	64,153,053	22.58	64,153,053		65,506,895	1,147,201			802,261	
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5	58,785,006	19.27	19,840,610	9,736,099	20,566,940	338,513	9,566,311	287,931	336,228	372,864
Undistributed							4,406,860		414,478		
Total 1947	82	1,824,622,871	19.66	1,618,879,699	51,435,793	1,624,498,995	26,724,821	47,238,610	1,471,300	57,435,750	1,822,645
At merchant plants	29	347,938,479	19.32	211,348,643	34,147,459	210,146,963	3,529,315	36,941,479	1,145,810	7,477,828	1,078,877
At furnace plants	53	1,476,684,392	19.74	1,407,531,056	17,288,334	1,414,352,032	23,195,506	10,297,131	325,490	49,957,922	743,768
Total 1946	81	1,487,434,225	19.79	1,287,504,417	49,982,452	1,284,471,366	18,024,763	47,042,597	1,417,296	66,822,811	1,289,128

[1] Included with "Undistributed."

viously, the term "motor" does not infer that all of it was used as a motor fuel, as it is known that a large part of it was sold and processed into the refined grades for industrial purposes. Toluol production, which had slumped badly in 1946 because of the depressed market, increased substantially and compared favorably with prewar production. Production of xylol (all grades) and solvent naphtha increased 19 and 28 percent, respectively, over 1946, reflecting the large demand for these aromatic solvents. Prices for virtually all derivatives increased sharply, especially industrial benzol, which advanced $0.035 per gallon.

TABLE 57.—Coke-oven crude light oil produced in the United States and derived products obtained and sold in 1947, by States, in gallons

State	Active plants	Produced		Refined on premises [1]	Derived products			On hand Dec. 31
		Total	Per ton of coal coked		Produced	Sold [2]		
						Quantity	Value	
Alabama	7	22,852,138	2.76	22,002,834	19,175,866	18,432,998	$2,964,552	280,632
California	1	1,996,368	3.72	1,996,732	1,736.567	1,578,531	(3)	14,209
Colorado	1	3,833,046	3.07	3,854,950	3,728,676	3,523,546	(3)	29,396
Illinois	7	13,844,740	2.64	10,454,988	8,657,258	9,008,717	1,528,641	200,494
Indiana	5	27,581,793	2.31	28,730,131	24,713,289	24,347,828	3,945,359	332,185
Maryland	1	11,246,439	4.09	11,270,869	9,715,192	9,666,949	(3)	59,262
Michigan	4	10,404,830	2.67	5,226,153	4,498,259	4,435,636	(3)	193,863
New York	8	17,473,659	2.17	26,790,827	23,667,837	22,888,868	3,782,425	266,681
Ohio	15	38,668,467	2.72	34,358,186	26,883,937	27,082,195	4,463,727	448,152
Pennsylvania	13	74,601,390	3.11	71,763,817	64,307,993	63,386,900	10,191,079	1,839,140
Tennessee	1	780,828	2.40	777,070	682,946	705,492	(3)	5,222
Texas	2	934,614	2.51	909,324	757,777	645,819	(3)	25,290
Utah	2	6,261,191	3.88	6,278,459	5,211,492	4,965,828	(3)	40,094
West Virginia	5	13,250,134	3.28	10,952,645	9,395,034	7,095,258	1,246,196	92,479
Connecticut, Kentucky, Massachusetts, Missouri, New Jersey, and Wisconsin	7	11,248,826	1.79	6,012,539	5,272,057	5,273,514	889,521	308,920
Undistributed							4,090,758	
Total 1947	79	254,978,463	2.75	241,379,524	208,404,180	203,038,079	33,102,258	4,136,019
At merchant plants	27	39,261,177	2.15	33,886,739	30,059,188	27,826,122	4,486,962	1,080,517
At furnace plants	52	215,717,286	2.90	207,492,785	178,344,992	175,211,957	28,615,296	3,055,502
Total 1946	77	206,914,333	2.77	198,593,963	171,607,226	171,597,004	22,523,610	3,784,767

[1] Comprises 236,688,759 gallons of crude light oil from own production and 4,690,765 gallons purchased from other coke-oven plants.
[2] Excludes 15,147,476 gallons of crude light oil valued at $1,681,043 sold as such.
[3] Included with "Undistributed."

TABLE 58.—Trend in yields of products obtained from refining crude light oil at oven-coke plants, 1937 and 1939–47, in percent

Year	Benzol		Toluol crude and refined	Xylol crude and refined	Solvent naphtha	Other light oil products
	Motor	All other grades				
1937	52.5	11.9	11.5	2.5	3.1	4.5
1939	48.6	15.4	12.1	2.5	2.9	3.8
1940	48.8	15.4	12.7	2.7	2.5	3.6
1941	47.2	16.8	13.0	3.4	2.3	3.6
1942	26.8	35.3	13.4	3.9	2.2	3.8
1943	8.6	53.9	13.1	3.6	2.1	3.6
1944	7.1	56.6	12.9	3.3	2.1	3.5
1945	12.3	53.9	11.5	3.2	2.0	3.3
1946	13.8	55.3	8.3	3.0	2.2	3.8
1947	6.5	60.1	10.9	3.0	2.3	3.5

TABLE 59.—Production of benzol and toluol, by grades, at oven-coke plants 1941–47, in gallons

Year	Benzol				Toluol		
	Motor	Nitration or 1° C.	Pure commercial or 2° C.	All other	Nitration or 1° C.	Pure commercial or 2° C.	All other
1941	106,372,000	15,414,500	18,286,400	4,182,600	14,689,800	13,268,500	1,378,900
1942	64,797,600	25,624,400	53,617,900	6,014,700	25,160,200	5,044,800	2,109,600
1943	21,267,900	35,047,800	93,246,600	4,144,800	27,152,300	2,394,700	2,725,600
1944	18,556,600	41,285,800	102,436,500	3,187,600	29,771,100	2,149,600	1,607,500
1945	28,788,100	39,166,500	86,237,300	1,266,700	23,355,400	2,219,700	1,494,200
1946	27,398,900	35,739,300	71,681,700	2,308,000	12,518,000	2,796,400	1,205,400
1947	15,802,700	42,475,300	100,111,800	2,470,800	20,514,100	4,989,500	892,800

NAPHTHALENE

TABLE 60.—Crude naphthalene produced and sold by coke-plant operators in the United States, 1937 and 1943–47

Year	Produced (pounds)	Sold			Receipts per ton of coke
		Pounds	Value		
			Total	Average per pound	
1937	60,797,108	60,315,581	$1,182,992	$0.020	$0.024
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
1946	71,605,138	71,769,750	1,602,739	.022	.030
1947	98,378,875	98,364,997	3,021,152	.031	.045

COKE OVENS OWNED BY CITY GAS COMPANIES (PUBLIC UTILITIES)

The accompanying table compares statistics on the activities of coke plants operated by gas utilities with those plants not owned by city gas companies for 1946 and 1947. This classification is maintained by the Bureau of Mines in the interest of those who may want to obtain information on the coking operations of city gas works proper and also to show their relative value to the coke industry as a whole.

Normally, maximum production of gas of proper analysis is the primary objective of these plants; however, the extremely heavy demand for industrial coke during and since the war has caused many operators to place great emphasis on coke, and in 1947 more than a million tons of metallurgical coke from this group of plants was shipped to iron blast furnaces and cupolas. The sales of 677,036 tons of foundry coke in 1947 by this group alleviated the shortage of this fuel materially. Although the volume of production has not decreased markedly in recent years, the number of operations have been declining steadily because of the substitution of natural gas for coke-oven gas in certain areas. In 1947, the North Shore Gas Co., Waukegan, Ill., discontinued distribution of coke-oven gas and was succeeded by the Waukegan Coke Corp., and the plant continued operations for the production of metallurgical coke. This reduced the number of active gas plants at the end of the year to 13, 2 less than at the beginning of 1946.

City gas plants in 1947 contributed 5 percent of the total production of oven coke, 6 percent of the gas, 6 percent of the tar, 3 percent of the crude light oil, and 4 percent of the ammonia.

TABLE 61.—Production of coke, breeze, and coal-chemical materials in the United States at oven-coke plants owned by city gas companies (public utilities [1]) and all other oven-coke plants, 1946–47

Product	1946			1947		
	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	71	14	85	73	13	86
Coke:						
Production ____ net tons	50, 459, 266	3, 470, 181	53, 929, 447	63, 175, 410	3, 583, 139	66, 758, 549
Value	$416, 145, 126	$33, 915, 086	$450, 060, 212	$668, 961, 045	$42, 139, 364	$711, 100, 409
Average per ton	$8. 25	$9. 77	$8. 35	$10. 59	$11. 76	$10. 65
Screenings or breeze:						
Production ____ net tons	3, 918, 828	313, 424	4, 232, 252	5, 185, 244	288, 869	5, 474, 113
Sales ____ do	987, 728	35, 859	1, 023, 587	1, 072, 581	34, 139	1, 106, 720
Value of sales	$2, 932, 544	$116, 540	$3, 049, 084	$3, 823, 918	$126, 190	$3, 950, 108
Average per ton	$2. 97	$3. 25	$2. 98	$3. 57	$3. 70	$3. 57
Coal charged into ovens:						
Bituminous ____ net tons	71, 299, 287	4, 821, 387	76, 120, 674	89, 400, 632	4, 924, 500	94, 325, 132
Anthracite ____ do	193, 272	45, 540	238, 812	217, 962	44, 234	262, 196
Total ____ do	71, 492, 559	4, 866, 927	76, 359, 486	89, 618, 594	4, 968, 734	94, 587, 328
Value	$406, 831, 627	$33, 711, 873	$440, 543, 500	$601, 517, 549	$39, 656, 275	$641, 173, 824
Average per ton	$5. 69	$6. 93	$5. 77	$6. 71	$7. 98	$6. 78
Coke—						
Used by producer:						
Net tons	30, 937, 637	1, 419, 693	32, 357, 330	39, 093, 901	1, 493, 738	40, 587, 639
Value	$251, 916, 628	$10, 813, 296	$262, 729, 924	$390, 980, 833	$14, 411, 987	$405, 392, 820
Sold:						
Net tons	19, 416, 705	2, 076, 201	21, 492, 906	23, 999, 550	1, 994, 345	25, 993, 895
Value	$163, 385, 251	$23, 381, 344	$186, 766, 595	$277, 137, 875	$26, 606, 612	$303, 744, 487
Coal-chemical materials:						
Tar:						
Production ____ gallons	556, 733, 395	40, 135, 350	596, 868, 745	695, 891, 477	40, 283, 003	736, 174, 480
Sales ____ do	337, 629, 254	40, 369, 328	377, 998, 582	367, 988, 658	39, 984, 467	407, 973, 125
Value of sales	$19, 037, 987	$2, 246, 150	$21, 284, 137	$28, 237, 834	$2, 744, 119	$30, 981, 953
Ammonia:						
Production (NH_3 equivalent of all forms) pounds	351, 563, 681	20, 294, 875	371, 858, 556	436, 567, 291	19, 588, 427	456, 155, 718
Liquor (NH_3 content):						
Production ____ pounds	46, 549, 806	3, 432, 646	49, 982, 452	48, 673, 103	2, 762, 690	51, 435, 793
Sales ____ do	43, 654, 464	3, 388, 133	47, 042, 597	44, 472, 455	2, 766, 155	47, 238, 610
Value of sales	$1, 338, 110	$79, 186	$1, 417, 296	$1, 399, 849	$71, 451	$1, 471, 300
Sulfate:						
Production ____ pounds	1, 220, 055, 501	67, 448, 916	1, 287, 504, 417	1, 551, 576, 751	67, 302, 948	1, 618, 879, 699
Sales ____ do	1, 216, 239, 403	68, 231, 963	1, 284, 471, 366	1, 557, 024, 670	67, 474, 325	1, 624, 498, 995
Value of sales	$17, 052, 633	$972, 130	$18, 024, 763	$25, 584, 853	$1, 139, 968	$26, 724, 821
Gas:						
Production ____ M cubic feet	729, 866, 510	53, 770, 506	783, 637, 016	916, 271, 433	54, 990, 847	971, 262, 280
Disposal of surplus:						
Used under boilers:						
M cubic feet	29, 440, 189	33, 624	29, 473, 813	37, 774, 872	182, 481	37, 957, 353
Value	$3, 301, 804	$5, 397	$3, 307, 201	$4, 449, 623	$27, 677	$4, 477, 300
Average per M cubic feet	$0. 112	$0. 161	$0. 112	$0. 118	$0. 152	$0. 118
Used in steel or affiliated plants:						
M cubic feet	265, 545, 711	----------	265, 545, 711	348, 236, 552	86, 418	348, 322, 970
Value	$31, 172, 118	----------	$31, 172, 118	$48, 508, 482	$26, 869	$48, 535, 351
Average per M cubic feet	$0. 117	----------	$0. 117	$0. 139	$0. 311	$0. 139

See footnote at end of table.

TABLE 61.—Production of coke, breeze, and coal-chemical materials in the United States at oven-coke plants owned by city gas companies (public utilities [1]) and all other oven-coke plants, 1946–47—Continued

Product	1946			1947		
	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
Coal-chemical materials—Continued						
Gas—Continued						
Disposal of surplus—Continued						
Distributed through city mains:						
M cubic feet	109, 804, 033	47, 430, 478	157, 234, 511	119, 823, 501	48, 041, 952	167, 865, 453
Value	$26, 823, 495	$18, 105, 202	$44, 928, 697	$34, 656, 479	$19, 372, 646	$54, 029, 125
Average per M cubic feet	$0. 244	$0. 382	$0. 285	$0. 289	$0. 403	$0. 322
Sold for industrial use:						
M cubic feet	26, 055, 615	2, 179, 936	28, 235, 551	36, 668, 726	2, 130, 798	38, 799, 524
Value	$3, 028, 974	$747, 689	$3, 776, 663	$4, 190, 995	$775, 236	$4, 966, 231
Average per M cubic feet	$0. 116	$0. 343	$0. 134	$0. 114	$0. 364	$0. 128
Crude light oil:						
Production gallons	199, 969, 160	6, 945, 173	206, 914, 333	247, 849, 742	7, 128, 721	254, 978, 463
Sales do	9, 360, 362	3, 838, 868	13, 199, 230	11, 924, 699	3, 222, 777	15, 147, 476
Value of sales	$789, 368	$268, 495	$1, 057, 863	$1, 439, 968	$241, 075	$1, 681, 043
Light oil derivatives:						
Production gallons	168, 651, 584	2, 955, 642	171, 607, 226	204, 697, 979	3, 706, 201	208, 404, 180
Sales do	168, 452, 382	3, 144, 622	171, 597, 004	199, 678, 808	3, 359, 271	203, 038, 079
Value of sales	$22, 172, 659	$350, 951	$22, 523, 610	$32, 702, 981	$399, 277	$33, 102, 258
Naphthalene, crude:						
Production pounds	71, 014, 970	590, 168	71, 605, 138	97, 638, 009	740, 866	98, 378, 875
Sales do	71, 179, 582	590, 168	71, 769, 750	97, 624, 131	740, 866	98, 364, 997
Value of sales	$1, 591, 061	$11, 678	$1, 602, 739	$3, 003, 588	$17, 564	$3, 021, 152
All other coal-chemical materials, value	$8, 207, 451	$87, 337	$8, 294, 788	$13, 044, 041	$59, 076	$13, 103, 117

[1] Coke ovens built by city gas companies some of which are operated in conjunction with coal- and water-gas plants. Does not include independent oven-coke plants which may sell gas to public-utility companies for distribution.

Copper

By CHARLES WHITE MERRILL AND HELENA M. MEYER

GENERAL SUMMARY

BETTER labor-management relations, with general absence of the strikes so serious in 1946, the highest prices in a generation, and the continued high rate of domestic consumption featured the copper industry in 1947. Mine output rose 39 percent, and smelter and refinery outputs from domestic ores, 44 and 57 percent, respectively.

New supplies of copper made available fell short of filling all needs, as consumption continued at virtually record peacetime levels. Government stocks were inadequate to continue to serve as a major source of supplies as in 1946, and increased production from domestic mines in 1947 merely offset in part the drop in the Government's contribution. Total imports continued at approximately the sharply reduced rate of 1946. The shortage of dollars in principal foreign markets and export controls here held foreign purchases far below requirements for the metal. Exports of metallic copper, nonetheless, doubled in 1947 but were less than half the annual average for 1938–1940.

The price situation was confused during the first half of 1947. The several sharp advances of the British Ministry of Supply in its maximum prices for copper, accompanied by gains in United States export prices, followed by rises in the domestic market (the excess of export prices over the domestic market continuing throughout the year and exceeding 2 cents a pound in April), and the advance of 52 percent in the average annual domestic price for the year featured 1947 prices. The excise tax of 4 cents a pound on copper imported into the United States was recessed by a bill signed by President Truman in April, effective April 30, 1947, through March 31, 1949.

At the general trade conference at Geneva, concluded October 20, the tax on copper was cut 50 percent. This cut, of course, will be ineffective until the end of the tax recess. In May producers followed the Reconstruction Finance Corporation in raising their prices to 21.5 cents a pound for electrolytic copper in the Connecticut Valley. Efforts to extend the Premium Price Plan beyond June 30, 1947, were ended unsuccessfully by Presidential veto on August 8. The end of premiums was expected to have little effect on production because the price had risen before June 30 to a point where only a very small proportion of the output was entitled to any premium benefits.

The average grade of copper ore mined in the United States continued downward in 1947, amounting to 0.90 percent compared with 0.91 percent in 1946 and with 1.29 percent a decade earlier. Of the copper ore mined in 1947, 73 percent came from open pits, and 68 percent of the total copper was produced by this type of mining.

Churn drilling was continued at the San Manuel, Ariz., ore body during 1947 but was suspended indefinitely on February 23, 1948. The drilling campaign had developed 123,499,580 tons of oxide ore, containing 0.767 percent copper, and 339,284,920 tons of sulfide ore, containing 0.788 percent copper, a total of 462,784,500 tons, averaging 0.782 percent copper. Thus one of the largest copper ore bodies in the United States has been proved; moreover, the ore area has not been entirely delimited. Plans have been made for underground exploration necessary to provide definite information regarding the structure and physical characteristics of the ore body and adequate samples for metallurgical testing.

The Mountain City Copper Co. closed its mine in the Cope district, Elko County, Nev., at the end of September, reportedly because of ore exhaustion. Active development of the property was begun in 1931; but output did not begin until 1935, when the mine became one of the leading producers of copper in the United States. During the first productive years the ore output had averaged over 25 percent copper.

Imports of copper in crude and refined form in 1947 continued at about the reduced level of 1946, which was about half of the 1944–45 rate. The drop has been chiefly in the refined classification, which assumed great importance during the war. Total unmanufactured imports were 5 percent above those in 1946. All imports were affected adversely by the period of uncertainty attending legislative deliberations in connection with removal of the excise tax. Export of refined copper, which in 1946 resumed its prewar place as the most important copper class, almost trebled in 1947 and was chiefly responsible for the approximate doubling of exports for the metallic copper group.

Stocks of refined copper at refineries fell 38 percent in 1947 and of blister and copper in process of refining at smelters and refineries, 16 percent; total producers' inventories were the smallest since the end of 1928.

Copper trading on the Commodity Exchange was resumed July 15 after a 6-year suspension.

Salient statistics of the copper industry in the United States, 1943–47, in short tons

	1943	1944	1945	1946	1947
New copper produced—					
From domestic ores, as reported by—					
Mines	1,090,818	972,549	772,894	608,737	847,563
Ore produced:					
Copper ore [1]	98,119,735	91,063,648	77,472,983	62,232,342	87,864,898
Average yield of copper, percent	1.04	.99	.93	.91	.90
Smelters	1,092,939	1,003,379	782,726	599,656	862,872
Percent of world total	36	35	33	29	35
Refineries	1,082,079	973,852	775,738	578,429	909,213
From foreign ores, matte, etc., refinery reports	297,184	247,335	332,861	300,233	250,757
Total new refined, domestic and foreign	1,379,263	1,221,187	1,108,599	878,662	1,159,970
Secondary copper recovered from old scrap only	427,521	456,710	497,095	406,453	503,376
Copper content of copper sulfate produced by refiners	7,667	8,269	8,237	5,070	6,161
Total production, new and old and domestic and foreign	1,814,451	1,686,166	1,613,931	1,290,185	1,669,507
Imports (unmanufactured)[2]	716,596	785,211	853,196	393,275	413,890
Refined [2]	402,762	492,395	531,367	154,371	149,478
Exports of metallic copper [3]	294,459	237,515	132,555	97,475	196,999
Refined (ingots, bars, rods, etc.)	177,341	69,002	53,572	[4] 52,629	[4] 147,642
Stocks at end of year	309,500	392,000	461,000	350,000	273,000
Refined copper	68,500	81,000	130,000	96,000	60,000
Blister and materials in solution	241,000	311,000	331,000	254,000	213,000
Withdrawals from total supply on domestic account:					
Total new copper	1,502,000	1,504,000	1,415,000	1,391,000	1,286,000
Total new and old copper	2,588,000	2,455,000	2,422,000	2,195,000	2,248,000
Price, average [5] cents per pound	11.8	11.8	11.8	14.4	20.9
World smelter production, new copper	3,038,000	2,843,000	2,379,000	[6] 2,039,000	[6] 2,458,000

[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 manufactures of copper," for which figures of quantity are not recorded.
[4] Excludes rods.
[5] Exclusive of bonus payments of the Office of Metals Reserve.
[6] Estimated.

Copper mining abroad continued to be affected adversely by some of the factors that impeded production in 1946. Labor shortages and strikes were again in evidence, but labor conditions as a whole improved notably. The problem of supplying sufficient coal to African mines was not solved in 1947. Inadequate dock facilities likewise impeded the movement of copper to international markets. All important copper-producing countries, however, with the possible exception of the U. S. S. R. for which precise data are not available, shared in the increase of 21 percent in world production of copper in 1947.

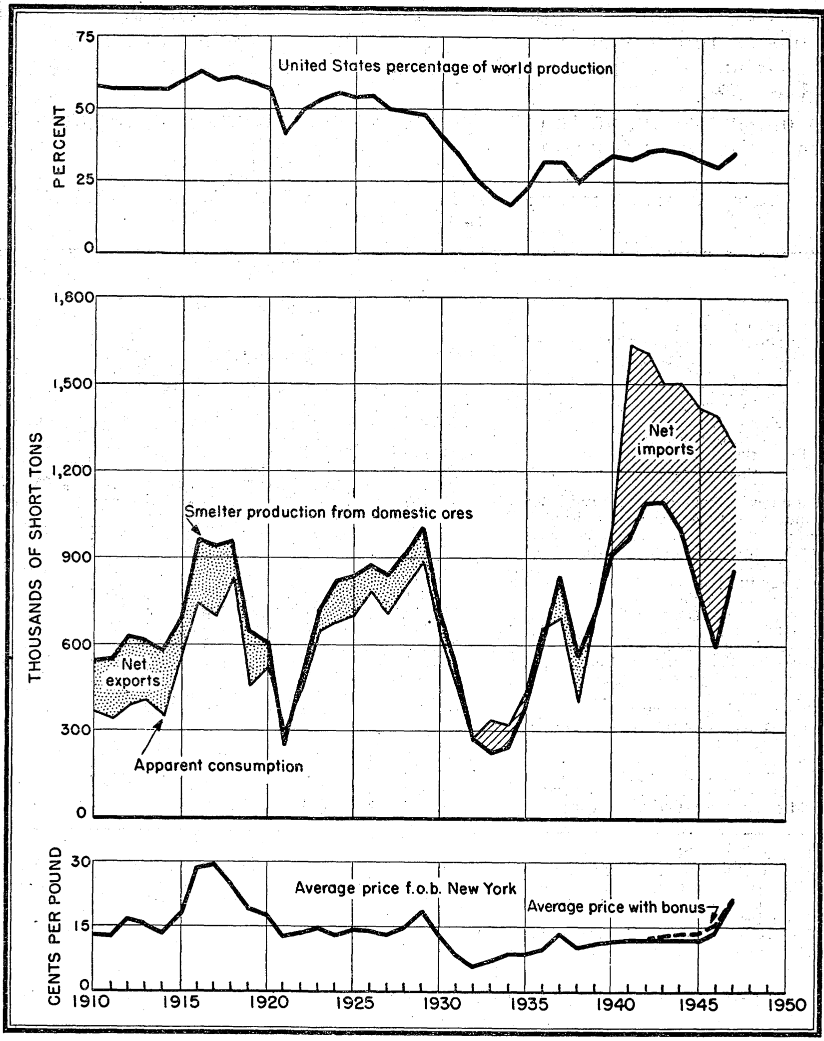

FIGURE 1.—Trends in production, consumption, and price of copper in the United States, 1910–47.

The following Bureau of Mines reports of investigations and information circulars, published recently, relate to copper in whole or in part.

Reports of investigations:
- 4088. Copper Deposits of Douglas County, Wis.
- 4108. San Manuel Copper Deposit, Pinal County, Ariz.
- 4110. Ward Copper Deposit, Seward Peninsula, Alaska.
- 4120. Rio Grande Copper Deposit, Elko County, Nev.
- 4124. Blue Ledge Copper-Zinc Mine, Siskiyou County, Calif.
- 4170. Copper Deposits, South Hecla Mine, Alta, Salt Lake County, Utah.
- 4203. Cline Copper and Tungsten Mine, Cabarrus County, N. C.
- 4214. Antler Copper-Zinc Deposit, Mohave County, Ariz.
- 4221. Stone Hill Copper Mine, Cleburne and Randolph Counties, Ala.

4279. Concentration of Copper-Cobalt Ores from the Blackbird District, Lemhi County, Idaho.
4290. Conrad Hill Copper and Gold Deposit, Davidson County, N. C.
4293. Christmas Copper Deposit, Gila County, Ariz.
4316. Diamond Drilling at the Tallapoosa Copper Mine, Haralson County, Ga.

Information circulars:
7379. Alaska's Minerals as a Basis for Industry.
7448. Mining Methods of the Holden Mine, Howe Sound Co., Chelan Division, Holden, Wash.
7452. Blast-Hole Drilling with Diamond Drills at the Tennessee Copper Co. Mines, Ducktown, Tenn.

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 recovery of metal 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 differences among the three sets of figures.

Copper produced from domestic ores, as reported by mines, smelters, and refineries, 1943–47, in short tons

Year	Mine	Smelter	Refinery
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
1946	608,737	599,656	578,429
1947	847,563	862,872	909,213

PRIMARY COPPER

Mine Production.—The figures for mine production are tabulated from reports supplied by all domestic mines that produce copper. These data are classified geographically, by metallurgical methods, and by types of ore. Tables presenting the information in detail are to be found in the State chapters of this volume.

In 1947 Arizona continued to be the leading mine producer of copper, having taken the lead from Montana in 1907 and having ranked ahead of all other States thereafter, except in 1909, when Montana resumed first place for 1 year. Utah, where the largest domestic copper producer is located, continued in second place, with a gain of 133 percent over the abnormally low output in 1946. Arizona and Utah contributed nearly 75 percent of the total for the United States and were followed by New Mexico, Montana, and Nevada, which contributed collectively nearly 20 percent, a total of over 94 percent for the five leading States.

A classification of production by mining methods shows that approximately 68 percent of the total copper and 73 percent of the copper ore came from open pits in 1947. Most of the domestic copper ore was treated by flotation at or very near the mine of origin, and the resulting concentrates were shipped for smelting. Some copper ores were direct-smelted either because of their high grade or because of their fluxing qualities.

Mine production of recoverable copper in the United States, 1937–47, with production of maximum year, and cumulative production from earliest record to end of 1947, by States, in short tons

State	Maximum production [1]		Production by years											Total production from earliest record to end of 1947
	Year	Quantity	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	
Western States and Alaska:														
Alaska	1916	59,927	17,336	14,549	128	55	72	22	27	2	5	2	12	685,878
Arizona	1929	415,314	288,478	210,797	262,112	281,169	326,317	393,387	403,181	358,303	287,203	289,223	366,218	11,544,310
California	1909	28,644	5,251	806	4,180	6,438	3,943	1,058	8,762	12,721	6,473	4,240	2,407	628,231
Colorado	1938	14,171	10,934	14,171	13,215	12,152	6,748	1,102	1,028	1,048	1,485	1,754	2,150	252,861
Idaho	1907	5,445	2,232	2,139	2,516	3,349	3,621	3,430	2,324	1,688	1,548	1,038	1,640	109,427
Montana	1916	176,464	144,528	77,213	97,827	126,391	128,036	141,194	134,525	118,190	88,506	58,481	57,900	6,636,253
Nevada	1942	83,663	74,603	46,169	66,597	78,454	78,911	83,663	71,068	61,232	52,595	48,616	49,603	1,832,271
New Mexico	1942	80,100	32,053	20,439	46,142	69,848	73,478	80,100	76,163	69,730	56,571	50,191	60,205	1,410,404
Oregon	1916	1,791	410	38	48	88	83	103	6	3	1	7	14	12,357
South Dakota	1918	32	----	----	----	6	----	1	----	1	----	----	----	106
Texas	1928	224	160	16	34	30	6	99	81	115	55	3	6	1,315
Utah	1943	323,989	205,994	108,126	171,890	231,864	266,838	306,691	323,989	282,575	226,376	114,284	266,533	5,166,974
Washington	1940	9,612	64	6,017	8,998	9,612	8,686	8,030	7,315	6,169	5,821	4,527	2,240	81,166
Wyoming	1900	2,102	----	----	----	2	4	----	----	----	----	1	----	16,326
Total	----	----	782,043	500,480	673,687	819,458	896,743	1,018,880	1,028,469	911,777	726,639	572,367	808,928	28,377,879
West Central States:														
Missouri	1945	3,399	269	----	----	685	1,400	1,300	1,340	3,302	3,399	1,857	1,760	[2] 21,438
States east of the Mississippi:														
Alabama	1907	42	4	----	----	----	----	----	----	----	----	----	----	
Georgia	1917	465	----	----	----	13	----	----	----	----	----	----	----	
Maine	1918	383	----	----	----	----	----	----	----	----	----	----	----	(3)
Maryland	1917	146	----	----	----	----	----	----	----	----	----	----	----	
Massachusetts	1906	5	----	----	----	----	----	----	----	----	----	----	----	
Michigan	1916	136,846	47,464	46,743	43,985	45,198	46,440	45,679	46,764	42,421	30,401	21,663	24,184	4,843,674
New Hampshire	1908	[4] 94	----	----	----	----	----	----	----	----	----	----	----	
North Carolina	1930	(5)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	----	----	----	
Pennsylvania	1942	(5)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	----	----	----	
South Carolina	(3)	(3)	1	(6)	----	(7)	(7)	(7)	(7)	----	(6)	(6)	(6)	
Tennessee	1930	(5)	[6] 12,217	[6] 10,540	[6] 10,648	[6] 12,732	[6] 13,566	[6] 14,174	[6] 13,855	[6] 12,860	[6] 12,385	[6] 12,850	[6] 12,686	(3)
Vermont	1946	(5)	----	----	----	----	----	----	290	1,898	(6)	(6)	(6)	
Virginia	1944	291	(7)	(6)	----	----	----	28	100	291	70	----	5	
Wisconsin	1914	5	----	----	----	----	----	----	----	----	----	----	----	(2)
Total	----	----	59,686	57,283	54,633	57,943	60,006	59,881	61,009	57,470	42,856	34,513	36,875	[8] 5,425,509
Grand total	1943	1,090,818	841,998	557,763	728,320	878,086	958,149	1,080,061	1,090,818	972,549	772,894	608,737	847,563	[9] 33,824,826

[1] For Missouri and States east of the Mississippi, maximum since 1905.
[2] Small quantity for Wisconsin included with Missouri.
[3] Data not available.
[4] The 1908 volume of Mineral Resources credits this figure to Massachusetts and New Hampshire; the 1909 volume credits it to New Hampshire alone.
[5] Bureau of Mines not at liberty to publish figure.
[6] Tennessee includes other States indicated by footnote 6; Bureau of Mines not at liberty to publish separate figures.
[7] Less than 1 ton.
[8] For States other than Michigan, figures represent largely smelter output. Excludes small quantity, not separable, for Wisconsin shown with Missouri.
[9] Largely smelter production for States east of the Mississippi except Michigan.

Mine production [1] of recoverable copper in the United States, 1942–47, by months, in short tons

Month	1942	1943	1944	1945	1946	1947
January	85, 655	91, 729	88, 820	70, 088	55, 381	70, 056
February	77, 514	85, 367	87, 622	63, 962	41, 934	68, 416
March	91, 949	93, 479	94, 446	70, 004	42, 018	74, 651
April	87, 922	91, 420	88, 106	67, 493	32, 295	72, 418
May	93, 139	94, 919	88, 055	72, 018	33, 526	75, 164
June	91, 173	89, 826	83, 480	67, 910	33, 171	70, 150
July	91, 987	88, 352	76, 172	62, 100	53, 948	73, 310
August	87, 031	87, 510	77, 390	61, 817	57, 163	72, 005
September	87, 051	90, 398	74, 846	59, 854	62, 667	70, 770
October	93, 814	94, 821	73, 045	61, 555	65, 625	66, 145
November	94, 973	90, 942	68, 909	58, 664	62, 336	63, 278
December	97, 853	92, 055	71, 658	57, 429	68, 673	71, 200
Total	1, 080, 061	1, 090, 818	972, 549	772, 894	608, 737	847, 563

[1] Monthly data for 1942–44 based largely on smelter receipts, whereas those for 1945–47 represent actual mine output. All monthly figures have been adjusted to final annual mine-production totals.

Mine production of copper in the principal districts [1] of the United States 1943–47, in terms of recovered copper, in short tons

District or region	State	1943	1944	1945	1946	1947
West Mountain (Bingham)	Utah	322, 248	281, 100	224, 284	112, 083	264, 315
Copper Mountain (Morenci)	Arizona	84, 347	106, 926	100, 826	95, 366	147, 899
Globe-Miami	do	100, 513	95, 305	78, 646	88, 556	91, 032
Summit Valley (Butte)	Montana	133, 569	117, 363	87, 948	57, 905	57, 187
Central (including Santa Rita)	New Mexico	70, 628	65, 520	[2] 55, 197	[2] 48, 806	57, 071
Ajo	Arizona	70, 069	46, 250	37, 950	45, 233	49, 687
Robinson (Ely)	Nevada	64, 090	54, 651	49, 175	45, 777	47, 524
Lake Superior	Michigan	46, 764	42, 421	30, 401	21, 663	24, 184
Yavapai County (mostly Verde (Jerome) district).	Arizona	38, 386	32, 273	24, 903	22, 909	21, 936
Mineral Creek (Ray)	do	37, 434	27, 452	19, 671	16, 355	18, 935
Warren (Bisbee)	do	50, 786	32, 683	12, 567	4, 605	17, 059
Pioneer (Superior)	do	18, 820	12, 722	8, 365	12, 244	15, 922
Chelan Lake	Washington	7, 219	6, 119	5, 803	4, 494	2, 214
Lordsburg	New Mexico	2, 496	2, 359	1, 146	1, 196	1, 770
Southeastern Missouri	Missouri	1, 340	3, 302	3, 399	1, 857	1, 760
San Juan Mountains	Colorado	554	512	1, 018	1, 333	1, 430
Coeur d' Alene	Idaho	1, 987	1, 289	1, 018	810	1, 312
Burro Mountain	New Mexico	2, 094	1, 261	(2)	(2)	1, 140
Cope	Nevada	5, 133	(3)	(3)	(3)	1, 105
Cochise	Arizona	4	115	493	987	1, 036
Ione	California	312	237	827	1, 004	837
Flat Creek	do	670	1, 292	1, 843	(3)	698
Klamath River	do	5, 067	7, 891	1, 526		
Swain County	North Carolina	(3)	(3)			
Copperopolis [4]	California	1, 930	2, 122	1, 123	91	(3)
Lebanon (Cornwall mine) [4]	Pennsylvania	(3)	(3)	(3)	(3)	(3)
Ducktown [4]	Tennessee	(3)	(3)	(3)	(3)	(3)
Orange County [4]	Vermont	290	1, 898	(3)	(3)	(3)

[1] Districts producing 1,000 short tons or more in any year of the period 1943–47.
[2] Burro Mountain included with Central. Bureau of Mines not at liberty to publish separate figures.
[3] Bureau of Mines not at liberty to publish figure.
[4] Not listed in order of output.

25 leading copper-producing mines in the United States in 1947, in order of output

Rank	Mine	District	State	Operator	Source of copper
1	Utah Copper	West Mountain (Bingham)	Utah	Kennecott Copper Corp	Copper ore.
2	Morenci	Copper Mountain (Morenci)	Arizona	Phelps Dodge Corp	Do.
3	Chino	Central	New Mexico	Kennecott Copper Corp	Do.
4	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Copper, zinc-lead ores.
5	New Cornelia	Ajo	Arizona	Phelps Dodge Corp	Copper ore.
6	Inspiration	Globe-Miami	do	Inspiration Consolidated Copper Co	Do.
7	Ruth and Copper Flat Pit	Robinson (Ely)	Nevada	Kennecott Copper Corp	Do.
8	Miami	Globe-Miami	Arizona	Miami Copper Co	Do.
9	Castle Dome	do	do	Castle Dome Copper Co., Inc	Do.
10	Ray Mines	Mineral Creek	do	Kennecott Copper Corp	Do.
11	Calumet and Hecla Cons	Lake Superior	Michigan	Calumet and Hecla Cons. Copper Co	Do.
12	Copper Queen	Warren	Arizona	Phelps Dodge Corp	Copper, lead, zinc-lead ores.
13	Consolidated Coppermines Group	Robinson (Ely)	Nevada	Consolidated Coppermines Co	Copper ore.
14	Magma	Pioneer	Arizona	Magma Copper Co	Do.
15	United Verde	Verde	do	Phelps Dodge Corp	Do.
16	Burra Burra, Eureka, Boyd, Mary, Calloway.	Polk County	Tennessee	Tennessee Copper Co	Copper-bearing pyrites.
17	Bagdad	Eureka	Arizona	Bagdad Copper Corp	Copper ore.
18	Cornwall	Lebanon County	Pennsylvania	Bethlehem Steel Co	Magnetite-pyrite-chalcopyrite ore.
19	Isle Royale	Lake Superior	Michigan	Isle Royale Copper Co	Copper ore.
20	Quincy	do	do	Quincy Mining Co	Copper-ore tailings.
21	North Butte	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Copper ore.
22	Elizabeth	Orange County	Vermont	Vermont Copper Co	Do.
23	Holden	Chelan Lake	Washington	Howe Sound Co	Copper, zinc-copper ore.
24	Bonney and Miser's Chest Group	Lordsburg	New Mexico	Banner Mining Co	Copper ore.
25	Burro Mountain Branch	Burro Mountain	do	Phelps Dodge Corp	Do.

The first five mines listed produced 67 percent of the United States total, 9 produced 82 percent, and the entire 25 accounted for 97 percent.

The Mountain City Copper Co. closed its mine in the Cope district, Elko County, Nev., at the end of September 1947, reportedly because ore was exhausted. Active development of the property was begun in 1931, but production did not start until 1935, when the mine became one of the leading producers in the United States.

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 1946; complete details for 1947 are not yet available. Of the total copper produced from copper ores in the United States during 1946, 91 percent was obtained from ores concentrated before smelting, 4 percent from direct-smelting ores, and 5 percent from ore treated by straight leaching. The percentages for 1946 compared with 92 percent obtained from concentrated ore, 5 percent from direct-smelting ores, and nearly 3 percent by straight leaching in 1945.

Close agreement between the output as reported by smelters and the recoverable quantity as reported by mines indicates that estimated recoverable tenor is close to 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, notably the "porphyry ores." 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 1946, 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	30,386,149	[1] 555,943,336	0.91	61,347	1,764,558	$0.12
California	86,297	[2] 2,407,300	1.39	[2] 348	[2] 21,018	.34
Colorado	8,292	466,901	2.82	131	36,286	4.09
Idaho	903	53,275	2.95	60	1,086	3.30
Michigan	4,719,994	43,326,000	.46			
Montana	1,781,895	[1] 109,366,259	3.07	11,590	2,082,321	1.17
Nevada	5,102,212	[1] 93,730,900	.92	43,260	289,701	.34
New Mexico	6,044,004	[1] 79,071,692	.65	1,566	100,318	.02
Oregon	152	10,000	3.29		57	.30
Texas	80	5,000	3.13		18	.19
Utah	12,471,208	[1] 214,653,684	.86	133,454	1,237,060	.45
Washington [3]	491,445	9,003,000	.92	32,356	94,208	2.46
Wyoming	19	2,000	5.26		10	.43
East of the Mississippi (except Mich.)	1,139,692	[4] 25,700,000		260	53,291	
Total	[3] 62,232,342	[4] 1,133,739,347	.91	284,372	5,679,932	.23

[1] Excludes copper recovered from precipitates as follows: Arizona, 16,492,429 pounds; Montana, 6,376,070 pounds; Nevada, 3,229,000 pounds; New Mexico, 20,203,536 pounds; Utah, 10,142,892 pounds.
[2] Includes metal recovered from pyritic ore (residue).
[3] Includes ore from Washington classed as zinc-copper ore and copper, gold, and silver recovered therefrom.
[4] Copper from magnetite-pyrite-chalcopyrite ore included with that from copper ore.

Copper ore, old tailings, etc., concentrated in the United States in 1946, 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] 26,984,754	859,752	[2] 465,885,731	0.86
California	67,819	1,329	250,700	.18
Colorado	3,100	167	83,000	1.34
Michigan	4,719,994	36,090	43,326,000	.46
Montana	1,761,041	289,303	107,767,534	3.06
Nevada	5,036,899	185,210	87,288,700	.87
New Mexico	5,974,442	169,638	[3] 77,900,610	.65
Utah	12,466,732	334,757	214,234,560	.86
Washington [4]	491,402	23,868	8,987,000	.91
East of the Mississippi (except Mich.)	1,014,452	[5] 72,524	[6] 24,557,000	----------
Total	58,520,635	[5] 1,972,638	[6] 1,030,280,835	.88

[1] In addition 2,969,041 tons were treated by straight leaching.
[2] In addition 57,061,962 pounds of copper were recovered by straight leaching.
[3] Excludes 20,203,536 pounds of copper recovered from precipitates.
[4] Includes ore classed as zinc-copper ore.
[5] Includes concentrates from magnetite-pyrite-chalcopyrite ore from Pennsylvania.
[6] Includes copper from magnetite-pyrite-chalcopyrite ore from Pennsylvania.

Copper ore, old tailings, etc., smelted in the United States in 1946, 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	432,354	32,995,643	3.82	[1] 578,446,000
California	18,478	2,156,600	5.84	[2] 8,480,000
Colorado	5,192	383,901	3.70	[2] 3,508,000
Idaho	903	53,275	2.95	[2] 2,076,000
Michigan				43,326,000
Missouri	----------	----------	----------	3,714,000
Montana	20,854	1,598,725	3.83	[1] 116,962,000
Nevada	65,313	6,442,200	4.93	[1] 97,232,000
New Mexico	69,562	1,171,082	.84	[1] 100,382,000
Oregon	152	10,000	3.29	14,000
Texas	80	5,000	3.13	6,000
Utah	4,476	419,124	4.68	[1] 228,568,000
Washington	43	16,000	18.60	9,054,000
Wyoming	19	2,000	5.26	2,000
East of the Mississippi (except Mich.)	125,240	1,143,000	.46	25,700,000
Total	742,666	46,396,550	3.12	1,217,474,000

[1] Considerable copper was recovered from precipitates.
[2] Mostly from ores not classed as copper ores.

Copper ores produced in the United States, 1942–46, 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
1942	2,221,191	4.00	85,865,167	1.02	92,285,626	1.09	0.0063	0.162	$0.34
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
1945	1,036,847	3.52	73,958,665	.90	[2] 77,472,983	.93	.0051	.119	.26
1946	742,666	3.12	58,520,635	.88	[2] 62,232,342	.91	.0046	.091	.23

[1] Includes old tailings, etc.
[2] Includes ore from Washington classed as zinc-copper ore.

Smelter Production.—The recovery of copper by smelters in the United States from ores of domestic origin totaled 862,872 short tons in 1947, an increase of 44 percent from the total of 599,656 tons for 1946. 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 was slightly above 35 percent, and in 1945–47 it ranged from 29 to 35 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 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 1.

Copper produced (smelter output) in the United States, 1943–47, and total, 1845–1947

Year	Short tons	Value [1]
1943	1,092,939	$257,934,000
1944	1,003,379	236,797,000
1945	782,726	184,723,000
1946	599,656	172,701,000
1947	862,872	360,680,000
Total, 1845–1947	33,894,113	9,949,614,000

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

Copper smelters and refineries in the United States in 1947

[Plants that treat primary materials mainly]

Location	Company	Final product
Arizona:		
Clarkdale	Phelps Dodge Corp., 40 Wall St., New York 5, N. Y.	Blister.
Morenci	do	Do.
Douglas	do	Do.
Hayden	American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.	Do.
Inspiration	Inspiration Consolidated Copper Co., 25 Broadway, New York 4, N. Y.	Electrolytic.
Miami	International Smelting & Refining Co., 25 Broadway, New York 4, N. Y.	Blister.
Superior	Magma Copper Co., Superior, Ariz	Do.
Maryland: Baltimore	American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.	Electrolytic.
Michigan:		
Hancock	Quincy Mining Co. (Idle), 63 Wall St., New York 5, N. Y.	Lake.
Houghton	Copper Range Co. (Idle), Houghton, Mich	Do.
Hubbell	Calumet & Hecla Consolidated Copper Co., Calumet, Mich.	Do.
Montana:		
Anaconda	Anaconda Copper Mining Co., 25 Broadway, New York 4, N. Y.	Blister.
Great Falls	do	Electrolytic.
Nevada: McGill	Kennecott Copper Corp., 120 Broadway, New York 5, N. Y.	Blister.
New Jersey:		
Carteret	American Metal Co., 61 Broadway, New York 6, N. Y.	Blister and electrolytic.
Perth Amboy	American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.	Electrolytic.
Do	International Smelting & Refining Co., 25 Broadway, New York 4, N. Y.	Do.
New Mexico: Hurley	Kennecott Copper Corp., 120 Broadway, New York 5, N. Y.	Blister and fire refined.
New York: Laurel Hill	Phelps Dodge Refining Corp., 40 Wall St., New York 5, N. Y.	Blister and electrolytic.
Tennessee: Copperhill	Tennessee Copper Co., 61 Broadway, New York 6, N. Y.	Blister.
Texas:		
El Paso	American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.	Do.
Do	Phelps Dodge Refining Corp., 40 Wall St., New York 5, N. Y.	Electrolytic and fire refined.
Utah:		
Garfield	American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.	Blister.
Tooele	International Smelting & Refining Co., 25 Broadway, New York 4, N. Y.	Do.
Washington: Tacoma	American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.	Blister and electrolytic.

Refinery Production.—The refinery output of copper in the United States in 1947 was made by 11 plants; 8 of these employed the electrolytic method only, 1 the furnace process on Lake Superior copper, 1 the furnace process on western ores, and 1 both the electrolytic and the furnace methods.

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 virtually all of the plant output was treated by this method in 1947. The El Paso plant of the Phelps Dodge Refining Corp. produced fire-refined copper in addition to the usual electrolytic grade. Of the plants specified above, the Lake refinery of the Copper Range Co. has been idle since October 9, 1945, and that of the Quincy Mining Co. since 1933.

In addition to the plants in the preceding paragraph, but included in the 11 active refineries noted, is the plant at Inspiration, Ariz., which is equipped to make electrolytically refined copper direct from the liquors obtained from leaching. Usually all of this copper is shipped as cathodes to other refineries, where it is melted and cast into merchant shapes; but in 1946 more than one-third went directly to consuming plants. None went directly to consumers after the second quarter of 1947.

The 13 plants indicated constitute what commonly are termed "regular refineries." Of these plants, eight employ the electrolytic process, four the furnace process, and one both methods. The electrolytic plants, exclusive of the one at Inspiration, have a rated capacity of 1,518,000 tons of refined copper a year. They produced at the rate of 86 percent of capacity in 1947.

The accompanying 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, 1943–47, in short tons

	1943	1944	1945	1946	1947
Primary:					
Domestic: [1]					
Electrolytic [2]	938,727	837,089	669,705	475,571	805,718
Lake [2]	44,867	41,597	29,995	21,567	23,998
Casting	98,485	95,166	76,038	81,291	79,497
	1,082,079	973,852	775,738	578,429	909,213
Foreign: [1]					
Electrolytic	297,184	247,335	298,128	300,233	250,757
Casting and best select			34,733		
Refinery production, new copper	1,379,263	1,221,187	1,108,599	878,662	1,159,970
Imports, refined copper [3]	402,762	492,395	531,367	154,371	149,478
Total new refined copper made available	1,782,025	1,713,582	1,639,966	1,033,033	1,309,448
Secondary:					
Electrolytic [4]	114,259	78,402	[5] 84,044	[5] 97,615	[5] 249,560
Casting	8,205	7,996	12,618	7,957	19,525
	122,464	86,398	96,662	105,572	269,085
Grand total	1,904,489	1,799,980	1,736,628	1,138,605	1,578,533

[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 1945–47.

Copper cast in forms in the United States, 1946–47

Form	1946		1947	
	Short tons	Percent	Short tons	Percent
Wire bars	502,000	51	885,000	62
Cakes	142,000	15	178,000	13
Billets	112,000	11	160,000	11
Ingots and ingot bars	102,000	10	99,000	7
Cathodes	115,000	12	87,000	6
Other forms	11,000	1	20,000	1
Total	984,000	100	1,429,000	100

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 24,600 short tons, having a copper content of 6,161 tons, in 1947 compared with 20,300 tons, containing 5,070 tons, in 1946. The output of copper sulfate by plants other than the regular primary refineries totaled 64,500 tons with a reported content of 16,115 tons in 1947 compared with 107,500 tons containing 26,886 tons of copper in 1946. Producers held 13,000 tons of copper sulfate at the beginning of 1947, total production was 89,100 tons, and shipments amounted to 86,600 tons. Some small purchases were made by producers during the year, and producers used a quantity equivalent to 6 percent of shipments. Inventories at the year end were 10,200 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 1943–47. Detailed information appears in the Secondary Metals—Nonferrous chapter of this volume.

Secondary copper produced in the United States, 1943–47, in short tons

	1943	1944	1945	1946	1947
Copper recovered as unalloyed copper	137,883	102,135	112,856	136,909	303,092
Copper recovered in alloys [1]	948,164	848,807	893,660	666,637	658,649
Total secondary copper	1,086,047	950,942	1,006,516	803,546	961,741
From new scrap	658,526	494,232	509,421	397,093	458,365
From old scrap	427,521	456,710	497,095	406,453	503,376
Percentage equivalent of domestic mine output	100	98	130	132	113

[1] Includes copper in chemicals, as follows: 1943, 13,019; 1944, 13,357; 1945, 18,666; 1946, 19,192; 1947, 18,838.

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. The method of calculating the quantity of copper available for consumption is shown in the accompanying 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 changes in consumers' stocks. Actual consumption of new copper doubtless did not drop in 1947, as shown by the calculation, and may have gained. The facts that an unusual quantity of copper refined from imported scrap is included in refined exports in 1947 and that a corresponding addition necessarily was not made to supplies of new copper distort the picture for that year, but the practice probably will not continue on a large scale.

New refined copper withdrawn from total year's supply on domestic account, 1943–47, in short tons

	1943	1944	1945	1946	1947
Total supply of new copper	1,782,025	1,713,582	1,639,966	1,033,033	1,309,448
Stock at beginning of year	84,000	68,500	81,000	130,000	96,000
Total available supply	1,866,025	1,782,082	1,720,966	1,163,033	1,405,448
Copper exported [1]	175,859	68,373	48,563	52,629	147,642
Stock at end of year	68,500	81,000	130,000	96,000	60,000
	244,359	149,373	178,563	148,629	207,642
Withdrawn on domestic account [2]	1,502,000	1,504,000	1,415,000	1,391,000	1,286,000

[1] Includes refined copper in ingots, bars, or other forms.
[2] Adjusted for Office of Metals Reserve stock changes.

The Bureau of Mines began to compile figures on actual consumption of copper in 1945. Details for 1945 and 1946 and preliminary totals for 1947 are shown in the accompanying table. Unlike the foregoing table, which attempts to eliminate all but new copper from measurement, the following one does not distinguish between new and old copper. It covers copper consumed in refined form.

The down trend in use of cathodes and the sharp rise in consumption of wire bars in 1947 are noteworthy.

Refined copper consumed in 1945–46, by classes of consumers, and in 1947, in short tons

Class of consumer	Cathodes	Wire bars	Ingots and ingot bars	Cakes and slabs	Billets	Other	Total
1945:							
Wire mills	14	504,129	15,438	----------	1	----------	519,582
Brass mills	239,072	57,949	219,343	158,061	108,364	1,880	784,669
Chemical plants	105	----------	215	4,800	67	5,111	10,298
Secondary smelters	7,943	----------	10,543	101	120	9	18,716
Foundries and miscellaneous	11,585	326	30,405	61	433	3,197	46,007
Total	258,719	562,404	275,944	163,023	108,985	10,197	1,379,272
1946:							
Wire mills	1,803	[1] 484,004	15,238	----------	----------	----------	[1] 501,045
Brass mills	[1] 97,890	56,834	[1] 170,772	187,614	[1] 102,804	1,678	[1] 617,592
Chemical plants	60	----------	4,432	----------	----------	5,661	10,153
Secondary smelters	17,180	----------	12,705	206	250	329	30,670
Foundries and miscellaneous	2,263	225	21,954	180	645	2,282	27,549
Total	[1] 119,196	[1] 541,063	[1] 225,101	188,000	[1] 103,699	9,950	[1] 1,187,009
1947	77,067	815,742	159,193	222,595	173,779	6,043	1,454,419

[1] Revised figure.

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, 1943–47, 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]
1943	68,500	241,000	1946	96,000	254,000
1944	81,000	311,000	1947	60,000	213,000
1945	130,000	331,000			

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

Over-all industry stocks of copper showed a further drop in 1947 as efforts to fill demand were continued. Although total stocks declined, unfilled orders on producers' books dropped to less than one-third of the tonnage at the beginning of the year.

Producers' (smelters and refineries) stocks of crude and refined copper totaled only 273,000 tons at the end of 1947, or a drop of 22 percent.

At the end of 1947 the Office of Metals Reserve held 9,986 tons of electrolytic and fire-refined copper in cathodes, shapes, and in-process copper, a decrease of 89 percent from the 92,758 tons at the beginning of the year. The foregoing stocks are on 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.

Fabricators held 423,432 tons of refined copper (including in-process metal and primary fabricated shapes) at the end of 1947, according to the United States Copper Association, or a gain of 3 percent over inventories at the beginning of the year. The feature of fabricators' stocks, however, was the drop to considerably less than one-third in stocks deficit compared with unfilled orders. The deficiency of stocks compared with booked orders was 104,922 tons at the end of the year compared with 342,632 tons 12 months earlier.

Figures compiled by the Copper Institute show that domestic stocks of refined copper decreased from 104,704 tons at the end of 1946 to 76,035 tons at the end of 1947. Inventory data of the Bureau of Mines and Copper Institute always vary owing to somewhat different bases. Before 1947, a primary reason was that Copper Institute coverage was limited to duty-free copper. The inclusion by Copper Institute of all copper after January 1, 1947, reduced the differences chiefly to variations in individual interpretation. In the Bureau of Mines classification, cathodes to be used chiefly for melting and casting into shapes are considered stocks in process and not refined stocks.

Stocks of copper in fabricators' hands at end of year, 1943–47, 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
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
1946	411,013	59,421	286,418	526,648	−342,632
1947	423,432	103,765	293,859	338,260	−104,922

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

PRICES

Reports to the Bureau of Mines from copper-selling agencies indicate that 1,160,000 short tons of copper were delivered to domestic and foreign purchasers (excluding deliveries of foreign copper to the Office of Metals Reserve) in 1947 at an average price (f. o. b. refinery) of 20.9 cents a pound, or 70 percent above the level prevailing for the years 1942–46. The averages for 1942–47 exclude bonuses paid for overquota outputs of individual mines, which were first applicable to February 1942 tonnages.

Average monthly quoted prices of electrolytic copper for domestic and export shipments, f. o. b. refineries, in the United States, 1946–47, in cents per pound

Month	1946			1947		
	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	19.45	19.270	19.926
February	11.87	11.775	11.700	19.87	19.349	20.403
March	11.87	11.775	11.842	21.12	20.911	22.206
April	11.87	11.775	12.159	21.37	21.225	23.315
May	11.87	11.775	13.780	22.19	22.105	23.591
June	14.15	14.055	14.430	21.50	21.348	21.642
July	14.25	14.150	15.406	21.37	21.226	21.359
August	14.25	14.150	16.091	21.37	21.225	21.326
September	14.25	14.150	16.486	21.37	21.225	21.388
October	14.25	14.150	17.094	21.37	21.209	21.389
November	17.08	17.036	17.619	21.37	21.200	21.460
December	19.37	19.275	19.183	21.37	21.200	21.488
Average for year	13.92	13.820	14.791	21.15	20.958	21.624

[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, 1938–47, in cents per pound

	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
Domestic f. o. b. refinery [1]	10.10	11.07	11.40	11.87	11.87	11.87	11.87	11.87	13.92	21.15
Domestic f. o. b. refinery [2]	10.000	10.965	11.296	11.797	11.775	11.775	11.775	11.775	13.820	20.958
Export f. o. b. refinery [2]	9.695	10.727	10.770	10.901	11.684	11.700	11.700	11.700	14.791	21.624
London spot [2] [3]	9.912	[4] 10.066	([5])	([5])	([5])	([5])	([5])	([5])	([5])	([5])

[1] As reported by The American Metal 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.
[4] Average for 8 months; thereafter, London Metal Exchange dealings suspended.
[5] No quotations. See text for official maximum price changes.

History of Premium Price Plan.—As early as 1941 the Office of Price Administration began studying means of encouraging the production of copper by marginal mines without raising the ceiling price. Late in 1941 arrangements were made for Government purchase of copper from three Michigan companies at 1 cent a pound above "out-of-pocket" costs, and in January 1942 it was announced that the Metals Reserve Company would purchase copper output above quotas at 17 cents a pound, Connecticut Valley, or an A bonus of 5 cents a pound. Quotas were assigned by the Office of Production Management and the Office of Price Administration; and beginning February 1, 1942, production above assigned quotas was eligible for the premium. When individual quotas were established, the mines falling into preferred classes were found largely to have zero quotas, which meant that the total quantities produced were entitled to bonuses. In the beginning well-established, large properties were assigned such high quotas that they were able to obtain virtually no benefits from the plan. Later, many quotas were revised downward to eliminate inequities and to take care of increased costs of production. Provisions were made to enable high-cost sections of mines not getting premiums to participate in the benefits, thus adding to supplies copper that otherwise would not have been produced. Flexibility in the operation of the plan was attained by changes, chiefly downward, in production quotas, but there were some special provisions to take care of cases where the ceiling price plus the bonus fell below mine costs, and in some instances as much as 27 cents a pound was paid for Government copper purchases. Subsequently an additional cent and later more generous allowances were possible as exploration premiums. The original plan was for 2½ years; it was extended in January 1943 to July 31, 1945, and was later extended first to the end of June 1946 and then to June 30, 1947. Several bills for further extension of the plan have been submitted, but none had been agreed to by the end of the fiscal year 1948.

The accompanying table shows premium-payment data for February 1942 through June 1947. Ceiling-price restrictions on copper ended along with most remaining commodities in November 1946. Immediately thereafter the price rose to a point where further A bonuses were not applicable; that is, the price was above the 12-cent ceiling plus a bonus of 5 cents. Data on bonus payments in 1947 cover total quantity and value only, and these were 41,391 short tons and $2,148,937, respectively.

Bonuses were paid on 10.77 percent of production in 1942, 22.88 percent in 1943, 25.47 in 1944, 27.43 in 1945, 34.78 in 1946, and 9.61 in 1947. The high percentage in 1946 is explained in part by lengthy strikes at some of the lower cost copper-producing properties in that year.

London Price.—Official maximum prices in the London market, which were £117 (equivalent to 21.05 cents a pound) per long ton for electrolytic copper when 1947 began, were advanced £10 to £127 (22.83 cents) effective February 28 and another £10 to £137 (24.63 cents) on March 31. Subsequently the maximum price was reduced £5 to £132 (23.73 cents) on July 14, at which level it remained through the remainder of the year. Parliament debated in July the advisability of the British Government policy of bulk buying, which apparently was contributing to the rise in world copper and zinc prices. The price gains in 1947 followed 1946 increases of £10 on April 8, £12 on July 1, £14 on November 13, and £19 on January 1, 1948, or a total during the 2-year period of £75. The 2-year gain of £75 is 21 percent greater than the price of £62 that prevailed throughout the war period.

Salient statistics covering bonus payments [1] of the Government, 1942–47

	1942 (February–December)		1943		1944		1945		1946		1947 (January–June)		1942–47	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	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	392,828	65.22	389,156	90.39	3,789,623	78.04
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	[2] 98,219	[2] 16.31				
Special (17.01–27 cents a pound)	716	.07	14,003	1.28	26,168	2.70	22,917	2.96	[2] 87,060	[2] 14.45				
									[3] 24,248	[3] 4.02	41,391	9.61	1,066,212	21.96
	103,068	10.43	231,385	21.21	220,651	22.76	202,306	26.13	209,527	34.78				
Metals Reserve mine contracts	[4] 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	209,527	34.78	41,391	9.61	1,066,212	21.96
Total production [5]	988,094	100.00	1,090,818	100.00	969,789	100.00	774,232	100.00	602,355	100.00	430,547	100.00	4,855,835	100.00
	Total	Price per pound (cents)	Total	Price per pound (cents)	Total	Price per pound (cents)	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	[2] $13,684,190	[2] 19.59				
Special	20,623	18.44	1,735,266	23.20	3,450,898	23.59	3,198,357	23.98	[2] 7,270,723	[2] 21.18				
									[3] 1,559,173	[3] 22.39				
	10,327,452	17.01	24,873,756	17.38	25,516,035	17.78	23,428,975	17.79	22,514,086	19.24	$2,148,937	23.16	$118,860,342	(6)
Metals Reserve mine contracts	[4] 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	22,514,086	19.24	2,148,937	23.16	118,860,342	(6)
Total United States production	----------	12.25	----------	13.30	----------	13.54	----------	13.65	----------	15.70	----------	21.25	----------	(6)

[1] From published and unpublished reports of the Office of Price Administration and the Office of Premium Price Plan for Copper, Lead, and Zinc. Excludes exploration premiums totaling $6,213,545 paid from July 1, 1946 through December 31, 1947 to encourage exploration and development of copper, lead, and zinc deposits; this total cannot be broken down by metals.

[2] January–October. A and Special quotas and premium payments for November and December are not separable and are shown with footnote 3.

[3] Total A and Special quotas and premium payments for November and December; separation by kinds not available.

[4] Treasury Procurement Division contracts in 1942.

[5] From monthly reports of the Bureau of Mines; do not exactly check final annual totals for the United States except for 1943.

[6] Not reported.

FOREIGN TRADE [1]

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. With the onset of World War II in 1939, United States needs for copper for its huge armament requirements absorbed all the copper that entered the country. The prewar flow was not resumed after the end of hostilities largely because of the enormous demand in the United States and the barriers to trade imposed by various governments. In 1947 the United States continued to require all and more than the quantities received from abroad, and exports of domestic metal were subject to strict controls.

The excise tax of 4 cents a pound on copper imported into the United States was recessed by a bill signed by President Truman in April, effective April 30, 1947, through March 31, 1949.

IMPORTS

Total receipts of unmanufactured copper gained 5 percent in 1947 but were equivalent to only half of the average annual quantities received in 1944–45. Entries of copper in crude forms increased, but entries of the important unrefined and refined classes dropped 13 and 3 percent, respectively, marking continuation of the declines since 1945. Ores and concentrates were received in larger quantity, particularly from Chile, Canada, Peru, Cuba, Bolivia, and the Republic of the Philippines. Canada, Mexico, and Peru supplied larger quantities of regulus, black or coarse copper (the least important class from a tonnage standpoint). Yugoslavia furnished an important quantity of unrefined copper in 1947, the first such receipt since 1939, and Mexico and the Union of South Africa shipped greater quantities than in 1946, whereas receipts from Northern Rhodesia, Belgian Congo, the United Kingdom, and Ecuador dropped to none, and those from Turkey, Chile, and Peru declined significantly. Receipts of refined copper from Chile rose 5 percent, but were only about one-third of the high record imports in 1944. Imports from Canada dropped 93 percent to 1,180 tons; 3,226 and 2,000 tons, respectively, were received from Japan and Peru, contrasted with none from each in 1946.

Copper (unmanufactured) imported [1] into the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons	Year	Short tons
1943	716, 596	1946	393, 275
1944	785, 211	1947	413, 890
1945	853, 196		

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

[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.

Copper (unmanufactured) imported into the United States, 1946–47, by countries, in short tons [1]

[U. S. Department of Commerce]

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
1946						
Australia		8				71
Belgian Congo	(2)			4,469		
Bolivia		4,573				
Canada	1	8,353	160		17,193	520
Chile	1,279	2,191	1	66,867	136,312	37
Cuba		12,378				
Ecuador		44		2,931		3
Mexico	3,242	5,038	338	54,858		
Newfoundland and Labrador		3,231	2			22
Northern Rhodesia [3]	2	258		11,682		
Peru	99	3,731	164	26,380		
Turkey				17,414		
Union of South Africa		137	64	4,297	866	32
United Kingdom				3,323		63
Other countries	161	119	3			358
Total	4,784	40,061	732	192,221	154,371	1,106
1947						
Australia	2	320				196
Bolivia	337	6,415				
Canada	29	18,468	2,126	28	1,180	4,651
Chile	6,586	13,072	321	59,885	143,006	250
Cuba	50	14,848				55
Czechoslovakia				1,096		
Ecuador		132	58			
Japan					3,226	
Mexico	5,447	4,158	1,763	64,410	66	62
Newfoundland and Labrador		3,922				42
Peru	387	7,326	906	21,978	2,000	
Philippines, Republic of		2,130				55
Turkey				1,933		
Union of South Africa	1,658	65	49	7,903		91
Yugoslavia		172		10,145		
Other countries	169	165				551
Total	14,665	71,193	5,223	167,378	149,478	5,953

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

EXPORTS

Refined copper resumed its prewar place as the chief copper export class in 1946 and maintained this position by a wide margin in 1947. Exports of refined copper almost trebled in 1947 as compared with 1946, but 1946 was only one-sixth of the prewar (1935–39) annual average. The United Kingdom, which dropped to third place as a destination of refined copper in 1946, returned to first place in1947 and accounted for most of the gain in refined shipments. Other gains were made in 1947 by the Netherlands, Italy, India, Argentina, Belgium and Luxembourg, Poland, Switzerland, and others in descending order of magnitude. Losses were recorded for Brazil, France, China, and others. All other classes of exports, except rods and insulated wire and cable, gained, as shown in the accompanying table. Insulated wire and cable continued the decline in progress since the all-time peak was established in 1944.

Copper exported from the United States in 1947,[1] by countries, in short tons

[U. S. Department of Commerce]

Country	Ore, concentrates, composition metal, and unrefined copper (copper content)	Refined in bars, ingots, or other forms	Rods	Old and scrap	Pipes and tubes	Plates and sheets	Wire (except insulated)	Insulated wire and cable	Other copper manufactures
Algeria		168			2		1	65	
Argentina		5,043	1		337	159	291	1,970	
Australia		954	2		1	180	6	81	
Belgium and Luxembourg		3,919			32	3	2	75	
Brazil	1	601	145		392	707	50	621	
Canada	2	84	113	92	790	701	799	2,956	
Canal Zone		26	4		40	27	15	337	
Chile		31	9		61	42	93	848	
China		647	23		32	265	480	1,290	
Colombia	1	5	3		95	460	326	1,150	
Cuba		5	33		938	166	463	1,890	
Denmark		635	840		156		224	60	
Dominican Republic		(2)			51	19	27	261	
France		6,747		46	(2)	1	86	765	
French Indochina			6		3	9	128	25	
Greece			6		5	29	1,314	26	
India		11,083		208	55	3	16	84	
Italy		7,646		22			3,826	1	
Mexico	4	59	78		649	306	178	1,498	(3)
Morocco, French					2	(2)	(2)	132	
Netherlands		10,283	849		151	34	28	223	
Norway		700			23	77	63	36	
Panama, Republic of			1		41	4	83	450	
Peru		3	6		50	103	42	553	
Philippines, Republic of		10	8		65	21	279	1,967	
Poland and Danzig		2,475			7		170	164	
Portugal		502	1	539	21	129	95	41	
Saudi Arabia		1			42	3	176	487	
Sweden	1	9,073			380	32	6	552	
Switzerland		8,329		27	53		(2)	61	
Turkey		2			24	289	14	358	
Union of South Africa		1	(2)		71	6	432	829	
U. S. S. R.					1		116	678	
United Kingdom	105	70,855		16	57	54	(2)	24	
Uruguay	(2)	201	1		28	22	81	347	
Venezuela	1	1	2		169	191	523	2,258	
Other countries		7,553	285	19	283	332	764	2,131	
Total: Short tons	115	147,642	2,416	969	5,107	4,374	11,197	25,294	(3)
Value	$33,180	$60,409,526	$943,741	$345,382	$4,245,596	$3,124,369	$6,584,545	$24,221,585	$2,580,974

[1] Changes for table in Minerals Yearbook, 1945, p. 142, are as follows: Pipes and tubes exported to U. S. S. R., 1,070 tons; total, 4,197 tons; value, $4,273,704. Wire (except insulated): Mexico, 616 tons; New Zealand, 1 ton; other countries, 1,857 tons; totals unchanged. Insulated wire and cable, total value, $32,020,461.

[2] Less than 1 ton.

[3] Weight not recorded.

Copper exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Ore, concentrates, composition metal, and unrefined copper (copper content)	Refined copper and manutures	Total (except "Other copper manufactures")		Other copper manufactures [1]	Grand total
	Short tons			Value		
1943	1,240	294,459	295,699	$107,598,224	$1,121,230	$108,719,454
1944	(2)	237,515	237,515	101,837,979	859,421	102,697,400
1945	34	132,555	132,589	54,212,247	1,000,008	55,212,255
1946	23	97,475	97,498	37,114,211	1,472,662	38,586,873
1947	115	196,999	197,114	99,907,924	2,580,974	102,488,898

[1] Weight not recorded.
[2] Less than 1 ton.

Brass and bronze exported from the United States, 1946–47 [1] by classes

[U. S. Department of Commerce]

Class	1946		1947	
	Short tons	Value	Short tons	Value
Ingots	1,708	$485,110	1,287	$521,433
Scrap and old	1,184	301,056	3,157	1,061,627
Bars and rods	4,244	1,756,332	5,336	2,872,470
Plates and sheets	3,038	1,615,675	5,976	4,224,152
Pipes and tubes	1,712	1,080,028	2,895	2,345,650
Pipe fittings	360	549,646	467	777,858
Plumbers' brass goods	913	1,723,906	1,885	4,085,322
Wire of brass or bronze	2,338	1,768,803	3,201	3,257,442
Brass wood screws	(2)	123,693	(2)	185,082
Hinges and butts of brass or bronze	(2)	120,264	(2)	239,756
Other hardware of brass or bronze	(2)	557,127	(2)	1,388,781
Other brass or bronze manufactures	(2)	5,039,066	(2)	6,841,834
Total	------------	15,120,706	------------	27,801,407

[1] Minerals Yearbook, 1946, p. 478, should read as follows: 1945: Bars and rods, 2,665 short tons, $1,027,997; other brass or bronze manufactures, $3,265,094; total, $18,882,251.
[2] Weight not recorded.

Unmanufactured brass (ingots, bars, rods, plates, and sheets) exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1943	94,617	$36,347,655	1946	8,990	$3,857,117
1944	128,852	46,610,439	1947	12,599	7,618,055
1945	33,781	11,833,013			

Copper sulfate (blue vitriol) exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1943	30,367	$3,074,668	1946	41,345	$4,076,850
1944	28,922	2,843,941	1947	34,021	4,099,551
1945	34,967	3,419,332			

WORLD REVIEW

All important copper-producing countries, with the possible exception of the U. S. S. R., for which precise data are not available, shared the increase in world copper output in 1947. General improvement in the labor situation was chiefly responsible for the larger world total.

World mine production of copper, 1941–47, in metric tons

[Compiled by B. B. Mitchell]

Country	1941	1942	1943	1944	1945	1946	1947
North America:							
Canada	291,802	273,815	260,900	248,145	215,416	166,892	204,382
Cuba	9,838	[1] 8,916	6,405	6,584	9,067	11,323	13,729
Mexico	48,716	51,379	49,774	41,302	61,680	61,054	64,811
Newfoundland	6,651	5,666	5,669	5,021	4,693	4,458	3,853
United States	869,214	979,811	989,568	882,277	701,154	552,234	768,892
Total North America	1,226,221	1,319,587	1,312,316	1,183,329	992,010	795,961	1,055,667
South America:							
Bolivia [1]	7,274	6,376	6,011	6,170	6,097	6,127	6,241
Chile	465,467	489,158	509,378	498,520	446,398	358,848	414,478
Ecuador [2]	3,209	1,587	4,418	3,720	3,289	2,699	172
Peru	36,822	35,332	33,407	32,396	31,916	24,700	26,629
Total South America	512,772	532,453	553,214	540,806	487,700	392,374	447,520
Europe:							
Austria	740	982	1,365	1,500	320	125	259
Finland	16,627	16,102	16,363	15,841	14,978	13,550	17,418
France	561	317	149	82	327	23	71
Germany [3]	24,000	23,000	21,600	23,500	(4)	[5] 19,900	[5] 17,500
Hungary	990	980	910	[6] 750	(4)	160	[3] 300
Italy [7]	3,940	4,350	[6] 2,889	----	----	(4)	(4)
Norway	17,988	15,471	16,248	14,462	5,203	12,249	13,608
Spain [7]	9,300	10,700	11,100	11,000	8,300	8,600	[3] 11,800
Sweden	13,390	18,056	17,832	16,121	14,926	15,362	14,968
U. S. S. R. [3 8 9]	160,000	160,000	130,000	130,000	160,000	(4)	(4)
Yugoslavia [9]	23,000	32,000	27,000	22,700	(4)	(4)	(4)
Total Europe [3 8]	271,000	282,000	245,000	236,500	223,000	250,000	255,000
Asia:							
China [9 10]	1,590	1,255	1,146	1,030	623	947	915
Cyprus [1]	----	----	5,177	1,422	----	71	12,681
Formosa	5,621	5,067	6,020	3,985	(4)	(4)	(4)
India	6,909	6,706	6,909	6,706	6,230	6,060	5,462
Japan	[11] 77,043	[11] 83,058	[11] 94,729	[11] 86,842	27,984	17,173	21,892
Korea (South)	[12] 970	[12] 1,160	2,052	2,720	1,251	522	389
Netherlands Indies	(4)	60	60	60	(4)	(4)	(4)
Philippines, Republic of	[3] 9,900	(4)	(4)	(4)	(4)	----	2,502
Turkey	10,507	8,257	10,000	11,050	[9] 9,858	[9] 10,050	[9] 10,080
U. S. S. R.	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Total Asia [3 8 13]	115,000	113,000	135,000	116,000	48,000	37,000	56,000
Africa:							
Algeria	(4)	(4)	5	44	76	----	----
Belgian Congo [9]	162,167	165,938	156,850	165,484	160,200	143,885	150,840
French Morocco	113	267	218	549	170	240	268
Portuguese West Africa	----	234	224	71	52	88	28
Rhodesia:							
Northern [9]	231,917	250,564	255,027	224,397	197,192	185,865	195,846
Southern	41	20	20	5	(4)	(4)	(4)
South-West Africa [3]	(4)	1,600	5,000	(4)	----	----	3,100
Union of South Africa	20,738	24,583	22,731	22,869	24,016	26,980	29,330
Total Africa	416,000	443,206	440,075	415,000	381,706	357,058	379,412
Australia	21,194	20,729	24,716	28,506	24,914	18,040	13,334
World total [3 13]	2,562,000	2,711,000	2,710,000	2,520,000	2,157,000	1,850,000	2,210,000

[1] Copper content of exports.
[2] United States imports.
[3] Approximate production.
[4] Data not available; estimate by authors of chapter included in total.
[5] British and Russian zones only.
[6] January to June, inclusive.
[7] According to Yearbook of American Bureau of Metal Statistics.
[8] Output from U. S. S. R. in Asia included with U. S. S. R. in Europe.
[9] Smelter product.
[10] Data represent areas designated as Free China during the period of Japanese occupation.
[11] Preliminary data for fiscal year ended Mar. 31 of year following that stated.
[12] Incomplete data.
[13] Includes estimate for Burma.

World smelter production of copper, 1941–47, in metric tons

[Compiled by B. B. Mitchell]

Country	1941	1942	1943	1944	1945	1946	1947
North America:							
Canada	[1] 254,489	[1] 244,040	[1] 232,740	[1] 224,049	[1] 198,427	150,862	180,393
Mexico	40,914	44,729	43,013	32,974	53,287	52,371	58,475
United States [2]	1,015,346	1,111,458	1,103,918	1,022,382	784,173	592,229	857,007
Total North America	1,310,749	1,400,227	1,379,671	1,279,405	1,035,887	795,462	1,095,875
South America:							
Chile	453,594	477,733	489,320	489,906	440,289	351,989	399,415
Ecuador [3]	----	----	4,030	3,708	3,285	2,659	----
Peru	28,289	29,473	28,215	26,888	25,639	19,703	17,750
Total South America	481,883	507,206	521,565	520,502	469,213	374,351	417,165
Europe:							
Austria	2,517	2,761	5,711	6,051	1,454	----	496
Belgium [4]	15,820	16,950	18,320	4,310	----	----	(5)
Finland	8,783	13,263	15,535	6,756	13,686	20,952	21,087
France [6]	659	407	404	122	6,213	9,696	13,599
Germany [7]	44,400	38,300	31,300	24,000	(5)	[8] 19,167	[8] 18,332
Italy	2,917	878	[9] 1,432	----		(5)	(5)
Norway	5,017	4,597	2,014	937	1,692	7,549	7,884
Rumania	124	46	70	(5)	(5)	1,116	(5)
Spain	8,900	11,590	10,952	10,891	6,268	8,147	7,858
Sweden	11,879	15,147	15,938	15,062	18,249	14,471	18,169
U. S. S. R. [7 10]	160,000	160,000	130,000	130,000	160,000	(5)	(5)
Yugoslavia	23,000	32,000	27,000	22,700	(5)	(5)	(5)
Total Europe [7]	284,000	296,000	258,700	220,800	207,600	260,000	270,000
Asia:							
China	[11] 1,590	[11] 1,255	[11] 1,146	[11] 1,030	623	947	915
India	6,116	5,968	6,198	5,822	6,096	6,412	6,426
Japan	[12] 100,526	[12] 102,062	[12] 119,858	[12] 102,352	[12] 26,871	23,043	36,812
Korea	3,806	4,330	4,554	5,193	[13] 427	[13] 527	[13] 392
Turkey	10,509	8,258	9,730	11,050	9,858	10,050	10,080
U. S. S. R.	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Total Asia [7]	122,600	121,900	141,500	125,500	43,900	41,000	55,000
Africa:							
Belgian Congo	162,167	165,938	156,850	165,484	160,200	143,885	150,840
Northern Rhodesia	231,917	250,564	255,027	224,397	197,192	185,865	195,846
Union of South Africa	19,962	23,877	22,150	22,397	23,665	26,723	29,026
Total Africa	414,046	440,379	434,027	412,278	381,057	356,473	375,712
Australia	22,016	25,004	20,785	20,217	20,827	23,023	19,613
World total [7]	2,635,000	2,790,000	2,756,000	2,579,000	2,158,000	1,850,000	2,230,000

[1] Copper content of blister produced.
[2] Smelter output from domestic and foreign ores, exclusive of scrap. Production from domestic ores only, exclusive of scrap, was as follows: 1941, 876,401; 1942, 987,004; 1943, 991,492; 1944, 910,245; 1945, 710,073; 1946, 543,996; 1947, 782,780. The diversion during the war of Belgian Congo matte from its previous destination, Belgium, for resmelting in the United States resulted in some duplication. The movement ended in 1945.
[3] United States imports.
[4] Figures represent blister copper only. 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.
[5] Data not available; estimate by authors of chapter included in total.
[6] Exclusive of material from scrap.
[7] Approximate production.
[8] British zone only (includes scrap).
[9] January to June, inclusive.
[10] Output from U. S. S. R. in Asia included with U. S. S. R. in Europe.
[11] Data represent areas designated as Free China during the period of Japanese occupation.
[12] Preliminary data for fiscal year ended Mar. 31 of year following that stated.
[13] South Korea only.

Belgian Congo.—Belgian Congo continued to rank fifth or sixth in copper production in the world, the unknown factor being the size of production in the U. S. S. R. Output rose from 143,885 metric tons in 1946 to 150,840 in 1947; the 1947 total was 9 percent less than the all-time record of 165,938 tons in 1942. Installation of a new hydroelectric power station at Koni on the Lufira River is in progress, and the company hopes to have it in operation in 1949. The new additions were expected to double the capacity of the Kipushi and Kolwezi concentration plants. The possibility of opening the Kansanshi copper and gold mine "covering about 475 acres in North Western Rhodesia on the Congo Border," said to have had ore reserves approximating 4,000,000 tons averaging 3.65 percent copper when it was closed in March 1938, was mentioned [2] recently. An economic treatment method must be found.

Canada.—Production of copper in Canada advanced 22 percent in 1947, paralleling the trend in all of the most important copper-producing areas of the world. Despite the rise, however, the 1947 total was lower than in every year except 1946, since 1936, and was 22 percent less than the annual average for 1936–45; it was 31 percent below the all-time peak output of 327,797 short tons in 1940. The value of copper production gained 96 percent in 1947 as compared with 1946, owing in part to the larger output but chiefly to the advance of 5.125 cents in the official Canadian price for copper in January and to the further rise following removal of price controls for copper in June.

Continuing conditions of inadequate labor supply accentuated by labor strikes impeded copper production in Canada in 1947. Insufficient power was an added deterrent in some areas.

Copper produced (mine output) in Canada, 1943–47, by Provinces, in short tons

Province	1943	1944	1945	1946	1947 (preliminary)
British Columbia	21,111	18,152	12,876	8,750	19,894
Manitoba	19,008	21,939	20,563	19,251	14,800
Ontario	138,920	142,654	119,726	89,712	114,050
Quebec	65,582	54,027	51,342	34,899	42,350
Saskatchewan	42,974	36,757	32,950	31,356	34,200
Northwest Territories		6			
Total	287,595	273,535	237,457	183,968	225,294

More than half of Canada's copper output usually comes from the nickel-copper ores of the Sudbury district, Ontario; in 1946 the proportion dropped to 49 percent, but it rose to 51 in 1947. The International Nickel Co. of Canada, Ltd., is the largest producer in the Province and in Canada. Mines and smelters operated continuously throughout the year but were handicapped by an acute manpower shortage lasting from April to October. Underground development totaled 54,790 feet, compared with 48,673 in 1946, bringing the total footage of underground development to 1,239,508 at the year end. A total of 10,406,644 short tons of ore was mined, compared with an average of 9,996,750 for the three preceding years. Proved ore reserves at the end of 1947 were 221,843,000 tons containing 7,171,000 tons of nickel-copper, an increase over the 217,142,000 tons containing 6,861,000 tons at the beginning of the year. Copper sales amounted to 110,336 tons compared with 74,889 tons in 1946. The Falconbridge Nickel Mines, Ltd.—the other important producer in Ontario—hoisted 730,965 tons of ore; reserves at the Falconbridge mine on December 31, 1947, totaled 8,279,000 tons containing 1.66 percent nickel and 0.87 percent copper, or relatively unchanged from the beginning of the year.

[2] The Mining Journal (London), Company News and Views: Vol. 229, No. 5842, August 9, 1947, p. 501.

Quebec again ranked second in copper production but supplied only 37 percent as much as Ontario. Noranda Mines, Ltd., is the outstanding producer in the Province. A total of 516,705 tons of ore was hoisted at the Horne mine in 1947; 194,601 tons were milled, and 359,631 tons of ore and concentrates were smelted. The smelter also treated 289,123 tons of custom material. Copper output for the Horne mine was 14,928 tons out of a total smelter output of 42,659 tons. In addition to copper, the Horne mine produced 85,462 ounces of gold and 319,215 ounces of silver. Developed ore reserves above the 2,975-foot level were 4,800,000 tons of sulfide ore averaging 7.15 percent copper, 14,480,000 tons of sulfide ore averaging 0.66 percent copper, and some siliceous fluxing ore. A labor strike, mentioned in the report of this series for 1946, caused suspension of production during the first 2 months of 1947, although the strike ended on February 9. The labor force averaged 1,288 at the end of 1947, an improvement over the recent past but a substantial drop as compared with a prewar normal force of 1,800. A total of 209,310 tons of ore, containing 3.37 percent copper, 6.70 percent zinc, 0.032 ounce gold, and 2.32 ounces of silver per ton, was milled by Normetal Mining Corp., Ltd. The copper concentrate was smelted at Noranda, and the zinc was shipped to the United States. Estimated ore reserves were 1,760,000 tons of ore containing 3.64 percent copper and 7.63 percent zinc. After treating 393,950 tons during the year, the ore reserves of Waite Amulet and its subsidiary totaled 1,765,000 tons at the end of 1947, compared with 2,100,000 at the beginning of the year. The Waite ore body is exhausted. Canadian Copper Refiners, Ltd., controlled by Noranda, operated at only 79 percent of capacity in 1947; but plans were being prepared for expansion, nonetheless, to take care of expected increases in refinery receipts originating in the East Sullivan and probably the Quemont properties.

The Hudson Bay Mining & Smelting Co., Ltd. (Flin Flon mine) and Sherritt Gordon Mines, Ltd., supply the copper output of Manitoba and Saskatchewan. A total of 1,855,035 tons of ore, averaging 2.6 percent copper, 4.4 percent zinc, 0.083 ounce gold, and 1.17 ounces of silver to the ton, was mined and milled at the Hudson Bay property. The copper smelter treated 412,901 tons of Hudson Bay ores and concentrates and 30,621 tons of custom concentrates. Production of refined copper for company account amounted to 41,359 tons at the property of Sherritt Gordon Mines, Ltd.; 359,031 tons of ore were milled, yielding 7,342 tons of copper, 3,682 ounces of gold, 121,343 ounces of silver, and 8,217 tons of zinc concentrate. Production was entirely from the West mine, and no new ore was found during the year; reserves on December 31 aggregated 1,008,000 tons, of which 269,000 were in pillars and sills. The company year's earnings were spent on the development of the new mine at Lynn Lake, mentioned in the report of this series for 1946, and anticipated expenditures of $1,300,000 for 1948 are expected to be available from 1948 earnings of the Sherritt Gordon mine. Ore reserves at the end of 1947 totaled 8,300,000 tons, averaging 1.514 percent nickel and 0.687 percent copper, and 153,000 tons, averaging 1.113 percent copper and 2.491 percent zinc. The foregoing represents an increase in nickel-copper ore reserves of 3,326,000 tons. It is proposed to move the pilot mill to Lynn Lake and to have it ready for operation by the time the underground lateral development is started. Nickel and copper concentrates will be stock-piled.

Chief producers of copper in British Columbia are the Granby Consolidated Mining, Smelting & Power Co., Ltd., and the Britannia Mining & Smelting Co., Ltd.

Exports of ingots, bars, and billets from Canada in 1947 as compared with 1946 were as follows, by countries of destination, in short tons:

Destination:	*1946*	*1947*
United Kingdom	63, 810	55, 740
France	9, 257	12, 152
Sweden	420	6, 243
Czechoslovakia		3, 579
India	2, 642	2, 992
Netherlands	2, 867	2, 904
Switzerland	2, 360	1, 903
United States	18, 176	1, 054
Other countries	1, 882	911
	101, 414	87, 478

Exports of copper in ore totaled 29,093 tons, of which 23,092 went to the United States and 5,499 to Norway, compared with 17,628, 12,484, and 4,898 tons, respectively, in 1946. In addition, 20,484 tons of rods, strip, sheet, and tubing and 5,694 tons of scrap were shipped from the country compared with 15,916 and 1,230 tons, respectively, in 1946.

Chile.—Mine output of copper was 414,478 metric tons in 1947, an increase of 16 percent as compared with 1946, the first gain since the peak production of 509,378 tons was established in 1943. Labor difficulties continued to impede production in 1947, but labor conditions nonetheless were better than in 1946. The over-all situation was described in the annual report of the Kennecott Copper Corp. as follows:

The wage agreement made in December 1946 covered the year 1947 and the month of January 1948. During this contract period, several short work stoppages occurred at the mine and one shut-down of about 15 days was occasioned by a strike of employees. In total, about 20,000,000 pounds of copper production was lost from these causes. Labor unrest throughout Chile finally culminated in a general strike at the coal mines of the country in October. Martial law was then declared and troops were placed in control at all large mining centers. Many leftist leaders and agitators were removed from the coal and copper mines by the military authorities and operations have since been conducted with less friction and somewhat better efficiency. Unbiased public opinion both at home and abroad commended the President of Chile for the way he handled a difficult situation.

The contractual obligation to raise wages in accordance with fluctuations in living costs required wage adjustments in February, March, July, and September amounting to a total of somewhat over 20 percent during the year. Compared to 1940 as a base, the 1947 average wage of workmen including family allowances and other perquisites shows an increase of about 270 percent in the 7-year period.

Freight rates on the state railroad were raised 18 percent during the year and there was also a minimum increase of 33 percent in customs duties covering a long list of items required in Braden operations.

The critical financial situation and the shortage of foreign exchange prompted legislation advancing the date of payment of special copper taxes to a current basis. Toward the end of the year further legislation was approved which placed on the copper companies a surcharge of 20 percent on the income taxes applying to a substantial part of 1946 and 1947 operations. For Braden, taxes plus exchange burdens equaled about 67 percent of net income. However, it is appropriate to note that monetary problems are presently being handled in a manner which gives a degree of encouragement for the future.

Snowfall was again below normal but nevertheless more than double that of the previous year. Present indications are that water conditions will be somewhat more favorable in the first part of 1948 than in the like 1947 period.

At Braden 138,472 short (125,619 metric) tons were produced compared with 93,725 (85,025) tons in 1946. The Chuquicamata mine of the Chile Exploration Co. produced 243,565 short (220,957 metric) tons compared with 231,926 (210,399) in 1946 and the Andes mine 65,075 (59,035) and 69,509 (63,057) respectively.

A recent article [3] described Caja de Credito Minero, a Chilean Government agency, and its record of aid to small miners in the country. A contract was entered into between Caja and the Allis-Chalmers Manufacturing Co. for the construction by the latter of a smelter, machine shops, office building, power plant, and short rail line. The Paipote smelter will be located near Copiapo.

Exports of the chief copper classes, by countries, are shown as follows, in metric tons:

Destination:	*Electrolytic*	*Standard (furnace refined)*	*Total refined*
United States	120, 210	82, 666	202, 876
Great Britain	16, 809	39, 677	56, 486
France	29, 802	14, 903	44, 705
Argentina	21, 087	250	21, 337
Italy	9, 021	9, 805	18, 826
Sweden	10, 763	3, 099	13, 862
Czechoslovakia	6, 042	3, 024	9, 066
Brazil	6, 668	225	6, 893
Switzerland	2, 030	1, 476	3, 506
Netherlands	2, 601	50	2, 651
India	2, 203	------	2, 203
Algeria	1, 367	------	1, 367
China	1, 088	------	1, 088
Denmark	720	------	720
Belgium	583	30	613
Germany	507	------	507
Norway	380	------	380
Canada	100	------	100
Bolivia	11	------	11
Uruguay	-------	65	65
Total	231, 992	155, 270	387, 262

Exports of ores and concentrates were 5,138 and 5,655 tons, respectively, all of which went to the United States. Exports of 7 tons of precipitates and 166 tons of cement copper likewise all went to the United States. Of the exports of 1,027 tons of copper bars, 721 went to Italy, 130 to Argentina, and 91 to the United States.

Czechoslovakia.—According to reports [4] reaching London, the old copper mines near Krompach are to resume operations; retimbering and safety work are in immediate prospect.

Ecuador.—The 1947 annual report of the American Metal Co., Ltd., contained the following statement:

> During the year, operations at the mine of the Cotopaxi Exploration Co. in Ecuador, in which your company held an interest of 35.67 percent, were discontinued, the mine was abandoned in contemplation of liquidation and your company disposed of its entire interest for the sum of $567,100. * * *.

Northern Rhodesia.—Production of copper gained only 5 percent in 1947, despite continuing world demand in excess of current supplies and the fact that the 1946 output was only 73 percent of the all-time peak established in 1940. Inadequate rail facilities, leading to coal

[3] Benitez, Fernando, Chile's Mining Bank Aids Small Operators: Eng. and Min. Jour., vol. 148, No. 12, December 1947, pp. 65–67.
[4] Metal Industry (London), vol. 71, No. 14, October 3, 1947, p. 293.

shortages, continued to restrict copper production in Northern Rhodesia. Congestion at the port of Beira, Mozambique, caused large stocks of copper to accumulate there, thus reducing exports. Much attention is being given to solving rail and port facility problems; and progress is reported, particularly in regard to increased rolling stock for the railroad. A temporary measure of relief was provided by importing coal from the Union of South Africa and the United States through Lobita Bay and by some adaptation to wood burning. During the year Rhodesia Railways was taken over by the Southern Rhodesian Government. Difficulty in obtaining requirements of steel, machinery, and other supplies delayed the copper production expansion program, particularly Nchanga's proposed capacity increase from 27,000 to 64,000 tons or more.

Northern Rhodesian mines had limited shut-downs during the year owing both to coal shortages and to strikes.

A total of 2,439,200 short tons of ore, containing 2.54 percent copper, was mined at the Roan Antelope mine in the fiscal year ended June 30, 1947, or 7 percent less than in the preceding 12 months. Production of blister copper amounted to 55,598 short tons in 1946–47 compared with 59,908 tons in 1945–46. Ore reserves at the end of June 1947 were estimated at 97,926,780 tons, containing 3.27 percent copper, or a reduction during the year of almost the entire production. Concentrating operations at Roan Antelope were described [5] recently.

The Rhokana Corp., Ltd., produced 98,275 (99,250 in 1945–46) short tons of copper in the year ended June 30, 1947, of which 12,700 (10,618 in 1946) tons were Nkana blister copper, 24,096 (21,784) were Nchanga blister copper, and 61,479 (66,848) were Nkana electrolytic copper. Ore reserves at the end of June 1947 totaled in the Nkana north ore body 24,884,000 short tons containing 3.32 percent copper, in the Nkana south ore body 20,165,000 tons containing 2.78 percent copper, and in the Mindola ore body 56,447,000 tons containing 3.66 percent copper, or a grand total of 101,496,000 tons containing 3.40 percent copper.

Ore reserves at the Nchanga mine were estimated as 141,117,000 tons in 1946.

Mufulira Copper Mines, Ltd., produced 53,198 short tons of blister copper in the year ended June 30, 1947, compared with 56,045 tons in the previous 12-month period. Mine capacity at present is 6,000 long (6,720 short) tons a month and plans call for an increase to 7,500 (8,400) by the end of the 1947–48 fiscal year. Estimated reserves on June 30, 1947, were 88,571,000 short tons at Mufulira, 25,000,000 at Chambishi, and 21,000,000 at Baluba, or a total of 134,571,000 tons averaging 3.84 percent copper. The Mufulira concentrator was recently described.[6]

South Africa.—According to stockholders' reports of the American Metal Co., Ltd., and the Newmont Mining Corp. for 1947, the total amount invested to date (reports dated February and March 1948) in Tsumeb Corp., Ltd., which purchased the Tsumeb mine, is South African £1,550,000. Operations of the property have been favored by prevailing metal prices, and according to present indications

[5] Goldick, M. R., Description of Concentrating Operations, Roan Antelope Copper Mines Limited, Northern Rhodesia: Am. Inst. Min. and Met. Engr., Mining Technol., January 1948, Tech. Pub. 2251, 16 pp.

[6] White, Jack, and Adair, Ralph B., Mufulira Copper Mines Limited, Concentrator, Northern Rhodesia: Am. Inst. Min. and Met. Eng. Mining Technol., January 1948, Tech. Pub. 2250, 9 pp.

Tsumeb is not likely to exercise its right to call upon subscribers for an advance of a further South African £700,000. Up to December 31, 1947, 51,928 tons of sorted dump ore and jig concentrates, averaging 9.5 percent copper and 29.3 percent lead, were delivered to Walvis Bay, on the South Atlantic coast, for shipment to overseas smelters. Construction of the mill, installation of other equipment, and unwatering of the mine are proceeding according to schedule. It was hoped to have the three mill units in operation by May 1948. Reports state that the American Metal Co., Ltd., and Newmont Mining Corp. each has a 28½-percent interest in Tsumeb Corp., Ltd., O'okiep Copper Co., a 9½-percent interest, and British and South African companies the remainder.

United Kingdom.—The second-largest copper-consuming nation in the world, the United Kingdom, increased total consumption from 493,716 long tons in 1946 to 540,886 tons in 1947, or 10 percent. Of the 1947 total, 350,119 tons were virgin metal, and 190,767 tons were scrap, compared with 325,409 and 168,307 tons, respectively, in 1946. Stocks of virgin metal were reported to be 110,200 tons at the end of 1947. These stocks include electrolytic copper (including rods), fire-refined, and blister held by the Ministry of Supply and consumers, and stocks in transit in the United Kingdom.

The British Ministry of Supply continued bulk purchasing in 1947. Changes in 1947, added to those in 1946, carried the price to more than double the wartime average. The changes are discussed in the Prices section of this report. Supplies came again chiefly from Northern Rhodesia, Canada, and Chile, and in addition in 1947 from the United States. Imports of the important copper classes in 1947, in long tons, were as follows:

Source:	*Electrolytic*	*Standard*
Northern Rhodesia	27, 410	112, 032
Canada	50, 423	(1)
Chile	16, 167	43, 016
United States	57, 344	(1)
Belgium Congo	14, 605	(1)
Other countries	37, 610	3, 419
	203, 559	158, 467

1 Not separately reported; if any, included with "Other countries."

The gross weight of copper ore imported—all from Canada—was 21,500 tons. Exports in 1947 were as follows:

	Long tons
Copper ingots, etc	20, 208
Plates, sheets, etc	17, 470
Wire in coils	18, 778
Tubes	4, 469
Other manufactures	8, 484
Total	69, 409

U. S. S. R.—Figures credited[7] to an authoritative continental source show that 73,000 tons of copper were produced in January to June 1947 compared with 64,000 tons in July to December 1946.

Resumption of construction of a copper combine at the Almalyk deposits in Uzbekistan (Central Asia) is reported by the Soviet press.[8] The combine will consist of a mine, mill, and large smelter. The deposit will be worked by the open-cut method.

7 Metal Bulletin (London), No. 3256, January 9, 1948, p. 7.
8 Foreign Commerce Weekly, vol. 26, No. 3, January 18, 1947, p. 25.

Feldspar

By ROBERT W. METCALF

GENERAL SUMMARY

CONTINUED active demand for pottery and enamel, a record production of plate glass, and near-record output of glass containers contributed to the high level of sales of crude feldspar in 1947 and to a new high in shipments of ground feldspar by merchant mills in the United States. Production of crude feldspar in 1947 reached 459,910 long tons, 10 percent less than in the peak year 1946, although much higher than in any other previous year. Sales of ground feldspar in 1947 rose 3 percent to 482,700 short tons valued at $5,861,141. Production of aplite increased 25 percent. Imports of Canadian crude feldspar in 1947 were 2 percent greater than in 1946. Tonnage of crude nepheline syenite from Canada was the largest yet recorded.

Salient statistics of the feldspar industry in the United States, 1935–39 (average), 1940–44 (average), and 1945–47

	1935–39 (average)	1940–44 (average)	1945	1946	1947
Crude feldspar:					
Domestic sales:					
Long tons	230,479	316,275	373,054	508,380	459,910
Value	$1,139,860	$1,559,673	$2,021,529	$2,594,099	$2,410,940
Average per long ton	$4.95	$4.93	$5.42	$5.10	$5.24
Imports:					
Long tons	9,558	11,149	14,924	16,365	16,685
Value	$64,905	$80,467	$114,917	$127,654	$124,587
Average per long ton	$6.79	$7.22	$7.70	$7.80	$7.47
Ground feldspar:					
Sales by merchant mills:					
Short tons	237,993	329,385	381,728	470,199	482,700
Value	$2,925,853	$3,565,610	$4,246,961	$5,346,107	$5,861,141
Average per short ton	$12.29	$10.83	$11.13	$11.37	$12.14

Production of crude feldspar in North Carolina in 1947 was only 4 percent less than in the record year 1946 and continued at an active pace. Output in Colorado and Virginia was 17 and 27 percent greater, respectively, than in 1946. South Dakota, Wyoming, and the New England producing States registered small to substantial declines in output. Sales of ground feldspar from North Carolina–Tennessee mills increased 5 percent over 1946; sales from Connecticut–New Jersey were 9 percent greater in 1947 than in 1946; Colorado and New York sales were each 21 percent higher, and Virginia and Maine showed substantial gains. In Arizona, Illinois, and New Hampshire marketed production of ground feldspar was less in 1947 than in 1946.

Had it not been for the decrease in glass-container production in the latter part of the year, the output of crude as well as ground feldspar undoubtedly would have set an all-time record in 1947. As it was, production of glass containers nearly reached the 1946 peak. Shipments, however, declined about 5 percent, and inventories at the end of 1947 more than doubled compared with 1946, indicating that supply was overtaking demand, at least temporarily. Plate-glass production, on the contrary, jumped 20 percent to another record. Manufacture of ceramic floor and wall tile also rose sharply in 1947 to more than 89,000,000 square feet, output nearly tripling since the end of the war.

The record residential construction and the continued high industrial building program in 1947 have encouraged large increases in producing facilities for glass fibers and block, sanitary ware, and porcelain enamel products, in which large tonnages of feldspar are consumed. Improvements and expansion in whiteware plants also have been numerous. To supply these potential augmented markets, several new grinding mills have been erected. The possibilities for growth in sales of feldspar for these ceramic uses are bright. Froth flotation as a means of processing feldspar has become increasingly significant to the industry.

A development of interest to all producers of feldspar is the Knutson-Gearhart bill, which became Public Law 384 (80th Cong.) on August 8, 1947. This was an omnibus measure which, in addition to repealing a number of wartime taxes and special privileges, provided in an amendment for reenactment of the 15-percent depletion allowance accorded to a number of nonmetallic minerals during the war years. Among the industries affected was feldspar production.

DOMESTIC PRODUCTION

CRUDE FELDSPAR

Production of crude feldspar declined 10 percent in tonnage and 7 percent in value in 1947 compared with the 508,380 long tons valued at $2,594,099 reported in 1946. Crude feldspar in 1947 was mined in 14 States, 2 more than in 1946. Small outputs were reported from California and Maryland in 1947, in addition to the States listed in 1946.

Crude feldspar sold or used by producers in the United States, 1943–47

Year	Long tons	Value: Total	Value: Average	Year	Long tons	Value: Total	Value: Average
1943	308,180	$1,646,277	$5.34	1946	508,380	$2,594,099	$5.10
1944	327,408	1,813,937	5.54	1947	459,910	2,410,940	5.24
1945	373,054	2,021,529	5.42				

Crude feldspar sold or used by producers in the United States, 1945–47, by States

State	1945		1946		1947	
	Long tons	Value	Long tons	Value	Long tons	Value
Colorado	26,279	$105,021	37,312	$145,975	43,676	$218,593
Connecticut	11,705	74,778	16,555	98,407	15,408	100,152
Maine	10,974	62,287	18,922	110,237	16,898	97,565
North Carolina	148,493	863,740	230,367	1,200,638	220,997	1,081,514
South Dakota	68,374	314,787	74,540	299,852	58,959	284,378
Virginia	29,089	178,664	32,960	204,588	41,820	261,741
Wyoming	17,021	62,614	20,345	83,496	18,801	90,258
Undistributed [1]	61,119	359,638	77,379	450,906	43,351	276,739
	373,054	2,021,529	508,380	2,594,099	459,910	2,410,940

[1] Includes Arizona, New Hampshire, New York, and Texas; and, in addition, California in 1945 and 1947, Georgia in 1946–47, Maryland in 1947, and Pennsylvania in 1945.

Output of crude feldspar in North Carolina in 1947 totaled 220,997 long tons valued at $1,081,514, only 4 percent in tonnage less than in the peak year 1946. Production in Virginia increased 27 percent; that in Colorado increased 17 percent; and that in New York and Arizona, although small, rose 26 and 5 percent, respectively, in 1947 compared to 1946. Other States, including South Dakota, Wyoming and the New England producing States—Connecticut, Maine, and New Hampshire—showed small to substantial decreases in output. As for many years, North Carolina, produced more spar than any other State. In 1947 South Dakota was second in order of production, followed by Colorado, Virginia, and New Hampshire.

GROUND FELDSPAR

Sales of ground feldspar by merchant mills in 1947 again set a new record in both quantity and value, reaching 482,700 short tons valued at $5,861,141, an increase of 3 percent in quantity and 10 percent in value over 1946. All States except Arizona, Illinois, and New Hampshire, registered appreciable gains in 1947 over 1946 levels. Output of North Carolina and Tennessee mills combined represented 45 percent of the total merchant sales of feldspar ground in the United States in 1947 compared with 44 percent in 1946 and 37 percent in 1945. Colorado mills supplied 14 percent of the total in 1947, compared with 12 percent in 1946 and 11 percent in 1945.

Ground feldspar sold by merchant mills[1] in the United States, 1943–47

Year	Active mills	Domestic feldspar			Canadian feldspar			Total	
		Short tons	Value		Short tons	Value		Short tons	Value
			Total	Average		Total	Average		
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
1946	28	454,869	5,029,330	11.06	15,330	316,777	20.66	470,199	5,346,107
1947	26	464,179	5,521,576	11.90	18,521	339,565	21.57	482,700	5,861,141

[1] Excludes potters and others who grind for consumption in their own plants.

North Carolina continued to be the largest producer of ground feldspar, followed in order in 1947 by Colorado, South Dakota, Tennessee, New Hampshire, and Maine. Ground spar sold by North Carolina-Tennessee mills in 1947 totaled 217,109 short tons, 5 percent higher than in 1946 and was the highest yet recorded. Connecticut-New Jersey sales in 1947 rose 9 percent; Maine sales, 17 percent; Colorado and New York sales each 21 percent; and Virginia, 16 percent, compared with 1946. Declines in output were reported for three States—New Hampshire, Illinois, and Arizona.

The Appalachian Minerals Co., Monticello, Ga. (formerly Burgess Mining Co.), was organized in 1947 to develop recently discovered feldspar deposits near Monticello, Jasper County, Ga. A mill has been erected and is expected to be in operation in the first part of 1948, grinding to 20-mesh for the glass trade. A fine-grinding unit for pottery and other ceramic-ware grades also is planned. A high-potash spar is to be marketed, with mica as a commercial byproduct.[1]

[1] Ceramic Age, vol. 50, No. 4, October 1947, p. 215; Eng. and Min. Jour., vol. 149, No. 1, January 1948, p. 103.

Scheduled for early 1948 production also is the new flotation plant of the Consolidated Feldspar Corp., Trenton, N. J., at Parkdale, Fremont County, Colo., just west of Canon City.[2]

Ground feldspar sold by merchant mills[1] in the United States, 1945–47, by States

State	1945			1946			1947		
	Active mills	Short tons	Value	Active mills	Short tons	Value	Active mills	Short tons	Value
California	3	809	$11,911	2	294	$5,276			
Colorado	3	41,433	307,619	2	55,251	448,011	2	66,940	$616,973
Connecticut	2	19,139	355,578	2	22,464	405,828	2	24,537	426,952
New Jersey	2			2			1		
Maine	2	9,746	156,618	3	14,822	235,636	3	17,414	280,154
North Carolina	4	142,208	1,665,634	4	207,527	2,194,552	4	217,109	2,360,352
Tennessee	2			2			2		
Undistributed[2]	12	168,393	1,749,601	11	169,841	2,056,804	12	156,700	2,176,710
	30	381,728	4,246,961	28	470,199	5,346,107	26	482,700	5,861,141

[1] Excludes potters and others who grind for consumption in their own plants.
[2] Includes (number of active mills in parentheses) Arizona (1), Illinois (1), New Hampshire (3 in 1945, 2 in 1946–47), New York (3), South Dakota (2 in 1945–46, 3 in 1947), and Virginia (2).

The Feldspar Milling Co., Inc., Burnsville, N. C., about the middle of 1947 had plans under way for erecting a new $500,000 plant at Spruce Pine to process feldspar by flotation.[3] Commercial operation of this mill was expected in 1948. It is reported that the Golding-Keene Co., Keene, N. H., has closed its local mill used for producing glass spar by the flotation process.[4] Grinding for pottery consumption will continue in the company mill on Ralston Street, Keene.

The Black Hills Tin Co., Tinton, S. Dak., has instituted changes in its spodumene-crushing unit and, with increased capacity, in 1947 began crushing feldspar to 20-mesh for shipment to eastern consumers. It was understood, also, that the Black Hills Keystone Corp. was overhauling its lepidolite mill at the Ingersoll mine near Keystone, S. Dak., to crush feldspar.

CONSUMPTION AND USES

Crude Feldspar.—Although several of the grinders mine their own feldspar, either themselves or through affiliated firms, a large proportion of the crude feldspar is mined by small operators and sold to merchant mills. An increasing tonnage of feldspar and feldspar-containing rocks is being refined in flotation machines.

Most consumers of feldspar buy spar already ground and sized from the merchant grinders. Some pottery and enamel manufacturers and makers of soaps, cleansers and sweeping compounds, however, purchase all or part of their requirements in crude form and grind it to their own specifications in their own mills. Some Canadian crude feldspar is purchased direct by consumers in this country. Manufacturers of artificial teeth annually consume a small tonnage of very carefully selected crude spar, which must be free from all grit and is sold at a substantial premium over No. 1 grade commercial feldspar.

[2] Ceramic Age, vol. 49, No. 5, May 1947, p. 246.
[3] Rock Products, vol. 50, No. 6, June 1947, p. 80; Ceramic Age, vol. 49, No. 5, May 1947, p. 224.
[4] Ceramic Age, vol. 49, No. 5, May 1947, p. 241.

Ground Feldspar.—Glass, pottery, and enamel industries in 1947 consumed 98 percent of the ground feldspar sold by merchant mills, compared with 99 percent in 1946. Consumption of glass spar in 1947 declined 8 percent from 1946 to 266,720 short tons, yet still was 7 percent higher than in any other year. Shipments to potteries totaled 183,829 tons, 19 percent higher than the former record year 1946. Consumption of feldspar in enamel manufacture rose 7 percent. Ground spar sold for use in soaps, cleansers, and abrasives in 1947 was over one and a half times that in 1946, although less than 2 percent of the total sales.

Ground feldspar sold by merchant mills in the United States, 1945–47

Use	1945		1946		1947	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Ceramic:						
Glass	249, 927	65. 5	289, 559	61. 6	266, 720	55. 3
Pottery	111, 695	29. 3	154, 340	32. 8	183, 829	38. 1
Enamel	13, 755	3. 6	22, 500	4. 8	24, 159	5. 0
Other ceramic uses	1, 747	. 4	144		60	
Soaps and abrasives	4, 245	1. 1	3, 081	. 7	7, 871	1. 6
Other uses	359	. 1	575	. 1	61	
	381, 728	100. 0	470, 199	100. 0	482, 700	100. 0

Reports from merchant grinders in 1947 indicated that Pennsylvania, Illinois, Ohio, West Virginia, Indiana, and New Jersey together consumed 75 percent of the total sales. New and enlarged glass, pottery, and enamel plants in many parts of the United States presage a continued active demand, especially in Southern and Western States.

Ground feldspar shipped from merchant mills in the United States, 1942–47, by destinations, in short tons

Destination	1942	1943	1944	1945	1946	1947
California	12, 224	8, 669	9, 788	8, 735	8, 641	7, 395
Illinois	50, 450	49, 302	49, 434	53, 114	68, 737	72, 212
Indiana	38, 998	40, 873	40, 057	47, 321	47, 756	44, 864
Maryland	8, 745	9, 028	7, 593	9, 411	18, 374	19, 531
Massachusetts	3, 630	3, 855	3, 508	3, 258	3, 009	3, 906
New Jersey	43, 029	40, 259	38, 158	35, 735	41, 340	43, 969
New York	18, 363	18, 024	21, 886	19, 005	19, 420	20, 279
Ohio	43, 950	42, 536	41, 208	48, 151	47, 031	63, 939
Oklahoma	8, 002	(1)	(1)	(1)	14, 411	13, 248
Pennsylvania	40, 013	36, 190	47, 803	47, 217	70, 706	84, 026
Tennessee	3, 507	2, 677	4, 983	8, 881	18, 337	10, 263
West Virginia	35, 161	48, 940	45, 658	58, 653	66, 024	51, 129
Wisconsin	7, 837	8, 718	7, 993	7, 058	10, 317	9, 958
Other destinations [2]	13, 877	26, 739	25, 132	35, 189	36, 096	37, 981
	327, 786	335, 810	343, 201	381, 728	470, 199	482, 700

[1] Included with "Other destinations"; separate figure for State not available.
[2] Includes Arkansas, Colorado, Connecticut, District of Columbia, Hawaii, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Oklahoma (1943–45), Puerto Rico, Rhode Island, South Carolina, and Texas, and shipments that cannot be segregated by States; also small shipments to Canada, England, Mexico, and other countries.

PRICES

Crude-feldspar quotations are not shown in trade journals. Average realizations by States, however, have been computed from the information supplied to the Bureau of Mines by the producers. According to these reports, the average realization per long ton for crude spar in 1947 increased 3 percent to $5.24 compared with $5.10 in 1946. Increases in average value occurred in all States except Maine and North Carolina, which showed small decreases, and generally were higher in western producing States than in the East.

Average realization per short ton for ground feldspar in 1947 increased 7 percent to $12.14 compared with $11.37 in 1946 and was the highest since 1936 ($12.99). The average value in Connecticut–New Jersey decreased somewhat in 1947. In all other States, average values were higher in 1947 than in 1946, ranging from $9.22 in Colorado to $20.30 in New York.

According to quotations appearing in E&MJ Metal and Mineral Markets, prices on Virginia feldspar and North Carolina glass spar and enamelers' spar were unchanged in 1947 compared to 1946 and other immediately preceding years, and were as follows: Virginia feldspar—No. 1, 230-mesh, $18; 200-mesh, $17; glass makers' spar No. 18, $12.50; and No. 17, $11.75; North Carolina glass feldspar—granular, 20-mesh, white, in bulk, $12.50 per ton and semi-granular, $11.75 per ton; enamelers' feldspar—$14 to $16 per ton, f. o. b., on either Spruce Pine, N. C., or Keene, N. H., basis. Potash and soda feldspars in bulk, f. o. b. North Carolina or Maine, 200-mesh, white were listed by the same source at $17 and $19, respectively, through November 1947. As of December 11, however, Maine potash spar was quoted at $18 per ton, other quotations remaining the same through February 1948.

FOREIGN TRADE [5]

Feldspar.—Imports for consumption of crude feldspar into the United States in 1947 increased 2 percent to 16,685 long tons, the largest since 1930 (21,006 tons). All the crude spar imported in 1947, except 5 tons from Norway, originated in Canada.

Feldspar imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Crude		Ground		Year	Crude		Ground	
	Long tons	Value	Short tons	Value		Long tons	Value	Short tons	Value
1943	10,758	$83,073	41	$417	1946	16,365	$127,654	(1)	$2
1944	11,686	95,956	10	203	1947	16,685	124,587		
1945	14,924	114,917							

[1] Less than 1 ton.

Tonnages of ground feldspar designated by the merchant grinders as exports totaled 2,822 short tons in 1946 and 1,750 tons in 1947.

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

Principal destinations were Canada, Mexico, Puerto Rico, and England.

Cornwall Stone.—Imports of Cornwall stone from United Kingdom, the only source for this material, increased substantially in 1947 compared with 1946, although the totals were much less than in the 1939–41 period.

Cornwall stone imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Unmanufactured		Ground		Year	Unmanufactured		Ground	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1943	392	$5,591	20	$442	1946	456	$6,031	80	$1,806
1944	463	6,394	10	225	1947	706	9,522	148	3,124
1945	838	11,317	-------	--------					

NEPHELINE SYENITE

Nepheline syenite is a quartz-free crystalline rock consisting chiefly of nephelite (an alumina-potash-soda silicate) and albite and microcline feldspars. Often associated as impurities are the iron-bearing minerals, black mica and magnetite, and accessory minerals such as zircon and corundum. Its high alumina content 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, and glazes.

Domestic Deposits.—Although the nepheline syenite in New Jersey has been found to be unsuitable for ceramic use,[6] interest continues in possible commercial utilization of Arkansas nepheline syenite in ceramics, particularly where moderate amounts of iron-bearing impurities may be permissible.[7]

Another development was the new $3,000,000 roofing-granule plant established at Little Rock by the Minnesota Mining & Manufacturing Co. This firm utilizes crushed and sized Arkansas nepheline syenite in the production of artificially colored roofing granules. Although not in operation the entire year, a considerable volume of granules was shipped in 1947.

Uses.—A comprehensive description of nepheline syenite, its chemical and physical properties and industrial applications, was published.[8] Manufacture of semivitreous ware or semiporcelain, employing nepheline syenite and other Canadian raw materials, was described.[9] The use of dolomite combined with feldspar and with nepheline

[6] Wilkerson, A. S., and Comeforo, J. E., New Jersey Nepheline Syenite: Ceram. Age, vol. 48, No. 3, September 1946, p. 103.

[7] Crockett, William E., and Foxhall, Harold B., Preliminary Report of Occurrence and Properties of Nepheline Syenite in Arkansas: Am. Ceram. Soc. Bull., vol. 27, No. 2, Feb. 15, 1948, pp. 64–67; Arkansas Resources and Development Commission, Arkansas Moves Forward: Ann. Rept. for 1947, Little Rock, 1948, pp. 30, 36.

[8] Koenig, C. J., Developments Regarding Nepheline Syenite in Ceramics: Canadian Ceram. Soc. Jour., vol. 16, 1947, pp. 17–25.

[9] Phillipson, E. J., A Semiporcelain Body Using Canadian Raw Materials: Canadian Ceram. Soc. Jour., vol. 16, 1947, pp. 26–37.

syenite as an auxiliary flux in floor-tile bodies was studied.[10] An excellent annotated bibliography of the literature with respect to nepheline syenite, covering both domestic and foreign sources, was published in 1947.[11]

Prices.—No quotations on crude nepheline syenite are reported in the trade press; however, average values per short ton (estimated foreign market value) of imports for consumption in the United States since 1941 have shown a steady rise, interrupted only in 1947—1941, $3.13; 1942, $3.35; 1943, $3.49; 1944, $3.50; 1945, $3.77; 1946, $3.98; and 1947, $3.57. Quotations on ground nepheline syenite during the period 1944–46, as reported in Oil, Paint and Drug Reporter, remained unchanged at $12 per short ton for glass-grade (24-mesh) and $15.50 per ton for pottery-grade (200-mesh), with bagged material $2 a ton higher. In early February 1947, these quotations were raised to $13.75 per ton for glass-grade and $17.25 for pottery-grade. As of December 8 and continuing into the first months of 1948, the prices quoted were $14.25 per ton for glass-grade and $18.25 per ton for pottery-grade. On September 8 the price given for bagged nepheline syenite rose to $3 per ton, instead of $2 as heretofore quoted. Quotations, except for bagging, as reported above, are for bulk shipments, f. o. b. Rochester, N. Y.

Foreign Trade.—Imports for consumption of crude nepheline syenite in the United States in 1947 were 5 percent higher in tonnage than in 1946, rising to a new record—54,382 short tons. All imports of both crude and ground nepheline syenite originated in the Province of Ontario, Canada.

Nepheline syenite imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Crude		Ground		Year	Crude		Ground	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1943	43, 105	$150, 225	737	$7, 680	1946	51, 852	$206, 613	1, 018	$11, 137
1944	39, 043	136, 664			1947	54, 382	194, 283		
1945	51, 785	194, 975	1, 073	11, 461					

Canada.—The nepheline syenite consumed in ceramics in the United States has originated almost wholly from the Blue Mountain deposits of American Nepheline, Ltd., near Lakefield, Peterborough County, Ontario, Canada. Large additional reserves of low-corundum material have been proved in the original producing area as a result of extensive diamond drilling. More recently another low-corundum area has been discovered.[12] A new 300-ton mill was placed in operation in April 1947 at the mine site at Blue Mountain,[13] and operated at capacity throughout the rest of the year. The principal product of the mill is glass spar.

[10] Morse, George T., Use of Dolomite as an Auxiliary Flux in Floor Tile: Paper presented at Fall Meeting of White Ware, Materials, and Equipment and Design Divisions, Am. Ceram. Soc., Wernersville, Pa., Sept. 12–13, 1947.

[11] Koenig, C. J., Literature Abstracts Pertaining to Nepheline Syenites: Ohio State Univ. Eng. Exp. Sta. Bull. 130, Columbus, Ohio, 1947, 33 pp.

[12] Maclean Hunter Publishing Co., Ltd., Financial Post Survey of Mines of Canada and Newfoundland: Montreal, Canada, 1948, p. 241.

[13] Chemical Industries, vol. 61, No. 1, July 1947, pp. 132, 134.

Europe and Asia.—Other than in Canada and in the United States, deposits of nepheline syenite are known on the Kola Peninsula in Northern European U. S. S. R. A great deal of research has been undertaken in U. S. S. R. regarding the use of this material as a constituent in glass and enamel and as a source of alumina. No statistics of output are available. Partial substitution of nepheline syenite for soda ash also has been tried in India, and nepheline rock in Finland has been tested as a source of potash fertilizer and as raw material for the glass and ceramic industries.[14]

APLITE

By far, the principal market for aplite is in the manufacture of glass, especially for containers, with minor amounts for enamel. Demand for this product continued to expand in 1947; and in spite of a slackening of activity in the container field toward the end of the year, sales were 25 percent greater in 1947 than in the previous record year 1946. Sales, however, may not be shown, as to do so would reveal operations of individual companies. Aplite is produced only in Amherst and Nelson Counties, Va., near Piney River.

TECHNOLOGY

A discussion of the grades of feldspar used and blending and grinding practices for spar employed in enamel manufacture was presented.[15] The preparation and calculation of glaze formulas were discussed.[16]

The results of core drilling, mapping, sampling, and laboratory testing of feldspar in Llano County, Tex., were published.[17] In an investigation of the feldspar deposits in southwestern Texas, tests indicated that in addition to a muscovite mica concentrate suitable for roofing, a low-iron feldspar concentrate and a clean quartz tailing could be recovered.[18] Pilot-plant tests have shown that the alumina and soda in Wyoming anorthosite can be extracted and satisfactorily recovered by the lime-soda process.[19]

WORLD REVIEW

World output of feldspar in 1947 was estimated at 710,000 metric tons, about 3 percent greater than the 1946 figure. This total does not include output in several countries (notably Brazil, China, and U. S. S. R.), where feldspar is known to be produced but for which no data are available upon which to base even an estimate.

Large postwar increases in production in Norway, France, Italy, Sweden, and Japan and a larger number of lesser producing countries reduced the ratio of United States output to that of the world from 75 percent in 1946 to 66 percent in 1947.

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14 Hausen, H., (Nepheline Rock from Livaara [Kuusamo] a New Industrial Raw Material?): Finska Kemistsamfundets Medd., vol. 54, 1945, pp. 68–79; Chem. Abs., vol. 41, No. 12, June 20, 1947, p. 3718.

15 Brozsin, M. J., Mining and Grinding of Feldspar: Enamelist, vol. 23, No. 8, August 1946, pp. 12–16.

16 Jenkins, R. Horace, Glazes and Glaze Formulas: Ceram. Age, vol. 48, No. 4, April 1947, pp. 160, 162–163.

17 Huseman, George W., and McMillan, W. D., Badu Feldspar Deposit, Llano County, Tex.: Bureau of Mines Rept. of Investigations 4102, 1947, 11 pp.

18 Holt, Stephen P., and Bowsher, John A., Texas Mica and Feldspar Co., Culberson and Hudspeth Counties, Tex.: Bureau of Mines Rept. of Investigations 4009, 1947, 7 pp.

19 Brown, R. A., and others, Recovery of Alumina from Wyoming Anorthosite by the Lime-Soda Sinter Process: Bureau of Mines Rept. of Investigations 4132, 1947, 127 pp.

World production of feldspar, 1940–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1940	1941	1942	1943	1944	1945	1946	1947
Argentina (shipments)	1,220	2,981	5,622	2,000	3,468	5,375	4,755	5,000
Australia:								
New South Wales	64	452	1,469	3,890	4,756	3,785	(2)	(2)
South Australia [3]	1,072	1,081	1,026	522	818	955	1,317	1,958
Victoria	10	69	175	58	143	217	-------	(2)
Western Australia	3,561	4,173	3,304	2,351	1,990	1,254	1,822	1,246
Austria	(2)	(2)	(2)	(2)	(2)	(2)	(2)	951
Canada (shipments)	19,464	23,623	20,203	21,644	21,327	27,439	31,972	27,596
Chile	-------	-------	-------	8	-------	124	44	(2)
Czechoslovakia	(2)	(2)	(2)	(2)	(2)	5,944	7,171	(2)
Egypt	138	52	19	20	50	40	(2)	(2)
Eritrea	(2)	(2)	(2)	(2)	(2)	(2)	50	150
Finland	[4] 721	2,132	3,392	3,571	3,584	3,400	3,620	(2)
France	(2)	(2)	14,870	19,340	9,609	8,433	26,557	54,657
Germany: Bavaria	12,762	12,973	12,332	12,824	41,200	(2)	[5] 36,000	(2)
India	999	1,257	2,100	1,340	343	310	1,304	(2)
Italy	10,538	12,758	7,497	(2)	(2)	(2)	6,244	10,794
Japan	[6] 2,874	[6] 2,436	[6] 2,527	[6] 2,939	[6] 2,313	[6] 1,377	[7] 7,514	16,917
Madagascar	(2)	(2)	9	2	34	(2)	12	(2)
Norway	6,782	7,527	6,269	5,712	[4] 7,108	[4] 1,579	[4] 7,319	[4] 23,513
Palestine	(2)	(2)	(2)	85	65	37	53	(2)
Portugal	18	(2)	(2)	(2)	639	(2)	(2)	(2)
Rumania	2,127	749	1,383	1,261	(2)	(2)	(2)	(2)
Spain	(2)	(2)	4,251	1,093	2,567	[8] 1,400	2,804	2,049
Sweden	22,222	21,988	19,243	25,879	15,537	15,172	25,276	(2)
Union of South Africa	(2)	-------	-------	-------	669	635	(2)	(2)
United Kingdom: Northern Ireland	-------	-------	10	203	172	-------	-------	-------
United States (sold or used)	295,430	344,299	321,240	313,126	332,663	379,042	516,539	467,292
Uruguay	(2)	(2)	(2)	(2)	264	[5] 265	513	843
Total [9]	400,000	465,000	440,000	440,000	475,000	500,000	690,000	710,000

[1] In addition to countries listed, feldspar is produced in Brazil, China, and U. S. S. R., but data are not available.
[2] Data not available; estimate by author of chapter included in total.
[3] Includes some chinastone.
[4] Exports.
[5] Estimate.
[6] Preliminary data for fiscal year ended March 31 of year following that stated.
[7] January to October, inclusive.
[8] January to September, inclusive.
[9] Estimated by author of chapter. No estimates included for countries listed in footnote 1.

Ferro-Alloys

By NORWOOD B. MELCHER

GENERAL SUMMARY

A 22-PERCENT increase in ferro-alloy production in the United States during 1947 was brought about by increases of 27 percent in the output of steel ingots and castings and 22 percent in alloy-steel production during the year.

Requirements for alloys containing elements used as scavengers for removing impurities in the process of making steel, especially manganese and silicon, follow the pattern of total steel production, whereas metals used mainly for alloying purposes vary with the alloy-steel requirements. Tungsten, although an alloying metal, finds its main use in the manufacture of cutting tools, and therefore the demand for this metal follows the trend in industrial activity and tends to parallel total output of steel ingots. Except for molybdenum, silicon, and vanadium, the United States depends largely on foreign sources for ores needed in the manufacture of ferro-alloys. Imports of ores for the manufacture of ferro-alloys continued at record or near-record levels throughout 1947.

The dependence upon imports for many of the ferro-alloying ores has resulted in these materials being given special consideration in strategic stock-piling. All of these ores except molybdenum are classified by the Munitions Board under Group A, comprising those strategic and critical materials for which stock-piling is deemed the only satisfactory means of insuring an adequate supply for a future emergency.

Several of the ferro-alloying ores and metals are discussed in detail in chapters of this volume dealing with particular metals; these chapters are: Chromium, Manganese, Molybdenum, Titanium, Tungsten, Vanadium, and Minor Metals.

PRODUCTION AND SHIPMENTS

The production of ferro-alloys in 1947 totaled 1,813,783 net tons, compared with 1,480,975 tons in 1946, an increase of 22 percent. In 1947 ferro-alloys were made at 15 blast-furnace plants, 17 electric-furnace plants, and 2 aluminothermic-furnace plants; in addition, 2 plants using electric furnaces produced ferrosilicon, and 6 produced ferrophosphorus as a byproduct. Shipments of all classes of ferro-alloys from furnaces increased 19 percent in quantity and 25 percent in value over 1946. Pennsylvania again was the largest producer and shipper of ferro-alloys in 1947, the output being proportionately larger than in 1946. This State supplied 31 percent of the United States total tonnage and 36 percent of the value, compared with 29 percent and 33 percent, respectively, in 1946. New York was second, supplying 19 percent of the tonnage and 24 percent of the value. Production and shipments of ferro-alloys also were reported from Alabama, California, Colorado, Florida, Indiana, Iowa, New Jersey, Ohio, Oregon, South Carolina, Tennessee, Virginia, Washington, and West Virginia.

Ferro-alloys produced and shipped from furnaces in the United States, 1946–47

Alloy	1946			1947		
	Production (net tons)	Shipments		Production (net tons)	Shipments	
		Net tons	Value		Net tons	Value
Ferromanganese	491,973	493,808	$61,355,778	614,626	614,647	$79,972,673
Spiegeleisen	111,696	114,982	3,793,673	134,329	124,517	4,980,030
Ferrosilicon	614,422	681,812	38,965,488	769,653	766,316	53,271,432
Ferrophosphorus	28,747	14,315	832,408	33,072	81,169	2,016,122
Ferrotungsten	1,350	1,491	4,310,055	2,094	2,101	6,677,298
Ferrotitanium Ferrovanadium	6,188	7,193		7,681	8,189	
Ferromolybdenum Molybdic oxide Calcium molybdate and compounds	9,901	11,844	67,016,253	13,195	13,142	73,104,419
Other ferro-alloys [1]	216,698	226,179		239,133	231,601	
Total	1,480,975	1,551,624	176,273,655	1,813,783	1,841,682	220,021,974

[1] Silicomanganese, manganese briquets, ferrochromium, ferrocolumbium, ferroboron, zirconium-ferrosilicon, and miscellaneous ferro-alloys.

Ferromanganese.—The ferromanganese produced in 1947 averaged 79 percent manganese and came from three electric and nine blast-furnace plants. Of the manganese ore used in 1947 for the manufacture of ferromanganese, 91 percent was foreign, compared with 90 percent in 1946. During 1947 steel producers used 14.5 pounds of metallic manganese as ferro-alloys per ton of steel produced. Of this quantity, 13.0 pounds were in the form of ferromanganese. A total of 732,619 short tons of ferromanganese was consumed during the year, virtually all by the iron and steel industry.

Spiegeleisen.—The production of spiegeleisen in 1947 increased 20 percent over 1946, but shipments from furnaces increased only 8 percent. The output came from five blast-furnace plants and averaged 21.9 percent Mn compared with 20.3 percent in the previous year. Shipments from furnaces in 1947 totaled 124,517 tons valued at $4,980,030 f. o. b. furnaces, or $39.99 per ton, compared with $32.99 per ton in 1946 and $32.38 in 1945. Four-tenths pound of metallic manganese in the form of spiegeleisen was used per ton of steel produced in 1947.

Ferrosilicon.—Shipments of ferrosilicon from furnaces during 1947 accounted for 42 percent of the total tonnage of ferro-alloys shipped during the year, and the value of shipments represented 24 percent of the total. Of the 769,653 tons of ferrosilicon produced, 37 percent or 285,197 tons were made in blast furnaces and 63 percent (484,456 tons) in electric furnaces. Included in the latter figure are 590 tons of ferrosilicon produced as a byproduct in the manufacture of artificial abrasives. The ferrosilicon made in blast furnaces (silvery pig iron) contained 9.9 percent silicon. Electric-furnace output, mostly ferrosilicon containing over 20 percent Si, averaged 38.5 percent. Shipments of all grades of ferrosilicon, including silvery pig iron, totaled 766,316 net tons valued at $53,271,432.

Consumption of ferrosilicon, silicon metal, and miscellaneous silicon alloys in the United States in 1947, by industries, in net tons

Alloy	Steel ingots and castings [1]	Steel castings [1]	Miscellaneous	Total
Silvery pig iron:				
5–20 percent silicon	71, 581	19, 749	326, 234	417, 564
Ferrosilicon:				
50 percent silicon	144, 859	14, 758	15, 890	175, 507
75 percent silicon	39, 735	226	2, 306	42, 267
Other grades [2]	31, 858	550	67, 943	100, 351
	288, 033	35, 283	412, 373	735, 689

[1] Data for castings made by companies that also produce steel ingots are included with "Steel ingots and castings" and excluded from "Steel castings."
[2] Includes grades of ferrosilicon not listed separately, silicon metal, and miscellaneous silicon alloys.

In 1947 plants producing both steel ingots and castings consumed 17 percent of the silvery pig iron. Companies that produced steel castings but no steel ingots (steel foundries) used 5 percent, and miscellaneous users—mainly gray-iron foundries—used 78 percent. Of the standard 50-percent ferrosilicon, 83 percent was used by manufacturers of steel ingots and castings, 8 percent by steel foundries, and 9 percent by iron foundries. Steel plants used 94 percent of the 75-percent ferrosilicon, while iron foundries used less than 6 percent and steel foundries less than 1 percent. Iron foundries used 67 percent of the "Other grades," whereas steel-ingot producers and steel foundries used 32 percent and 1 percent, respectively. The most important grade of ferrosilicon is the standard 50 percent, which is employed as a deoxidizer and solidifier in the manufacture of most grades of killed and semikilled steel. Only a small quantity of this alloy is used in iron foundries and other industries. Alloys containing 75 percent silicon and miscellaneous silicon alloys are used as ladle additions in gray-iron foundries and in the manufacture of high-silicon steel for use in electrical equipment and high-silicon spring steel. The accompanying table shows the consumption of the various grades of silicon alloys according to major consuming industry groups.

Ferrophosphorus.—All ferrophosphorus in 1947 was produced in electric furnaces as a byproduct in the manufacture of phosphate fertilizers and other chemicals. Increased demands for ferrophosphorus for metallurgical and chemical uses in 1947 resulted in substantial shipments of this material from stocks at producing plants during the year. Although production totaled 33,072 tons, a 15-percent increase over 1946, shipments from plants totaled 81,169 tons or nearly six times those of 1946.

Ferrotungsten.—The ferrotungsten produced in the United States during 1947 was made in electric furnaces using both foreign and domestic ores. Total consumption of tungsten concentrates in the United States was about 8,200 net tons (60-percent WO_3 basis) in 1947, compared with 6,800 tons in 1946. The domestic material was obtained from eight States and Alaska, but three States—Nevada, North Carolina, and California—supplied 93 percent of the total. Imports of tungsten ores and concentrates in 1947, were equivalent to 9,459 net tons of 60 percent WO_3, a 32-percent gain over 1946. These ores and concentrates came from 18 foreign countries in 1947, but 5—Bolivia, Brazil, China, Korea, and Spain—supplied 74 percent of the total.

Ferrochromium.—All of the ferrochromium output in the United States in 1947 was produced in electric furnaces, virtually all from foreign ores. Reported domestic consumption of ferrochromium in 1947 totaled 113,491 net tons, compared with 122,562 tons in 1946 and 144,447 tons in 1945. The consumption of ferrochromium canvassed by the Bureau of Mines represents about 85 percent of the total. Exports in 1947 totaled 3,081 net tons valued at $1,057,359, compared with 2,510 tons valued at $732,221 in 1946. Imports amounted to 10,680 net tons, compared with only 1,460 tons in 1946.

Ferromolybdenum.—The ferromolybdenum produced in 1947 was made at Langeloth and Washington, Pa., by electric and aluminothermic processes mostly from domestic ore.

Producers of ferro-alloys in the United States in 1947

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, sodium molybdate.
Colorado Fuel & Iron Corp	Pueblo, Colo	Ferromanganese.
Electro Metallurgical Co	Alloy, W. Va. Columbiana, Ohio Holcomb Rock, Va. Niagara Falls, N. Y. Portland, Oreg Sheffield, Ala	Ferromanganese, silicomanganese, manganese briquets, ferrosilicon, silicon briquets, zirconium-ferrosilicon, ferrochromium, chromium briquets, ferrotungsten, ferrovanadium, ferroboron, 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, silvery pig iron.
E. J. Lavino & Co	Reusens, Va Sheridan, Pa	Ferromanganese.
Metal & Thermit Corp	Jersey City, N. J	Ferrotitanium.
Molybdenum Corp. of America	Washington, Pa	Ferrotungsten, ferromolybdenum, calcium molybdate, molybdenum oxide, ferroboron, manganese boride.
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.
Oldbury Electro-Chemical Co	Niagara Falls, N. Y.	Ferrophosphorus (byproduct).
Permanente Metals Corp	Permanente, Calif	Ferrosilicon, silicon briquets.
Pittsburgh Metallurgical Co	Charleston, S. C Niagara Falls, N. Y.	Ferrosilicon, silvery pig iron, ferrochromium.
Sloss-Sheffield Steel & Iron Co	N. Birmingham, Ala.	Ferromanganese.
Southern Ferro Alloys Co	Chattanooga, Tenn.	Ferrosilicon, silicon briquets.
Tennessee Products & Chemical 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 Clairton, Pa Duquesne, Pa Etna, Pa	Ferromanganese, spiegeleisen.
Vanadium Corp. of America	Niagara Falls, N. Y. Bridgeville, Pa	Ferrosilicon, silicon briquets, alsifer, ferrochromium, ferrovanadium, ferrotitanium, grainals.
Victor Chemical Works	Mt. Pleasant, Tenn.	Ferrophosphorus (byproduct).
Virginia-Carolina Chemical Corp	Nichols, Fla	Ferrophosphorus (byproduct).

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 much less expensive than ferromolybdenum and consequently are used to a greater extent. As with ferromolybdenum, these compounds were made almost entirely from domestic raw materials in 1947.

Ferrotitanium.—Most of the ferrotitanium produced in 1947 was made in electric furnaces, but a small quantity was made by the aluminothermic process. The ferrotitanium produced in 1947 averaged 19 percent titanium as in 1946, and both foreign and domestic ores (ilmenite and rutile) were consumed in its manufacture. Ferrotitanium is used as a deoxidizer and scavenger in steel manufacturing. When employed 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 metal, titanium prevents intergranular corrosion.

Ferrovanadium.—All ferrovanadium produced in 1947 was made in electric furnaces, and both foreign and domestic ores were used in its manufacture. The alloy averaged 45 percent V in 1947, compared with 43 percent in 1946.

Ferroboron.—Shipments of ferroboron in 1947 averaged 16.2 percent B. Ferroboron is used in special steels as a hardening agent, but it is also a highly efficient deoxidizer.

Ferrocolumbium.—Ferrocolumbium is used in some stainless steels to prevent intergranular corrosion. It also reduces air hardening and oxidation at high temperatures in chromium steels. In 1947 the output of ferrocolumbium averaged 55 percent Cb and was produced in electric furnaces.

Zirconium-Ferrosilicon.—The zirconium-ferrosilicon produced in 1947 averaged 14 percent Zr as in 1946. Zirconium, a powerful deoxidizer and scavenger, reduces age hardening and thereby improves deep-drawing properties of sheet steel. It is used instead of ordinary ferrosilicon and is more effective.

Silicomanganese.—The silicomanganese produced in 1947 averaged 67 percent manganese and was made in electric furnaces. This alloy is used mainly by the steel industry in the manufacture of steel ingots.

Manganese Briquets.—The foundry industry is the principal user of manganese briquets, which are added to molten iron to overcome the harmful effects of sulfur and to act as a deoxidizer and a scavenger. The briquets produced in 1947 averaged 57 percent manganese.

FOREIGN TRADE [1]

Ferromanganese was the chief ferro-alloy import in 1947, although important quantities of ferrochromium and ferrosilicon were received. Imports and exports of the rarer ferro-alloys are not recorded separately but are grouped as shown in the following tables.

[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.

Ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1946–47,[1] by varieties

[U. S. Department of Commerce]

Variety of alloy	1946 Gross weight (net tons)	1946 Content (net tons)	1946 Value	1947 Gross weight (net tons)	1947 Content (net tons)	1947 Value
Calcium silicide (calcium-silicon content)	(2)	331	$87,647			
Chrome or chromium metal	1	(2)	31	(3)	(2)	$4
Ferrochrome or ferrochromium containing 3 percent or more of carbon	1,460	992	251,926	10,680	6,450	1,725,400
Ferromanganese:						
Containing not over 1 percent carbon	52	43	15,428			
Containing over 1 and less than 4 percent carbon	8,521	6,991	1,686,723	9,154	7,534	1,723,148
Containing not less than 4 percent carbon	23,557	18,874	2,790,905	72,153	57,647	9,123,888
Ferrosilicon	12,598	1,331	260,695	13,859	2,141	465,360
Ferrotitanium	4	(2)	2,207	45	(2)	27,766
Manganese-boron, manganese metal, and spiegeleisen not more than 1 percent carbon (manganese content)	(2)	(3)	77	(2)	(3)	11
Manganese-silicon (manganese content)	(2)	114	20,892			
Silicon-aluminum and aluminum-silicon	5	(2)	1,040	(4)	(2)	8
Spiegeleisen (more than 1 percent carbon)	360	(2)	17,512			
Tungsten and combinations, in lumps, grains, or powder:						
Tungsten metal (tungsten content)	(2)	6	19,076	(2)	5	18,414
Combinations containing tungsten or tungsten carbide (tungsten content)	(2)	(5)	143			
Tungstic acid				(2)	4	148

[1] Changes for table in Minerals Yearbook, 1946, p. 506, are as follows: Ferrochrome or ferrochromium containing 3 percent or more carbon in 1945 should read: Gross weight, 6,432 tons; content, 4,334 tons; value, $999,889.
[2] Not recorded. [3] Less than 1 pound. [4] 50 pounds. [5] 2 pounds.

Ferromanganese and ferrosilicon imported for consumption in the United States, 1946–47, by countries

[U. S. Department of Commerce]

Country	Ferromanganese (manganese content) 1946 Net tons	1946 Value	1947 Net tons	1947 Value	Ferrosilicon (silicon content) 1946 Net tons	1946 Value	1947 Net tons	1947 Value
Canada	18,313	$2,907,253	54,809	$8,697,897	1,331	$260,695	2,141	$465,360
Norway	7,595	1,585,803	10,372	2,149,139				
	25,908	4,493,056	65,181	10,847,036	1,331	260,695	2,141	465,360

Ferro-alloys and ferro-alloy metals exported from the United States, 1943–47, by varieties

[U. S. Department of Commerce]

Variety of alloy	1943 Net tons	1943 Value	1944 Net tons	1944 Value	1945 Net tons	1945 Value	1946 Net tons	1946 Value	1947 Net tons	1947 Value
Spiegeleisen	314	$10,123	202	$6,508	2,393	$82,699	7,513	$271,827	305	$12,632
Ferrochrome	2,360	759,362	532	175,698	1,471	487,755	2,510	732,221	3,081	1,057,359
Ferromanganese	12,510	1,717,888	600	101,445	836	175,556	2,951	381,194	20,168	2,811,653
Ferromolybdenum	558	710,224	2,214	2,665,920	884	1,050,863	370	456,574	477	630,813
Ferrophosphorous	116	8,531	41	3,440	603	42,204	1,228	80,037	6,041	241,464
Ferrosilicon	28,963	1,817,483	2,483	283,360	1,089	114,520	3,163	244,625	1,357	187,973
Ferrotitanium and ferrocarbon-titanium	752	103,133	792	125,987	744	122,887	550	63,723	509	80,590
Ferrotungsten	516	1,503,724	1,177	3,664,242	431	1,344,281	91	270,325	41	134,546
Ferrovanadium	222	518,322	596	2,212,490	86	246,862	57	161,289	89	266,040
Other ferro-alloys	300	92,239	143	176,111	73	33,016	218	61,489	206	88,289
	46,611	7,241,029	8,780	9,415,201	8,610	3,700,643	18,651	2,723,304	32,274	5,511,359

Fluorspar and Cryolite

By HUBERT W. DAVIS [1]

FLUORSPAR

GENERAL SUMMARY

PRODUCTION, shipments, and consumption of fluorspar in the United States established peacetime records in 1947; moreover, production and shipments had been exceeded in only 1942, 1943, and 1944 and consumption in only 1943 and 1944. Imports of fluorspar into the United States were also at a high rate in 1947 (2.6 times those of 1946) but were 25 percent below the peak established in 1945. The higher level of operations in the steel and hydrofluoric acid industries, coupled with record demand for fluorspar by the ceramic trade, was chiefly responsible for the greatly accelerated activity in fluorspar in 1947.

Illinois maintained its rank as the premier producer of fluorspar in 1947 by supplying 51 percent of the total domestic shipments. The steel industry continued to be the predominant user of fluorspar and accounted for proportionately more (55 percent) of the total consumed in 1947 than in 1946 (53 percent). Reversing a downward trend that had persisted for four consecutive years, the average consumption of fluorspar per ton of basic open-hearth steel produced turned upward to 5.54 pounds in 1947 compared with 5.39 pounds in 1946. The hydrofluoric-acid industry, the second largest utilizer of fluorspar, although using 20 percent more than in 1946, accounted for 27 percent of the total compared with 28 percent in 1946. Usage of fluorspar by the glass and enamel trades established new records in 1947.

Deliveries of fluorspar to consumers in the United States totaled 397,465 short tons in 1947 (319,195 tons from domestic mines and 78,270 tons from foreign sources); in addition, 9,109 tons of finished

[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.

Salient statistics of fluorspar in the United States, 1938–47, in short tons

Year	Shipments from domestic mines	Foreign trade		Consumption	Industry stocks at end of year		
		Imports for consumption	Exports		Consumers' plants	Domestic mines [1]	Total
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	124,959
1944	413,781	87,200	1,980	410,170	98,446	19,021	117,467
1945	323,961	104,925	1,420	356,090	103,148	19,863	123,011
1946	277,940	29,852	1,729	303,190	98,663	18,957	117,620
1947	329,484	78,725	1,180	376,138	114,150	33,101	147,251

[1] Finished fluorspar only.

fluorspar from domestic mines were delivered to Government stock pile. In 1946, deliveries to consumers totaled 298,367 tons (272,304 tons from domestic mines and 26,063 tons from foreign sources); in addition, 3,907 tons of finished fluorspar were delivered to Government stock pile. Total deliveries to steel plants in the United States advanced to 230,224 tons (154,614 tons in 1946), and those to hydrofluoric-acid plants increased to 102,013 tons (84,190 tons in 1946); sales to glass and enamel plants rose to 50,054 tons (47,483 tons in 1946).

The average composite selling price ($32.48 a short ton) of all grades of fluorspar (both domestic and foreign) delivered to consumers in the United States in 1947 was $0.48 more than in 1946.

Public Law 384, granting a permanent 15-percent depletion allowance on fluorspar-mining company taxes, was signed by President Truman on August 8, 1947.

Hourly wage increases of 6 to 10 cents were made by many fluorspar-mining companies in 1947.

The total quantity of fluorspar shipped in and imported into the United States from about 1870 through 1947 was approximately 8,365,000 short tons, comprising about 83 percent from domestic mines and 17 percent from foreign sources.

RESERVES

The following information on reserves of fluorspar in the United States was prepared by the Bureau of Mines and Geological Survey and published in hearings before a subcommittee of the Committee on Public Lands, United States Senate, Eightieth Congress, first session, 1947, pages 242–245.

The largest fluorspar deposits in the United States are in the districts and States that are now producing the largest amounts of fluorspar; accordingly, by far the largest reserves of fluorspar are in the Kentucky-Illinois field and the next largest in Colorado and in New Mexico. Other States having important but less-developed fluorspar resources are Nevada, Texas, Utah, Idaho, Montana, Arizona, California, and Wyoming. In Alaska, fluorspar deposits are known at the Lost River tin mine on Seward Peninsula, and fluorite has been reported from Zarembo Island and from a locality near Wrangell in southeastern Alaska, but no fluorspar has been mined.

The accompanying table shows the available fluorspar reserves of the United States as of January 1944. The group containing 35 percent or more of CaF_2

includes nearly all the known deposits that are workable under economic and technologic conditions similar to those in 1944, as well as some deposits that cannot now be mined economically because they are remote from markets, are subject to unusually high mining or milling costs, or contain excessive amounts of undesirable impurities. In some areas it is not profitable to mine fluorspar containing less than 50 percent of CaF_2. A very few deposits, omitted from this group because they contain less than 35 percent of CaF_2, may be minable even though they contain as little as 30 percent of CaF_2, because they are near markets and are of such type that they can be easily mined and processed. Deposits containing less than 1,000 tons have been excluded from the summary.

The estimates of material containing 15 to 34 percent of CaF_2 are based on incomplete data and are believed to be conservative. Relatively few deposits of this grade have been investigated. Material containing less than 15 percent of CaF_2 has not been included in the estimate because there seems little likelihood that it will be utilized until so far into the future as to have little significance at present.

The estimated reserves of fluorspar in ore containing 35 percent or more of CaF_2 are equivalent to roughly 20 years' supply at the wartime rate of use and about 40 years' supply at the average rate from 1935 to 1939. However, known resources of fluorspar ore could not support production sufficient to take care of full domestic needs for the 20 to 40 years mentioned because of the declining rate of production that accompanies depletion. Insufficient data are available to estimate productivity of deposits that are not minable under economic and technologic conditions existing in 1944. A rough estimate of 10 to 25 years of normal prewar supply in material containing from 15 to 34 percent of CaF_2 is probably conservative.

Estimated fluorspar reserves of the United States as of January 1944, by regions, in short tons

Region	Material (ore) containing 35 percent or more of CaF_2					
	Measured	Indicated	Inferred	Total crude material	CaF_2 content	Average grade (estimated percent CaF_2)
Kentucky and Illinois	1,722,000	2,328,000	7,000,000	11,050,000	5,525,000	50
Rocky Mountain States (Colorado, Utah, Idaho, Wyoming, Montana)	104,000	782,000	1,250,000	2,136,000	961,200	45
Southwestern States (Arizona, New Mexico, Texas)	102,000	209,000	800,000	1,111,000	610,500	55
Pacific Coast States and Nevada	7,000	30,000	80,000	117,000	81,900	70
All other States			4,000	4,000	2,000	50
Alaska		56,000	250,000	306,000	128,500	42
Total	1,935,000	3,405,000	9,384,000	14,724,000	7,309,100	49

Region	Material containing 15 to 34 percent of CaF_2 [1] (measured, indicated, and inferred)			Total	
	Crude material	CaF_2 content (estimated)	Average grade (estimated percent CaF_2)	Crude material	CaF_2 content
Kentucky and Illinois	4,500,000	675,000	15	15,550,000	6,200,000
Rocky Mountain States (Colorado, Utah, Idaho, Wyoming, Montana)	3,500,000	700,000	20	5,636,000	1,661,200
Southwestern States (Arizona, New Mexico, Texas)	1,000,000	200,000	20	2,111,000	810,500
Pacific Coast States and Nevada	450,000	90,000	20	567,000	171,900
All other States	140,000	28,000	20	144,000	30,000
Alaska	2,000	400	20	308,000	128,900
Total	9,592,000	1,693,400	18	24,316,000	9,002,500

[1] Based on incomplete data and believed to be conservative.

PRODUCTION AND SHIPMENTS

Production of finished fluorspar totaled 343,700 short tons in 1947, including 151,110 tons of flotation concentrates. However, the production also included 5,100 tons of finished fluorspar recovered from milling about 13,000 tons of crude ore that had been mined before 1947. Thus, total mine production (expressed in terms of finished fluorspar) was 338,600 tons in 1947 compared with 271,600 tons in 1946. Of the mine production in 1947, 7 mines (producing over 10,000 tons each) supplied 122,800 tons or 36 percent, 17 mines (producing 5,000 to 10,000 tons each) supplied 117,000 tons or 35 percent, 30 mines (producing 1,000 to 5,000 tons each) supplied 68,200 tons or 20 percent, and 11 mines (producing 500 to 1,000 tons each) supplied 8,000 tons or 2 percent; thus, 65 mines produced 316,000 tons or 93 percent of the total. Of the remaining output (22,600 tons or 7 percent), some (in quantities ranging from a few tons to 500 tons) came from an undetermined number of small mines and prospects, but much was derived from treating tailings from previous milling operations.

In 1947 mines operated by consumers produced 99,300 tons of finished fluorspar compared with 60,800 tons in 1946.

Fluorspar shipments from domestic mines in 1947 aggregated 329,484 short tons valued at $10,954,875, increases of 19 percent in quantity and 21 percent in value over 1946. Of the 1947 total, 60,630 tons were shipped by river or river-rail for delivery to consumers as compared with 51,428 tons in 1946.

Illinois (51 percent) and Kentucky (27 percent) supplied 78 percent of the fluorspar shipped in 1947 compared with 78 percent also in 1946. Shipments from Illinois and Kentucky were 18 percent more than in 1946 compared with a gain of 20 percent from other producing States.

The average value of all grades of finished fluorspar shipped in 1947 ($33.25 a short ton) established a new peak and was $0.73 more than the previous high of 1946.

The accompanying tables show shipments of fluorspar, by States.

Flourspar shipments in 1947 comprised 180,425 tons of fluxing gravel (including 19,110 tons of flotation concentrates, which were blended with fluxing gravel) and foundry lump, 149,058 tons of ground and flotation concentrates, and 1 ton of acid lump. The bulk of the fluxing-gravel and foundry-lump fluorspar was shipped to steel plants

Fluorspar shipped from mines in the United States, 1946–47, by States

State	1946			1947		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Colorado	32,539	$925,867	$28.45	32,153	$950,882	$29.57
Illinois	154,525	5,493,642	35.55	167,157	6,148,654	36.78
Kentucky	63,143	1,889,454	29.92	90,256	2,713,508	30.06
New Mexico	17,584	489,607	27.84	27,526	841,095	30.56
Arizona	389	7,959	20.46	1,601		
Nevada	6,234			8,042	300,736	24.27
Texas	1,118	232,440	23.82	1,019		
Utah	2,370			1,730		
Washington	38					
	277,940	9,038,969	32.52	329,484	10,954,875	33.25

Fluorspar shipped[1] from mines in the United States, by States, 1943–47, with shipments of maximum year and cumulative shipments from earliest record to end of 1947, in short tons[2]

State	Maximum shipments		Shipments by years					Total shipments[1] from earliest record to end of 1947
	Year	Quantity	1943	1944	1945	1946	1947	
Arizona	1939	1,608	1,328	976	1,126	389	1,601	14,025
California	1934	181	134	26				341
Colorado[3]	1944	65,209	49,145	65,209	52,437	32,539	32,153	506,106
Illinois[3]	1943	198,789	198,789	176,259	147,251	154,525	167,157	3,696,113
Kentucky[3]	1941	142,862	109,849	112,791	95,142	63,143	90,256	2,366,013
Nevada	1941	8,967	8,653	7,293	7,038	6,234	8,042	77,487
New Hampshire	1917	1,274						8,302
New Mexico	1944	42,973	37,050	42,973	14,449	17,584	27,526	263,185
Tennessee	1906	360	57					1,197
Texas	1944	4,769	960	4,769	3,413	1,118	1,019	11,384
Utah	1944	3,466	51	3,466	2,973	2,370	1,730	15,468
Washington	1945	132			132	38		382
Wyoming	1944	19		19				19
	1944	413,781	406,016	413,781	323,961	277,940	329,484	6,960,022

[1] Figures for 1880–1905 represent production.
[2] Quantity and value figures, by States, for years 1880 to 1925 in Mineral Resources, 1925, pt. 2, pp. 13–14, and for 1910 to 1940 in Minerals Yearbook, Review of 1940, p. 1297.
[3] 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 (estimated) included in "Total shipments" column as follows: Colorado, 4,400 tons; Illinois, 20,000 tons; and Kentucky, 600 tons.

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 Government stock pile. Of the ground and flotation concentrates shipped in 1947, hydrofluoric-acid plants took 60 percent and glass and enamel plants 33 percent; the remainder went chiefly to aluminum- and magnesium-reduction works, to manufacturers of steel, ferro-alloys, and welding rods, and to smelters of secondary metals.

The accompanying table shows shipments of fluorspar, by grades and industries, in 1946 and 1947.

Fluorspar shipped from mines in the United States, 1946–47, by grades and industries, in short tons

Grade and industry	1946	1947	Grade and industry	1946	1947
Fluxing gravel and foundry lump:			Acid lump:		
Ferrous	[1] 134,822	[1] 165,281	Ferrous	15	
Nonferrous	1,410	1,734	Nonferrous	2	1
Cement	661	812	Hydrofluoric acid	267	
Miscellaneous	175	3,489		284	1
Government stock pile	3,907	9,109	Total:		
	[1] 140,975	[1] 180,425	Ferrous	140,776	171,862
			Nonferrous	3,643	2,518
Ground and flotation concentrates:			Cement	661	812
			Glass and enamel	47,377	49,559
Ferrous	[1 2] 5,939	[1 2] 6,581	Hydrofluoric acid	79,047	89,667
Nonferrous	2,231	783	Miscellaneous	800	4,777
Glass and enamel	47,377	49,559	Government stock pile	3,907	9,109
Hydrofluoric acid	78,780	89,667	Exported	1,729	1,180
Miscellaneous	625	1,288		277,940	329,484
Exported	1,729	1,180			
	[1 2] 136,681	[1 2] 149,058			

[1] Fluxing gravel includes (and flotation concentrates exclude) the following quantities of flotation concentrates blended with fluxing gravel: 1946, 9,129 tons; 1947, 19,110 tons.
[2] Includes pelletized gravel.

SHIPMENTS, BY USES

As is evident from the accompanying table and figure 1, the predominant purchaser of fluorspar is the steel industry, which also consumes substantial quantities of hydrofluoric acid and sodium fluoride, for which fluorspar is the basic material.

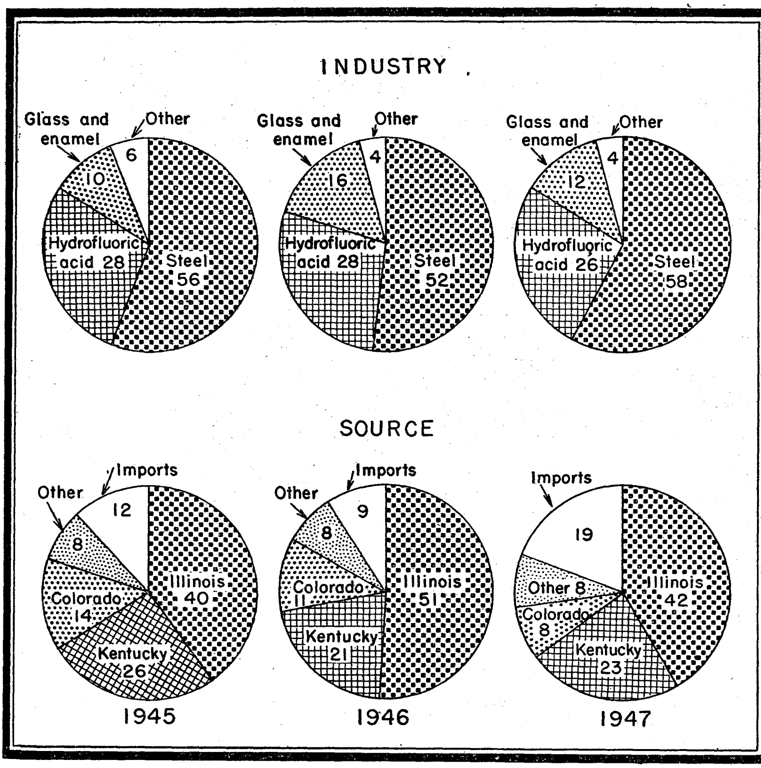

FIGURE 1.—Fluorspar sales (domestic and foreign) to consumers in the United States, 1945–47, by consuming industries and sources, in percent.

Fluorspar shipped from mines in the United States, 1946–47, by uses

Use	1946				1947			
	Quantity		Value		Quantity		Value	
	Percent of total	Short tons	Total	Average	Percent of total	Short tons	Total	Average
Steel	48.3	134,295	$3,843,038	$28.62	50.2	165,427	$4,799,531	$29.01
Iron foundry	1.8	4,855	137,507	28.32	1.3	4,439	133,728	30.13
Glass	14.3	39,837	1,306,005	32.78	12.4	40,843	1,434,905	35.13
Enamel	2.7	7,540	262,530	34.82	2.6	8,716	315,491	36.20
Hydrofluoric acid	28.5	79,047	3,111,291	39.36	27.2	89,667	3,662,409	40.84
Miscellaneous	2.4	6,730	221,001	32.84	3.1	10,103	346,532	34.30
Government stock pile	1.4	3,907	93,800	24.01	2.8	9,109	218,600	24.00
Exported	.6	1,729	63,797	36.90	.4	1,180	43,679	37.02
	100.0	277,940	9,038,969	32.52	100.0	329,484	10,954,875	33.25

STOCKS AT MINES OR SHIPPING POINTS

According to the reports of producers, the quantity of fluorspar in stock at mines or shipping points at the close of 1947 totaled 91,433 tons, or 1.3 percent more than in 1946. These stocks comprised 33,101 tons of finished fluorspar and 58,332 tons of crude fluorspar (calculated to be equivalent to 29,000 tons of finished fluorspar).

Stocks of fluorspar at mines or shipping points in the United States, Dec. 31, 1946 and 1947, by States, in short tons

State	1946			1947		
	Crude [1]	Finished	Total	Crude [1]	Finished	Total
California	150		150	150		150
Colorado	4,207	579	4,786	7,135	674	7,809
Idaho	50		50	50		50
Illinois	28,814	10,006	38,820	23,545	15,313	38,858
Kentucky	3,129	8,007	11,136	8,266	16,526	24,792
Nevada					41	41
New Mexico	[2] 34,939	226	[2] 35,165	19,186	395	19,581
Texas					103	103
Utah		139	139		49	49
	[2] 71,289	18,957	[2] 90,246	58,332	33,101	91,433

[1] This crude (run-of-mine) fluorspar must be beneficiated before it can be marketed.
[2] Revised figure.

CONSUMPTION AND CONSUMERS' STOCKS

Fluorspar (domestic and foreign) consumed and in stock in the United States, 1946–47, by industries, in short tons

Industry	1946			1947		
	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	145,631	65,341	3,005	189,773	77,820	4,488
Electric-furnace steel	14,898			19,481		
Bessemer steel	206			141		
Iron foundry	4,925	1,165	66	4,089	1,759	171
Ferro-alloys	2,044	927		2,478	870	101
Hydrofluoric acid [1]	83,901	17,431	1,810	100,363	19,693	554
Primary aluminum [2]	1,417	1,182		896	909	
Primary magnesium						
Glass	39,852	7,136	1,414	42,130	7,682	692
Enamel	6,739	1,946	283	8,938	1,780	243
Cement	608	1,262		811	1,263	
Welding rod	417	181		7,038	2,374	238
Miscellaneous	2,552	2,092	125			
	303,190	98,663	6,703	376,138	114,150	6,487

[1] Fluorspar used in making artificial cryolite and aluminum fluoride (aluminum raw materials) is included in the figures for hydrofluoric acid, which is an intermediate in their manufacture.
[2] Figures on consumption represent fluorspar used as a flux; see footnote 1.

Production of basic open-hearth steel and consumption and stocks of fluorspar (domestic and foreign) at basic open-hearth steel plants, 1943–47

	1943	1944	1945	1946	1947
Production of basic open-hearth steel ingots and castings .... long tons	69,695,000	71,387,000	64,510,000	54,034,000	68,506,000
Consumption of fluorspar in basic open-hearth steel production .... short tons	205,676	201,788	176,488	145,631	189,773
Consumption of fluorspar per long ton of basic open-hearth steel made .... pounds	5.9	5.7	5.5	5.4	5.5
Stocks of fluorspar at basic open-hearth steel plants at end of year .... short tons	57,200	53,100	63,900	61,600	68,400

Fluorspar (domestic and foreign) consumed in the United States, 1927–47, in short tons

Year	Steel	Hydrofluoric acid	Glass	Enamel	Iron foundry and ferro-alloys	All other	Total
1927	142, 700	15, 500	6, 800	5, 800	3, 900	1, 500	176, 200
1928	158, 100	20, 500	6, 200	5, 700	4, 100	1, 600	196, 200
1929	162, 100	15, 600	6, 600	5, 200	3, 800	1, 500	194, 800
1930	112, 600	12, 600	4, 300	4, 000	2, 700	2, 000	138, 200
1931	69, 300	12, 000	7, 100	3, 000	1, 300	1, 300	94, 000
1932	38, 400	7, 000	6. 700	2, 400	800	700	56, 000
1933	64, 700	7, 800	7, 000	3, 200	1, 200	700	84, 600
1934	85, 300	11, 000	7, 700	3, 500	2, 100	1, 000	110, 600
1935	105, 000	12, 900	11, 000	4, 900	2, 600	1, 000	137, 400
1936	140, 800	20. 100	11, 600	5, 400	2, 700	1, 800	182, 400
1937	146, 400	24, 100	11. 600	5, 900	3, 700	2, 600	194, 300
1938	77, 600	18, 900	10, 500	4, 000	2, 800	1, 300	115, 100
1939	123, 800	26, 300	15, 300	6, 100	3, 500	1, 800	176, 800
1940	155, 500	37, 000	13, 400	5, 500	4, 600	2, 500	218, 500
1941	210, 400	56, 000	20, 300	7, 300	5, 100	4, 500	303, 600
1942	242, 600	81, 600	18, 500	3, 100	7, 800	7, 200	360, 800
1943	234, 148	113, 614	20, 592	1, 726	7, 260	11, 545	388, 885
1944	230, 201	129, 553	27, 315	2, 547	7, 815	12, 739	410, 170
1945	197, 916	109, 315	31, 874	3, 695	6, 786	6, 504	356, 090
1946	160, 735	83, 901	39, 852	6, 739	6, 969	4, 994	303, 190
1947	209, 395	100, 363	42, 130	8, 938	6, 567	8, 745	376, 138

Fluorspar was reported consumed in 39 States and the District of Columbia in 1947, but 3 States—Illinois, Ohio, and Pennsylvania—used 207,466 tons or 55 percent of the total consumption. Pennsylvania was again the chief consuming State; it ranked first in consumption of fluorspar in both steel and glass but seventh in hydrofluoric acid. Illinois maintained its rank as the largest consumer of fluorspar in hydrofluoric acid in 1947.

The accompanying table shows, so far as possible without revealing the figures of individual companies, the consumption of fluorspar, by States, in 1946 and 1947.

Fluorspar (domestic and foreign) consumed in the United States, 1946–47, by States, in short tons

State	1946	1947
Alabama; Georgia	7, 101	10, 076
Arkansas; Louisiana; Mississippi; North Carolina	16, 491	21, 740 (Arkansas through South Carolina)
Florida; South Carolina	----------	
California	6, 755	9, 185
Colorado; Iowa; Utah	8, 184	14, 161
Connecticut	420	549
Delaware; District of Columbia; New Jersey	25, 361	27, 535
Illinois	49, 311	59, 646
Indiana	26, 435	27, 916
Kansas; Nebraska; South Dakota	166 (Kansas through Wyoming)	82
Wyoming		----------
Kentucky; Maryland	5, 858	6, 179
Maine; Massachusetts; Rhode Island	1, 346	1, 441
Michigan	8, 052	10, 545
Minnesota; Wisconsin	1, 632	2, 888
Missouri	2, 197	3, 935
New York	12, 625	12, 823
Ohio	46, 493	62, 871
Oklahoma	805	1, 445
Oregon; Washington	1, 501	1, 966
Pennsylvania	70, 661	84, 949
Tennessee	1, 856	1, 257
Texas	4, 572	9, 736
Virginia	94	132
West Virginia	5, 274	5, 081
	303, 190	376, 138

REVIEW BY STATES

Arizona.—Production of fluorspar in Arizona was 1,601 short tons in 1947 compared with 389 tons in 1946. The 1947 output came from Cochise and Yuma Counties and was shipped to steel plants and a nonferrous smelter. The fluorspar from Cochise County was from the Lone Star mine operated by Cooper Shapley, Jr., and that from Yuma County was a byproduct of the Sonora lead mine.

California.—At the plant of Industrial Minerals & Chemical Co., at West Berkeley some Nevada fluorspar was ground on a toll basis for Balfour, Guthrie & Co.

Colorado.—Production of finished fluorspar in Colorado was 32,200 short tons in 1947 compared with 32,400 tons in 1946. In addition, some crude ore equivalent to 1,400 tons of finished fluorspar was mined but not milled in 1947. Thus, production (expressed in terms of finished fluorspar) totaled 33,600 tons in 1947 compared with 32,800 tons in 1946. Output came from Boulder, Chaffee, Jackson, Mineral, and Park Counties.

Shipments from Colorado were 32,153 tons in 1947 compared with 32,539 tons in 1946. The 1947 shipments comprised 22,542 tons of flotation concentrates and 9,611 tons of metallurgical-grade fluorspar.

The Ozark-Mahoning Co., operating a flotation mill near Jamestown, produced 52 percent more flotation concentrates in 1947 than in 1946. However, the plant was operated from January 1 to March 14, 1946, by Harry M. Williamson & Son; nevertheless, the total output of concentrates in 1947 was 24 percent greater than that of both operators in 1946. The flotation-mill feed comprised ore chiefly from the Argo and Emmett mines; but some was also contributed by the Blue Jay mine, where development was in progress during the year. These mines are in Boulder County and were operated by Harry M. Williamson & Son. The Ozark-Mahoning Co. also operates a flotation mill at Rosiclare, Ill.

The flotation mill of General Chemical Co., near Jamestown, produced 5 percent less concentrates in 1947 than in 1946. The flotation-mill feed comprised ore chiefly from the company-operated Burlington mine in Boulder County, but a small quantity of ore was purchased from local mines. The company also has mines in Chaffee County, where development was continued in 1947 and a small quantity of metallurgical-grade fluorspar was produced and shipped to a steel plant. The General Chemical Co. also has a flotation mill at Deming, N. Mex.

Colorado Fluorspar Mines, Inc., produced 21 percent less finished fluorspar in 1947 than in 1946. The company operates a combination flotation-jig mill and a mine near Salida, Chaffee County. The mill feed comprised ore chiefly from its own mine, but a small quantity was contributed by nearby mines. The flotation mill was operated throughout 1947, but the jig unit was active only during the last quarter of the year.

The Wagon Wheel Gap mine of the Colorado Fuel & Iron Corp., in Mineral County, produced 57 percent more fluxing-gravel fluorspar in 1947 than in 1946.

At the Crystal mine near Northgate, Jackson County, operated by the Crystal Fluorspar Mines Co., production and shipments of metallurgical-grade fluorspar were virtually the same in 1947 as in 1946.

A small quantity of fluorspar was produced (but not shipped) by Luke E. Smith from a property near Jefferson, Park County.

Illinois.—Illinois maintained its premier position as a fluorspar-producing State. Production of finished fluorspar was 172,500 tons in 1947; about 98 percent came from Hardin County and the remainder from Pope County. However, the production includes 3,200 tons of finished fluorspar recovered from crude ore mined before 1947. Consequently, total mine production (expressed in terms of finished fluorspar) was 169,300 tons in 1947 compared with 149,900 tons in 1946. Some 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, East Green, Eureka, Fairview, Hillside, Lead Hill, Mahoning Shaft No. 3, Midway-North Boundary-Air Shaft, Minerva, Recovery Shaft, Rock Candy Mountain, Rose Creek, Rosiclare, Victory, and West Green properties supplied about 94 percent of the fluorspar produced in Illinois in 1947; most of the remainder came from many mines and prospects, chiefly the Cave in Rock, Douglas, Hawkins, Humm, Jefferson, Knox, Lead Hill, Stewart, and Wall; some was recovered from tailings from previous milling operations.

Shipments of fluorspar from Illinois (167,157 tons) were 8 percent more than in 1946 and contributed 51 percent of the total domestic shipped. Of the 1947 total, 41,319 tons were shipped by river or river-rail to consumers compared with 40,486 tons in 1946.

The Aluminum Ore Co. (Alcoa Mining Co. after January 1, 1948) produced 14 percent more flotation concentrates in 1947 than in 1946. The mill feed comprised ore from the company-operated Argo, Blue Diggings, and Fairview mines. The ore from these mines is first treated in the company heavy-media unit, which supplies an enriched product for flotation feed. The Argo-Blue Diggings vein system was worked through the Blue Diggings and Fairview shafts on the 400-, 500-, 600-, 700-, and 800-foot levels; a winze was sunk to the 900-foot level in 1947, and a crosscut to the vein was under way at the end of the year.

The Crystal Fluorspar Co. produced 19 percent more finished fluorspar than in 1946. Output in 1947 was obtained from the Crystal mine and the newly opened Jefferson mine, and from retreating log-washer fines at the Patton flotation mill. The Jefferson mine has been under development since 1945 and in 1947 the shaft was sunk from 208 to 260 feet and 596 feet of drifts were driven. At the Crystal mine 800 feet of drifting and 32 feet of raising were done in 1947.

Both the gravity-concentrating and flotation mills of Inland Steel Co. at Rosiclare were operated at a greatly increased rate in 1947; consequently, outputs of fluxing gravel and flotation concentrates were 102 and 233 percent, respectively, more than in 1946. The flotation concentrates are blended with fluxing gravel. The mill feed comprised ore from the Hillside, Wall, and Rock Candy Mountain mines in Illinois and the Keystone mine in Kentucky. Production and shipments of finished fluorspar from the Keystone mine have been credited to Kentucky in the statistics.

The Ozark-Mahoning Co. produced slightly less flotation concentrates in 1947 than in 1946, but shipments were moderately more. The mill feed in 1947 comprised ore from Deardorff, East Green, Mahoning Shaft No. 3 (formerly W. L. Davis No. 2), and West Green mines near Cave in Rock, Ill., the Delhi-Babb, Goering, and Mineral Ridge mines near Salem, Ky., and some purchased ore. Production of finished fluorspar in 1947 comprised 83.7 percent acid-grade concentrates and 16.3 percent pelletized gravel. Production and shipments of finished fluorspar from the Delhi-Babb, Goering, and Mineral Ridge mines have been credited to Kentucky in the statistics.

The Rosiclare Lead & Fluorspar Mining Co. operated the Eureka, Hawkins, Interstate, Midway-North Boundary-Air Shaft, Pell, Recovery Shaft, and Rosiclare properties in 1947, but the Rosiclare mine was again the chief producing mine of the company. The ore from the company mines is mill feed for its heavy-media, jig, and flotation units. Production of finished fluorspar of all grades was 16 percent greater than in 1946, but shipments were slightly less. This company, together with the Pigmy Corp., a subsidiary, was the largest producer of fluorspar in the United States in 1947.

The mine and flotation mill of Minerva Oil Co. were operated at a rate somewhat greater than in 1946; consequently, output of flotation concentrates was 30 percent larger in 1947. The company did some development in Livingston County, Ky., where it has leases on a substantial acreage.

Kentucky.—Production of fluorspar in Kentucky in 1947 reversed a downward trend that had persisted since 1942. Production of finished fluorspar was 98,800 short tons in 1947. In addition, some crude ore equivalent to 2,300 tons of finished fluorspar was mined but not milled in 1947. Thus, total mine production (expressed in terms of finished fluorspar) was 101,100 tons in 1947 compared with 63,900 tons in 1946. Shipments also were greater; they were 90,256 tons—a 43-percent gain over 1946. Of the 1947 shipments, 19,311 tons were shipped by river or river-rail compared with 10,942 tons in 1946.

Output in Caldwell County in 1947 was substantially more than in 1946 and was chiefly from the Bright, Crowder, Hughett, Tyrie, New York & Kentucky, and Senator mines. The Hughett mine, inactive for several years, was reopened in 1947. A heavy-media-process plant to serve the Senator mine was brought into operation in 1947.

The major part of the 1947 output in Crittenden County came from the Asbridge No. 21, Big Four, Blue, Davenport, Delhi-Babb, Keystone, Krausse, Pigmy, Tabb No. 1, Tabb No. 2, Watkins, and Yandell No. 22 mines. Most of the remainder came from many smaller producing mines and from numerous prospects; some was recovered from tailings from previous milling operations.

Production and shipments of fluorspar in 1947 by the United States Coal & Coke Co., the largest producer in Kentucky, were 103 and 77 percent, respectively, more than in 1946, when operations were adversely affected by a strike at its mines and mill. Production came from the company-operated Asbridge No. 21, Tabb No. 1, Tabb No. 2, and Yandell No. 22 mines, but some was from the Big Four mine owned by the company but operated by Perry & Loyd; a small tonnage was also produced under contract from the Pogue mine. Output at the Big Four mine, however, was 78 percent smaller than in 1946.

The Kentucky Fluor Spar Co. and affiliates shipped 16 percent more fluorspar and "fluorbarite" than in 1946. The company operates a mill at Marion and, through its mining division (Roberts & Frazer), operated the Carr and Wright mines in Livingston County. Only about one-third of the supply came from company mines in 1947; most of it was supplied by the Austin, C. R. Babb, Humm, Rose Creek, Stewart, Lead Hill, and Knox mines and the flotation mills of Minerva Oil Co., Minerals Flotation Corp., and Butler & Moodie.

The Keystone mine of Inland Steel Co. near Marion was operated throughout 1947 and a heavy-media-process plant to serve it was brought into production in August. The company plans to build a loading station on the Kentucky bank of the Ohio River, opposite Elizabethtown, Ill. A diamond-drill exploratory program was begun at the company Barnes mine, also near Marion.

The Pigmy mine of the Pigmy Corp. (subsidiary of the Rosiclare Lead & Fluorspar Mining Co.) produced 7 percent less fluorspar than in 1946.

In 1947 the Delhi Fluorspar Corp. completed sinking a 200-foot shaft at the Hickory Cane mine near Marion, where it made a small production. Output from this mine, however, was inadequate for its needs, and as a consequence the company purchased both finished fluorspar and milling ore from many local producers, as well as some ore from Mexico. The finished fluorspar recovered from milling Mexican ore, as well as that shipped, is not included in the statistics for Kentucky. Total shipments by Delhi Fluorspar Corp. were 42 percent more than in 1946.

L. Conyer, who operates a jig mill near Marion, shipped 17 percent more fluorspar than in 1946. He purchases both finished fluorspar and milling ore from many local producers, and all his shipments came from these sources in 1947.

Ben E. Clement sold 123 percent more fluorspar in 1947 than in 1946. He purchased fluorspar from local producers and some acid-grade fluorspar from Mexico. The Mexican fluorspar was used to raise the grade of locally purchased fluorspar. The Mexican fluorspar is not included in the statistics for Kentucky.

Crider Bros. Fluorspar Co. worked the Blue mine near Mexico, Ky., and the Jameson mine near Lola, reclaimed some fluorspar from the Blue and Haffaw dumps, and purchased fluorspar from local producers. Its sales were 123 percent larger than in 1947. The company did extensive development at the Blue mine, and it acquired title to the flotation plant of Alco Minerals, Inc., near Marion and moved it to a new location near Mexico, Ky., where it will be operated in conjunction with the gravity mill serving the Blue mine.

The Minerals Flotation Corp., an affiliate of the Fluorspar Corp., operated its flotation mill at Marion throughout 1947 and output of concentrates was 11 percent more than in 1946. The mill feed comprised chiefly tailings accumulated over a period of years. This source of fluorspar has been exhausted, and hereafter an enriched mill feed will be supplied by the heavy-media-process plant of the Fluorspar Corp.

Davenport Mines, Inc., did extensive underground development at the Davenport mine near Salem in 1947. Output in 1947 was triple that in 1946.

In Livingston County most of the output came from the C. R. Babb, Bonanza, Carr, Goering, Guill, Jameson, Lovelace, Mineral Ridge, and Wright mines and from reworking the Klondike tailings.

Output at the Carr and Wright mines of Roberts & Frazer was 10 percent greater than in 1947.

The Ozark-Mahoning Co. operated the Mineral Ridge mine until November 30, when the lease was assigned to Alco Lead Corp., which operated it in December and had a heavy-media-process plant under construction at the end of 1947. The Ozark-Mahoning Co. operated the Goering mine until October 31, when it was subleased to Frailey & Winters, who operated it the remainder of 1947.

Butler & Moodie continued to reclaim fluorspar from Klondike tailings.

In the Central Kentucky district production and shipments of fluorspar increased to 5,771 and 6,030 tons, respectively, in 1947 (4,235 and 3,786 tons in 1946). The largest producer in this district is Hageman Properties, Inc.; in 1947 its output came chiefly from the Faircloth and Haydon mines in Woodford County near Wilmore. The company made a small production at the Twin Chimney and Gobel Dean mines in Mercer County near Harrodsburg. A comparatively small output of fluorspar was produced at the Lone Oak mine, also in Mercer County near Harrodsburg, by Albert Brauer. A small tonnage of ore mined in 1945 at the Leed property by J. B. Towles was sold to and milled by Hageman Properties, Inc., in 1947.

Nevada.—Shipments of fluorspar from Nevada (8,042 tons) reversed a 3-year downward trend in 1947; they were 29 percent greater than in 1946. Most of the 1947 output went to steel plants, but some was shipped to cement and enamel plants, nonferrous smelters, and iron foundries. The fluorspar moving to enamel plants was ground by Industrial Minerals & Chemical Co., West Berkeley, Calif.

The chief producing mine in Nevada in 1947 was the Baxter in Mineral County, operated by V. S. Baxter; its production was 46 percent more than in 1946. The Daisy mine in Nye County, operated by J. Irving Crowell, Jr., was the second-largest producing mine in Nevada in 1947; its output was 3 percent greater than in 1946. The other producing mine was the Cirac, also in Mineral County, operated by Cirac Fluorite Mine; there was no output at this mine in 1946.

New Mexico.—Production of finished fluorspar in New Mexico was 27,700 short tons in 1947, a gain of 58 percent over 1946. However, the 1947 production includes 5,700 tons of finished fluorspar recovered from treating some crude ore mined before 1947. Consequently, total mine production (expressed in terms of finished fluorspar) was 22,000 tons in 1947 compared with 15,200 tons in 1946. The 1947 output came from Grant, Luna, Sierra, and Valencia Counties.

Shipments of fluorspar from New Mexico likewise increased and totaled 27,526 tons, a gain of 57 percent over 1946.

The flotation mill of General Chemical Co. at Deming produced 18 percent more concentrates in 1947 than in 1946. The mill feed comprised ore from the company Shrine mine in Grant County and purchased ore from local mines.

The flotation mill of Zuñi Milling Co. at Los Lunas operated throughout 1947, whereas in 1946 it operated only from October 15 until December 31. Consequently, output of concentrates was much greater in 1947. The mill feed comprised ore from the company mines near Grants in Valencia County, tailings from previous milling operations, and purchased ore from local mines.

The Government-owned heavy-media plant at Gila, which resumed operation on October 8, 1946, was operated until May 29, 1947, when the accumulated stock of ore at the mill was exhausted. The plant was operated by the Shattuck Denn Mining Co. as agent for the Office of Metals Reserve and the concentrates produced were shipped to Government stock pile. The mill was first put into operation on December 27, 1943; it operated entirely on locally purchased ores; the total quantity purchased was 79,500 tons, which yielded 30,924 tons of fluxing-gravel fluorspar.

The flotation mill of Indian Metals Co. of New Mexico at Lordsburg was operated until May 4, 1947, when it was closed. The mill feed comprised purchased ore from local mines.

At the Burro Chief mine near Tyrone, Grant County, output of milling ore, which was sold to local mills, was 2½ times that in 1946, but production of finished fluorspar was 87 percent smaller. The Burro Chief mine has been described by the Mining World.[2]

Resumption of operations at the flotation mill of Zuñi Milling Co. provided a market for milling ore in 1947; as a consequence there was a revival of activity at several properties in Valencia County, where the Bonita, Grants No. 1, Keeney, Mirabal, and Nell No. 1, as well as the mines of Zuñi Milling Co., were operated in 1947. Other producing mines in New Mexico in 1947 included the Blue Jacket, Cox, Foster, Great Eagle, Greenleaf, Humming Bird, Purple Heart, Sadler, and White Eagle.

Texas.—Production of finished fluorspar in Texas was 1,122 short tons in 1947, a gain of 20 percent over 1946; shipments (1,019 tons), however, were 9 percent smaller. Production was from the Eagle Mountains mine in Hudspeth County near Van Horn, operated by the J & L Fluorite Co. The 1947 output comprised 36.6 percent metallurgical-grade fluorspar and 63.4 percent flotation concentrates.

Utah.—George Spor & Son, operating the Spor mine in Juab County near Delta, and Brice Prisby, operating the Rain Bow mine in Millard County near Kanosh, were the only producers of fluorspar in Utah in 1947. Production and shipments were 1,640 and 1,730 short tons, respectively, in 1947 compared with 2,340 and 2,370 tons in 1946.

MILL DEVELOPMENTS

The trend toward the heavy-media process for treating fluorspar ores continued in 1947. Three plants were completed and brought into operation in Kentucky in 1947, a fourth plant was under construction, and a fifth plant was planned. With this process lower-

[2] Mining World, Burro Chief Fluorspar: vol. 9, No. 6, June 1947, pp. 31–33.

grade ore and narrower veins can be mined, much higher recoveries of flurospar are attained than with jigs, higher-grade concentrates are produced, and the rate of depletion of reserves is retarded.

In 1947 the Fluorspar Corp. completed a heavy-media separation plant near Princeton, Ky., to serve its nearby Senator mine. This was the first heavy-media plant brought into operation in the State to treat fluorspar. The heavy-media plant of Inland Steel Co. near Marion was put into operation in October; it will serve the company Keystone mine and will eliminate an 18-mile haul to the company mill at Rosiclare, where the ore heretofore had been treated. The Kentucky Fluor Spar Co. brought its heavy-media plant into operation in November; the plant is at Marion, Ky., and will treat ore from the company-owned mines as well as purchased ores. A heavy-media plant to serve the Mineral Ridge mine near Salem, Ky., was under construction at the close of 1947 by the Alco Lead Co. Davenport Mines, Inc., had completed plans for the construction of a heavy-media plant to serve its mine of the same name near Salem. The company was changing from steam to electric power.

The heavy-media unit of Alcoa Mining Co., which was put into operation in October 1946, has been described.[3]

The Crystal Fluorspar Co. was installing Richards jigs in its mill at its Crystal property for separation of the lead and zinc in the ore from the Jefferson mine. A new grinding unit was installed in the mill of J & L Fluorite Co. near Van Horn, Tex. Additional equipment to increase capacity at the flotation plants of Ozark-Mahoning Co. at Jamestown, Colo., and Rosiclare, Ill., was installed in 1947.

Output of flotation concentrates from domestic ore totaled 151,110 short tons in 1947 compared with 129,359 tons in 1946. In addition, flotation mills in the United States recovered 42 and 354 tons, respectively, from milling Mexican ore in 1947 and 1946.

PRICES

Metallurgical-grade fluorspar containing 70 percent or more effective calcium fluoride content was quoted at $33 a short ton f. o. b. Illinois-Kentucky mines until mid-September, when the price was advanced to $34.50; on November 8 it was raised to $35. Corresponding increases were made in the price for other grades of metallurgical-grade fluorspar. On July 1 the selling price f. o. b. Illinois mines of acid-grade fluorspar containing a minimum of 97½ percent calcium fluoride was advanced from $37 a ton to $38.50; and in early December it was raised to $40.

The average selling price of all grades of domestic fluorspar shipped in 1947 was $33.25 a short ton—a new peak—compared with $32.52 in 1946.

FOREIGN TRADE

Imports.—Receipts of imported fluorspar into the United States were 78,379 short tons in 1947—a gain of 166 percent over 1946.

Fluorspar imported for consumption in the United States, which represents the quantity on which the duty was paid, was 78,725 tons—a gain of 164 percent over 1946. The imports in 1947 comprised 15,623 tons containing more than 97 percent calcium fluoride and

[3] Lay, W. C., Sink-and-Float Separation: Eng. and Min. Jour., vol. 148, No. 10, October 1947, pp. 80–83.

63,102 tons of lower grade. They were valued[4] at $1,256,726. The value assigned to the higher-grade foreign fluorspar averaged $22.18 a ton in 1947 and that to the lower grade $14.43. 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 continued at $5.625 a short ton and on fluorspar containing more than 97 percent calcium fluoride $3.75.

The bulk of foreign fluorspar received in the United States in 1947 was for use by domestic consumers; however, about 4,400 short tons of that received were delivered to Government stock pile.

Fluorspar imported for consumption in the United States in 1947, by countries and customs districts

[U. S. Department of Commerce]

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
Canada:						
Buffalo			227	$6,888	227	$6,888
Laredo			57	706	57	706
			284	7,594	284	7,594
Italy: Philadelphia			4,126	40,793	4,126	40,793
Mexico:						
Arizona	2,104	$30,963	7,356	107,623	9,460	138,586
Duluth and Superior			80	1,176	80	1,176
El Paso			7,637	70,754	7,637	70,754
Laredo	4,986	99,699	29,802	464,045	34,788	563,744
	7,090	130,662	44,875	643,598	51,965	774,260
Newfoundland:						
Buffalo			2,050	68,716	2,050	68,716
Philadelphia	8,257	206,360			8,257	206,360
	8,257	206,360	2,050	68,716	10,307	275,076
Spain: Philadelphia	275	9,277	11,767	149,557	12,042	158,834
United Kingdom: Rochester	1	169			1	169
Total: 1947	15,623	346,468	63,102	910,258	78,725	1,256,726
1946	6,621	158,859	23,231	357,956	29,852	516,815
1945	10,275	254,800	94,650	1,967,962	104,925	2,222,762

[4] 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."

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 1946 and 1947, 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. The quantities in the following table are based upon the actual outturn weights and include the finished fluorspar recovered from milling and drying foreign ore, rather than the ore milled or concentrate dried.

Imported fluorspar delivered to consumers in the United States, 1946–47, by uses

Use	1946			1947		
	Short tons	Selling price at tidewater, border, or f. o. b. mill in the United States, including duty		Short tons	Selling price at tidewater, border, or f. o. b. mill in the United States, including duty	
		Total	Average		Total	Average
Steel	20,319	$485,592	$23.90	64,797	$1,665,629	$25.71
Hydrofluoric acid	5,143	163,659	31.82	12,346	506,497	41.03
Ferro-alloys	309	10,700	34.63	229	7,900	34.50
Glass and enamel	106	3,384	31.92	495	21,902	44.25
Other	186	4,238	22.78	403	13,377	33.19
	26,063	667,573	25.61	78,270	2,215,305	28.30

Exports.—Producers of fluorspar reported exports of 1,180 short tons of fluorspar valued at $43,679 in 1947 compared with 1,729 tons valued at $63,797 in 1946. The exports (all ceramic ground and flotation concentrates) by producers in 1947 comprised 617 tons to Canada, 43 tons to Mexico, 480 tons to Peru, and 40 tons to Venezuela.

Fluorspar reported by producers as exported from the United States, 1942–47

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1942	9,016	$242,545	$26.90	1945	1,420	$45,939	$32.35
1943	9,044	246,973	27.31	1946	1,729	63,797	36.90
1944	1,980	65,909	33.29	1947	1,180	43,679	37.02

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WORLD REVIEW

The accompanying table shows world production of fluorspar, by countries, 1943–47, insofar as statistics are available.

World production of fluorspar, 1943–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1943	1944	1945	1946	1947
Argentina (shipments)	1,713	2,674	3,012	(2)	(2)
Australia:					
Queensland	544	520	801	875	(2)
Victoria	468	266	145	326	(2)
Bolivia (exports)	(2)	(2)	19	(2)	[3] 28
Canada	10,169	6,281	6,685	7,296	5,245
France	24,160	13,400	13,749	21,528	25,834
Germany	198,536	[4] 170,000	(2)	21,190	(2)
India	1,667	1,249	(2)	(2)	(2)
Italy	(2)	(2)	(2)	7,806	(2)
Japan	7,282	7,967	3,207	(2)	[4] 100
Korea [5]	39,589	53,131	16,098	(2)	(2)
Mexico (exports)	22,469	56,450	50,251	21,949	45,737
Newfoundland (shipments)	56,478	44,912	25,300	23,366	36,191
Norway	905	3,119	2,516	(2)	(2)
Southern Rhodesia	297	----	----	----	154
Spain	35,911	55,595	9,643	8,712	15,929
Sweden	2,107	1,836	3,448	3,722	(2)
Switzerland	582	520	----	(2)	(2)
Tunisia	16	----	----	----	(2)
Union of South Africa	4,646	3,481	3,657	4,821	4,815
United Kingdom	55,106	48,927	44,281	46,644	(2)
United States (shipments)	368,330	375,374	293,891	252,142	298,901
Total (estimate)	1,009,000	1,049,000	677,000	567,000	660,000

[1] In addition to countries listed China, South-West Africa, and U. S. S. R. produce fluorspar, but data of output are not available. Estimates by author of chapter included in total.
[2] Data not available; estimates by author of chapter included in total.
[3] January to September, inclusive.
[4] Estimate.
[5] Exports to Japan.

Canada.—According to the Dominion Bureau of Mines, production of fluorspar in Canada was 5,245 metric tons [5] (all from Ontario) in 1947 compared with 7,296 tons in 1946. In Canada output falls short of consumption, and the greater part of the deficiency is met by importations, chiefly from Mexico, Newfoundland, and the United States. However, small quantities (258 and 281 metric tons, respectively, in 1947 and 1946) of metallurgical-grade fluorspar are exported to the United States. Imports into Canada were 22,903 metric tons during the first 10 months of 1947 compared with 28,860 tons in the entire year 1946.

Mexico.—Chiefly as a result of demand by the United States, production of fluorspar (as measured by exports) in Mexico increased from an average of 11,907 metric tons annually during the 4 years 1940–43 to 56,450 and 50,251 tons, respectively, in 1944 and 1945. Exports declined to 21,949 metric tons in 1946; but the downward trend was halted in 1947, when 45,737 metric tons were exported. About 2,200 tons of Mexican fluorspar are used in local metallurgical plants and some is also exported to Canada. Some ground fluorspar is imported from the United States for use in ceramic plants.

Newfoundland.—The St. Lawrence Corp. of Newfoundland, Ltd., and Newfoundland Fluorspar, Ltd. (a subsidiary of Aluminum Co.

[5] 1 metric ton is equivalent to 1.10231 short tons.

of Canada, Ltd.), are the only producers of fluorspar in Newfoundland.

Shipments of fluorspar from Newfoundland were 36,191 metric tons in 1947 compared with 23,366 tons in 1946. The St. Lawrence Corp. of Newfoundland, Ltd., has developed and opened nine mines, but the Iron Springs mine, which is equipped with two shafts, was the only one worked in 1947. The company has a gravity-concentrating mill and a flotation mill in Newfoundland for treating the ore; and a subsidiary, St. Lawrence Fluorspar, Inc., has a plant at Wilmington, Del., for drying the flotation concentrate. Shipments by the St. Lawrence Corp. of Newfoundland, Ltd., and St Lawrence Fluorspar, Ltd., were 16,151 metric tons in 1947.

Newfoundland Fluorspar, Ltd., has two mines and ships crushed fluorspar to Arvida, Quebec, where the Aluminum Co. of Canada, Ltd., has a flotation plant; some crushed fluorspar is also shipped to other consumers. Shipments by Newfoundland Fluorspar, Ltd., were 20,040 metric tons in 1947 and comprised 18,292 tons to Arvida, Quebec, and 1,748 tons to other customers. The company reopened its Tarefare mine in 1947, but work consisted mostly of development, as this mine had scarcely reached the production stage; nevertheless, a moderate amount of fluorspar was produced which, together with that in accumulated stock piles, sufficed for the requirements at Arvida in 1947. Arrangements were made during the latter part of 1947 to reopen the Director mine for 1948 production, and unwatering of it was begun on November 27, 1947. Most of the 1948 output from the Director mine is expected to be taken from the 250-foot level, but some may be taken from the 150-foot level. Development will continue at the Tarefare mine in 1948.

CRYOLITE

Cryolite occurs in commercial quantity and is mined at only one place—Ivigtut, Greenland. The mine at Ivigtut, the grades of ore produced, methods of processing and purification, and various uses of cryolite have been described.[6]

Artificial cryolite was manufactured in the United States in 1947 by the Aluminum Ore Co. at East St. Louis, Ill., and the Reynolds Metals Co. at Bauxite (Hurricane Creek), Ark.

The chief use of cryolite is in the reduction of aluminum; comparatively small quantities are used in glass, enamels, abrasives, and insecticides.

Imports of cryolite into the United States were 19,650 long tons valued at $1,564,380 in 1947 compared with 10,200 tons valued at $815,627 in 1946. The cryolite imported in both years came from Greenland.

Exports of cryolite from the United States were 836 long tons valued at $216,357 in 1947 compared with 1,160 tons valued at $285,110 in 1946. Of the 1947 exports, 539 tons went to Canada, 104 tons each to Yugoslavia and Poland, and the remainder elsewhere.

[6] Gibbs, A. E. (technical director, Pennsylvania Salt Manufacturing Co.), Cryolite as a Chemical Raw Material: Chem. Ind., vol. 38, No. 5, May 1936, pp. 471–476.

Fuel Briquets and Packaged Fuel[1]

By GERTRUDE S. GOODMAN

GENERAL SUMMARY

THE production of fuel briquets rose again in 1947 to a new high of 3,171,596 net tons. Packaged fuel dropped in 1947 to 182,881 net tons.

The fuel-briquetting industry in the United States consists of a relatively few large plants (35 in 1947), producing a small, hard pillow-briquet suitable for shipment. The packaged-fuel industry, on the other hand, consists of a large number of small plants (62 in 1947), producing 3- to 4-inch, more or less friable cubes wrapped (usually 6 to the package) in sturdy paper, designed primarily for local consumption.

FUEL BRIQUETS

Salient statistics of the fuel-briquetting industry from 1943 to 1947 are summarized in table 1. Production by regions from 1917 to 1947 is shown in figure 1.

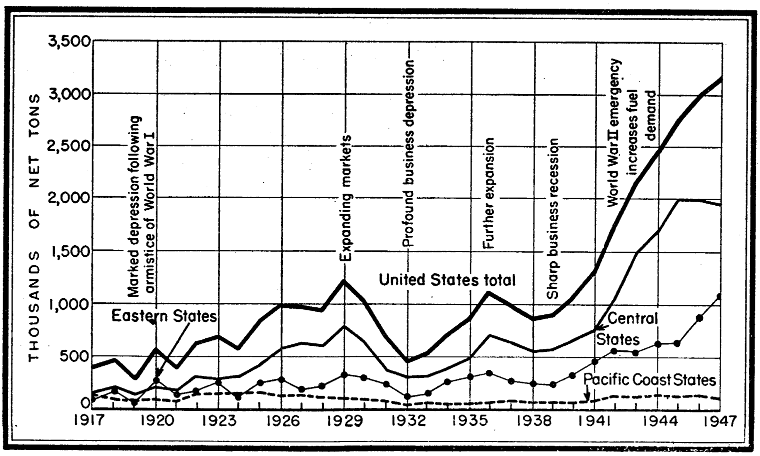

FIGURE 1.—Production of fuel briquets in the United States, by regions, 1917–47.

[1] Briquets made from charcoal, wood scrap, and fruit pits not included in Bureau of Mines review.

TABLE 1.—Salient statistics of the fuel-briquetting industry in the United States, 1943–47

Year	Production: Eastern States	Production: Central States	Production: Pacific Coast States	Production: Total	Imports	Exports
	Net tons					
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
1946	880, 109	1, 986, 234	137, 684	3, 004, 027	653	163, 339
1947	1, 089, 705	1, 966, 834	115, 057	3, 171, 596	387	248, 760

Year	Apparent consumption[1] (net tons)	Value of production	Plants in operation	Average value per net ton, f. o. b. plant: Eastern States	Central States	Pacific Coast States
1943	1, 989, 223	$15, 148, 109	28	$5. 04	$7. 44	$10. 26
1944	2, 301, 827	18, 434, 579	30	5. 42	8. 03	10. 07
1945	2, 588, 819	21, 678, 886	32	5. 65	8. 40	10. 04
1946	2, 841, 341	25, 299, 612	35	6. 61	9. 03	11. 26
1947	2, 923, 223	30, 762, 253	35	7. 82	10. 56	12. 77

[1] Production plus imports minus exports.

DOMESTIC PRODUCTION

The output of fuel briquets in 1947, continuing its upward trend since 1938, totaled 3,171,596 tons valued at $30,762,253—a 6-percent increase in tonnage and a 22-percent increase in value over 1946. Production increased markedly in the Eastern States but declined slightly in the Central and more significantly in the Pacific Coast States (table 2).

Briquets were made in 16 States in 1947, with production centered in Wisconsin (10 plants totaling 1,344,720 tons valued at $14,649,795), followed by Pennsylvania, West Virginia, Missouri, and Illinois, in that order. Pennsylvania's 4 plants produced 580,582 tons valued

TABLE 2.—Production of fuel briquets in the United States, 1946–47

	1946: Plants[1]	1946: Net tons	1946: Value	1947: Plants[1]	1947: Net tons	1947: Value	Percent of change from 1946 in—: Tonnage	Percent of change from 1946 in—: Value
Eastern States	7	880, 109	$5, 817, 639	8	1, 089, 705	$8, 519, 741	+23. 8	+46. 4
Central States	25	1, 986, 234	17, 931, 641	24	1, 966, 834	20, 773, 184	−1. 0	+15. 8
Pacific Coast States	3	137, 684	1, 550, 332	3	115, 057	1, 469, 328	−16. 4	−5. 2
	35	3, 004, 027	25, 299, 612	35	3, 171, 596	30, 762, 253	+5. 6	+21. 6

[1] 11 plants in 1946 and 10 plants in 1947 in Wisconsin; 4 plants in Pennsylvania; 3 in Illinois; 2 each in Arkansas, Kansas, Michigan, Missouri, and West Virginia; and 1 each in California, Massachusetts, Minnesota, Nebraska, New York (1947 only), North Dakota, Oregon, and Washington.

at $4,774,843, and Illinois' 3 plants, 132,935 tons valued at $907,605. Production for the other States cannot be shown without revealing individual plant data.

Twenty-two plants operated every month of the year, and four plants operated 11 months, together accounting for 97 percent of the total production.

Number of Plants.—All of the 35 plants reporting production in 1947 were also active in 1946,[2] except the Lake Coal Co., Inc., Syracuse, N. Y., which began commercial operations in December 1947. Three additional plants, reported under construction in Arkansas, Wisconsin, and Wyoming in 1947, with a combined capacity of several hundred thousand tons, expect to go into production in 1948. Four plants were idle in 1947, and three went out of business.

Capacity.—Table 3 gives comparative data for the past 5 years on annual capacity and relative production of active briquetting plants for the United States as a whole. In 1947, nine plants—each with an annual capacity of 200,000 tons or more—furnished 2,270,361 tons, or 72 percent of the national production, utilizing 73 percent of their combined capacity. The largest capacities as well as the largest production in 1947 were reported by the Berwind Fuel Co. and the Stott Briquet Co., Inc., for their plants at Superior, Wis.

TABLE 3.—Annual capacity and production of briquetting plants in the United States, 1943–47

	Active plants		Production		
				Percent of—	
	Number	Annual capacity (net tons)	Net tons	Annual capacity	Annual production
1943	28	3,164,000	2,163,998	68.4	100.0
1944	30	3,493,900	2,464,961	70.6	100.0
1945	32	3,782,900	2,762,204	73.0	100.0
1946	35	4,533,300	3,004,027	66.3	100.0
1947:					
Capacity of—					
Less than 5,000 tons	1	17,860	6,361	35.6	.2
5,000 to less than 10,000	2				
10,000 to less than 25,000	3	41,500	27,823	67.0	.9
25,000 to less than 100,000	[1] 13	617,400	255,020	41.3	8.0
100,000 to less than 200,000	7	828,400	612,031	73.9	19.3
200,000 to less than 400,000	6	1,610,000	1,325,861	82.4	41.8
400,000 or more	3	1,500,000	944,500	63.0	29.8
	35	4,615,160	3,171,596	68.7	100.0
Production of—					
Less than 2,000 tons	[1] 3	108,500	6,818	6.3	.2
2,000 to less than 5,000	2				
5,000 to less than 10,000	5	80,860	43,175	53.4	1.4
10,000 to less than 25,000	4	215,000	81,886	38.1	2.6
25,000 to less than 100,000	10	950,800	514,030	54.1	16.2
100,000 or more	11	3,260,000	2,525,687	77.5	79.6
	35	4,615,160	3,171,596	68.7	100.0

[1] 2 of these plants operated less than 3 months during the year.

Raw Fuels.—Nine kinds of raw fuels entered into the manufacture of 13 types of briquets in 1947 (tables 4 and 5). In the Eastern States region anthracite fines and bituminous coal were the raw fuels

[2] Years plants (active in 1947) started producing are given in the 1947 Fuel Briquet Directory (which also shows type of raw fuel used), obtainable on request from the Bureau of Mines, Washington 25, D. C.

TABLE 4.—Raw fuels used in making fuel briquets in the United States in 1947

Character of raw fuels used	Plants	Net tons
Pennsylvania anthracite	16	1,064,790
Arkansas hard coals	8	[1] 369,091
Bituminous low-volatile	16	1,241,043
Bituminous high-volatile	5	134,436
Semicoke (lignite char)	1	
Residual carbon from pyrolysis of natural gas	1	129,208
Residual carbon from manufacture of oil gas	2	
Petroleum coke	3	35,927
	[2] 35	2,974,495

Plants using—	Plants	Raw fuels used (net tons): Yard screenings	Other raw fuels	Total
Yard screenings exclusively (from own or other yards)	4	27,974	----	27,974
Raw fuels (other than yard screenings) exclusively	20	----	1,679,039	1,679,039
Both yard screenings and other raw fuels	11	277,242	990,240	1,267,482
	35	305,216	2,669,279	2,974,495

[1] Includes also some Oklahoma semianthracite.
[2] 17 plants used 1 kind of fuel only, 2 plants used 2 kinds (separately), 15 used mixtures of 2 kinds, and 1 used a mixture of 3 kinds; hence the sum of the items shown exceeds the total number of plants.

used by plants near mines in Pennsylvania and West Virginia. In the Central States region—with plants in nine States and production concentrated in the Lake dock territory—all available fuels except residual carbons were used; in this region the increased use of Arkansas hard coals is especially noteworthy. In the Pacific coast region residual carbons from the manufacture of oil gas and pyrolysis of natural gas were the raw fuels used.

The most outstanding gain in production of briquets in 1947 over 1946 occurred at plants near coal mines (table 6).

TABLE 5.—Classification of plants and production of fuel briquets in the United States, by kinds of raw fuel used, 1946–47

Raw fuel used	1946 Plants	1946 Briquets produced: Net tons	1946 Percent of total	1947 Plants	1947 Briquets produced: Net tons	1947 Percent of total
Pennsylvania anthracite	2			3	146,995	4.6
Mixture of Pennsylvania anthracite and bituminous low-volatile	11			10	1,366,417	43.1
Mixture of Pennsylvania anthracite and bituminous high-volatile	2	1,983,238	66.0	2		
Mixture of Pennsylvania anthracite and bituminous high- and low-volatile	----			1	443,896	14.0
Semianthracite	6	296,968	9.9	[1] 6	400,491	12.6
Arkansas hard coals (mixture)	[1] 2			[1] 2		
Bituminous:						
Low-volatile	6	540,844	18.0	4	616,579	19.5
High-volatile	1			2		
Semicoke (lignite char)	1			1		
Residual carbon from pyrolysis of natural gas	1	166,715	5.6	1	138,657	4.4
Residual carbon from manufacture of oil gas	2			2		
Petroleum coke	2			2		
Mixture of petroleum coke and bituminous high-volatile	1	16,262	.5	----	58,561	1.8
Mixture of petroleum coke and bituminous low-volatile	----			1		
	[2] 35	3,004,027	100.0	[2] 35	3,171,596	100.0

[1] 1 of these plants also used Oklahoma semianthracite.
[2] In 1946 and 1947, 2 plants made 2 kinds, hence the sum of the items shown exceeds the total number of plants active in the respective years.

Raw fuels, other than yard screenings, accounted for 90 percent of the raw fuels used in the manufacture of fuel briquets in 1947 (table 4).

TABLE 6.—Production of fuel briquets, grouped according to location of plants with reference to supply of raw fuel, 1946–47

Location of plant	1946 Plants	1946 Production (net tons)	1947 Plants	1947 Production (net tons)	Change in 1947 Net tons	Change in 1947 Percent
Near Lake coal docks:						
Lake Superior	4	1,091,580	4	927,452	−164,128	−15.0
Lake Michigan	8	454,314	7	483,986	+29,672	+6.5
Lake Huron	1		1			
	13	1,545,894	12	1,411,438	−134,456	−8.7
Near coal mines:						
Eastern States	6	879,463	6	1,089,044	+209,581	+23.8
Central States	9	402,091	9	516,995	+114,904	+28.6
	15	1,281,554	15	1,606,039	+324,485	+25.3
Near petroleum refineries and oil- and natural-gas plants:						
Central States	1	164,481	1	138,106	−26,375	−16.0
Pacific Coast States	3		3			
	4	164,481	4	138,106	−26,375	−16.0
Other locations:						
Eastern States	1	12,098	2	16,013	+3,915	+32.4
Central States	2		2			
	[1] 3	12,098	[1] 4	16,013	+3,915	+32.4
Total United States	35	3,004,027	35	3,171,596	+167,569	+5.6

[1] Fall River, Mass.; Flint, Mich.; Omaha, Nebr.; and—in 1947 only—Syracuse, N. Y.

Binders.—Asphalt binders predominate in briquetting practice in the United States (table 7). In 1947, 33 operators used approximately 202,000 tons of asphaltic types and small quantities of starch, coal-tar pitch, and oil-gas tar pitch; 2 operators used no binder. The percentage of binder in the briquets (by weight) ranged from less than 5 to 9 percent or more. Sixteen plants, accounting for 56 percent of the total 1947 briquet production, used binders ranging from 5 to less than 7 percent; 2 plants used less than 5 percent; 12, 7 to 9 percent; and 3, 9 percent or more.

TABLE 7.—Classification of briquetting plants in the United States by type of binder used, 1944–47

	1944 Plants	1944 Percent of total briquet production	1945 Plants	1945 Percent of total briquet production	1946 Plants	1946 Percent of total briquet production	1947 Plants	1947 Percent of total briquet production
Type of binder used:								
No binder [1]	3	5.0	3	4.3	2	92.3	2	95.8
Asphalt	24	84.1	26	86.7	30		30	
Asphalt and coal-tar pitch	1	10.9	1	9.0	1	7.7	1	4.2
Asphalt and starch	1		1		1		1	
Oil-gas tar pitch	-------		-------		1		1	
Starch	1		1		-------		-------	
	30	100.0	32	100.0	35	100.0	35	100.0
Production (net tons)	-------	2,464,961	-------	2,762,204	-------	3,004,027	-------	3,171,596

[1] Residual carbon from manufacture of oil gas and bituminous coal were raw fuels used at plants employing no binder.

Weight and Shape.—Briquets in the United States (pillow-, barrel-, and cube-shaped) range in weight from 1½ to 20 ounces. Pillow shapes under 5 ounces (except for an 11-ounce bituminous, high-volatile pillow by Coal Processing Corp., Buckner, Ill.) were made at 32 plants in 1947; 2½-ounce cylindrical (barrel-shaped) briquets, at 2 plants; and 18- and 20-ounce cubes at 1 plant.

SHIPMENTS

In 1947 briquets were shipped to 35 States and the District of Columbia and exported principally to Canada (table 8). Production and shipments for each State cannot be shown without revealing confidential data, because there are only 1 or 2 plants in 13 of the 16 producing States. The difference between production in 1947 (3,171,596 tons) and shipments within the United States (2,885,658 tons) represents briquets exported, used at plants for power or heat, and variation in year-end stocks. Briquets are employed almost entirely for domestic space heating, but six operators reported a total of 14,807 tons used for power or heat at their plants in 1947.

TABLE 8.—Shipments of fuel briquets of domestic manufacture in the United States, by States of destination, as reported by producers, 1946–47, in net tons [1]

State of destination	1946	1947	State of destination	1946	1947
Arkansas	438	1,249	Nebraska	56,890	59,719
California	11,577	11,119	New Hampshire	10,686	5,419
Connecticut	15,302	5,101	New Jersey	27,734	32,403
Delaware	3,537	785	New York	94,124	48,462
District of Columbia	2,159	2,174	North Carolina	19,080	24,184
Florida	544	283	North Dakota	157,482	127,671
Georgia	200	49	Ohio	74,391	96,562
Idaho		293	Oregon	95,688	67,642
Illinois	113,082	156,167	Pennsylvania	49,498	126,135
Indiana	63,552	80,286	Rhode Island	8,249	3,417
Iowa	124,271	110,701	South Carolina	5,723	6,565
Kansas	13,931	27,357	South Dakota	132,348	122,615
Kentucky	4,939	5,955	Vermont	5,864	3,573
Maine	17,924	8,732	Virginia	24,811	36,824
Maryland	21,049	28,551	Washington	6,923	22,092
Massachusetts	63,458	23,219	West Virginia	2,708	4,305
Michigan	187,452	290,482	Wisconsin	543,692	542,169
Minnesota	579,356	453,198			
Mississippi	97			2,784,662	2,885,658
Missouri	245,903	350,200			

[1] For shipments outside the United States see export statistics, table 10.

Generally, rail movement represents shipments to considerable distances and shipments by truck, local and nearby consumption (table 9).

TABLE 9.—Direct shipments of fuel briquets by rail and truck, as reported by producers, 1946–47, in net tons [1]

Produced in—	1946			1947		
	Rail	Truck	Total	Rail	Truck	Total
Eastern States	860,786	19,463	880,249	1,068,409	20,349	1,088,758
Central States	1,617,462	475,753	1,979,027	1,516,103	549,456	1,958,439
Pacific Coast States			114,188			[2] 107,120
Total United States	2,478,248	495,216	[3] 2,973,464	2,584,512	569,805	[3] 3,154,317

[1] Includes shipments outside the United States.
[2] Includes small tonnage shipped by scow.
[3] An additional 30,585 tons were used by 7 producers as fuel at their plants in 1946 and 14,807 tons by 6 producers in 1947.

PRICES

Monthly retail prices of fuel briquets from 1941 to 1945 for 21 selected cities, published in yearbooks of this series, were compiled from data collected by the Bureau of Labor Statistics, United States Department of Labor. Collection of briquet price data has, however, been discontinued except for the following cities, for which the December 1947 retail prices are quoted: Chicago, Ill., $18.54 per net ton; Milwaukee, Wis., $16.85; Minneapolis, Minn., $18.88; and St. Louis, Mo., $16.12.[3]

The trend in prices in the past 5 years is indicated by the average values in the Eastern, Central, and Pacific Coast States shown in table 1; these are values received by producers and not retail prices (as quoted above), which include transportation costs to markets and wholesalers' margins.

The value received at the plant ranged from $5 to over $20 per ton in 1947. Sales realizations vary widely because of the different local conditions under which briquets are manufactured and sold. The outstanding factors influencing the value per ton realized at any plant are cost of raw materials and labor and prices of competing fuels.

In the Eastern States, nearly all the output comes from plants in the anthracite region of Pennsylvania and the bituminous low-volatile fields of southern West Virginia, where the cost of raw fuel does not involve freight charges; the value f. o. b. plant is therefore relatively low. In the Central States 72 percent of the production came from plants at coal docks on the Great Lakes; the raw fuel for these plants involves a considerable freight charge, reflected in higher values per ton f. o. b. plant. In the Pacific Coast States (where the raw fuels used are residual carbons from manufacture of oil gas and pyrolysis of natural gas), the average per ton represents the highest value f. o. b. plant in the United States.

FOREIGN TRADE[4]

Imports of briquets into the United States in 1947 amounted to 387 tons valued at $3,220—virtually all from Canada.

Exports of briquets in 1947, principally to Canada, increased 52 percent over 1946 (tables 1 and 10).

[3] Retail Prices of Fuels by Cities, Preliminary Report, November-December 1947: Bureau of Labor Statistics, U. S. Department of Labor, 1948.
[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 10.—Briquets (coal and coke) exported from the United States, 1945–47, by countries of destination and customs districts

[U. S. Department of Commerce]

	1945		1946		1947	
	Net tons	Value	Net tons	Value	Net tons	Value
COUNTRY						
Canada	157,789	$1,126,233	163,305	$1,355,869	238,081	$2,633,912
Cuba	4	100	23	500	----	----
Denmark	----	----	----	----	8	180
Dominican Republic	----	----	1	60	4	89
Eire	----	----	----	----	30	613
France	895	5,200	----	----	----	----
French West Africa	----	----	----	----	10,621	156,453
Mexico	10	176	8	194	10	130
Panama, Republic of	----	----	2	35	----	----
Switzerland	10,662	122,522	----	----	----	----
Trinidad and Tobago	----	----	----	----	6	58
	169,360	1,254,231	163,339	1,356,658	248,760	2,791,435
CUSTOMS DISTRICT						
Arizona	4	97	----	----	10	130
Buffalo	25,080	149,652	41,871	381,445	86,033	1,040,963
Dakota	29,398	234,003	20,071	175,300	50,996	515,135
Duluth and Superior	10,062	80,555	34,428	312,266	39,579	417,164
Florida	4	100	22	500	----	----
Laredo	4	67	----	----	----	----
Maine and New Hampshire	85	495	934	6,385	1,022	11,970
Maryland	----	----	----	----	10	195
Michigan	67,727	468,446	40,502	252,523	18,696	162,024
New Orleans	----	----	2	35	10,627	156,511
New York	----	----	----	----	14	320
Ohio	----	----	----	----	202	2,465
Philadelphia	11,557	127,722	----	----	4	99
Puerto Rico	----	----	1	60	4	89
Rochester	4,085	20,580	15,859	130,859	26,920	256,914
St. Lawrence	21,338	172,434	6,302	62,315	13,788	218,722
San Diego	1	12	8	194	----	----
Vermont	15	68	3,302	34,307	45	320
Virginia	----	----	----	----	10	179
Washington	----	----	37	469	800	8,235
	169,360	1,254,231	163,339	1,356,658	248,760	2,791,435

TECHNOLOGIC DEVELOPMENTS

The Bureau of Mines field office at Golden, Colo., has added facilities to study briquetting on a laboratory scale, and tests were conducted on various fuels to determine their briquetting properties. The Bureau will also cooperate with the Wyoming Natural Resources Research Institute in a project on the briquetting of western coals.[5]

The Illinois Geological Survey at Urbana, Ill., continued experimental work during 1947 on the briquetting of Illinois coals by the Piersol [6] process. Attention was given primarily to corrugated bri-

[5] Parry, V. F., Résumé of Bureau of Mines Research and Development Work on Western Coals, 1942–47 Bureau of Mines Rept. of Investigations 4171, 1948, p. 7.

[6] 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 Briquettes: Impacted Without Binder from Partially Volatilized Illinois Coal: Illinois State Geol. Survey Rept. of Investigations 41, 1936 30 pp.
Singh, A. D., Trends in the Development of Smokeless Fuels: Coal Heat, vol. 49, No. 3, March 1946, pp. 61, 64.

quetted ribbons made at room temperature from Illinois deduster dust, heat-treated and broken into stoker-size fuel.

A selected bibliography of publications on fuel briquetting was recently completed by the Bureau of Mines.[7]

WORLD PRODUCTION

From table 11 it will be seen that Germany, France, and the United States are the top-ranking briquet-producing countries of the world. Attention is called to changes in previously published data for Germany, Japan, and Australia; all data for fiscal years ending before June 30 are now included in columns for the previous year (for example, data for year ended March 31, 1944, will be found in the 1943 column).

TABLE 11.—World production of fuel briquets, 1942–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1942	1943	1944	1945	1946	1947
Algeria	45,565	50,765	87,440	101,756	98,320	78,139
Australia: Victoria [2]	421,619	435,727	462,380	512,349	522,157	(3)
Belgium	1,127,430	1,013,410	456,990	787,530	1,079,620	(3)
Canada	220,139	244,892	277,707	275,625	298,960	290,880
Czechoslovakia:						
Coal	468,000	553,000	464,000	71,309	209,180	(3)
Lignite	261,000	323,000	328,000	192,485	252,452	(3)
Eire	21,052	90,188	123,749	118,558	85,781	(3)
France	3,424,550	3,045,910	1,588,490	3,531,530	5,399,403	5,279,000
Germany:						
Coal [4]	[2] 7,186,522	[2] 6,419,404	(3)	(3)	[5] 1,902,293	(3)
Lignite [6]	[2] 59,707,162	[2] 61,550,277	55,407,000	(3)	[5] 39,884,438	(3)
Hungary:						
Coal	268,210	227,480	(3)	(3)	(3)	(3)
Lignite	57,130	58,250	[7] 20,450	[8] 13,450	33,670	(3)
Indochina, French	54,600	29,860	17,620	1,940	4,710	(3)
Japan [2]	942,553	538,508	237,999	383,481	(3)	(3)
Morocco, French	(3)	10,872	25,198	(3)	(3)	(3)
Netherlands:						
Coal	968,052	896,192	608,316	412,571	725,859	910,046
Lignite	57,005	55,457	42,959	35,757	43,655	41,673
New Zealand	13,052	12,386	12,661	9,941	13,183	(3)
Poland:						
Coal	752,960	813,098	765,217	93,078	529,082	632,258
Lignite	(3)	(3)	(3)	-----------	27,190	41,697
Portugal	60,094	46,601	48,698	72,177	96,000	(3)
Rumania	194,726	175,877	(3)	(3)	(3)	(3)
Spain	788,613	653,994	924,862	1,049,520	833,445	(3)
Tunisia	20,691	(9)	(9)	16,619	32,347	36,764
Turkey	23,869	30,256	34,276	23,692	(3)	15,130
United Kingdom	71,294	749,342	883,974	1,002,333	1,567,664	1,862,115
United States:						
Briquets	1,586,023	1,963,136	2,236,163	2,505,816	2,725,193	2,877,208
Packaged fuel	229,560	195,592	159,455	188,823	173,198	165,906
Total [10]	78,971,000	80,183,000	65,214,000	(3)	(3)	(3)

[1] In addition to countries listed, briquets are produced in Bulgaria, Italy, Netherlands Indies, Sweden, and Yugoslavia, but production figures are not available.
[2] Fiscal year ended Mar. 31 of year following that stated.
[3] Data not available.
[4] Figures include production from East Upper Silesia through 1944.
[5] Excludes Polish zone.
[6] Figures include production from Sudetenland through 1944.
[7] January to June, inclusive.
[8] June to December, inclusive.
[9] Data previously listed for 1943 and 1944 represent tonnage consumed by Tunisian railways; later information indicates this was taken from stocks and there was actually none produced.
[10] Totals incomplete; represent only rounded sum of figures given in table. Data additional to those published in Minerals Yearbook, 1946, as follows: Eire, 1939—6,005; Portugal, 1939—24,267 and 1941—74,903; United Kingdom, 1940—671,609 and 1941—172,080 tons.

[7] Fisher, Paul L., A Selected Bibliography on Briquetting of Coal and Other Carbons: Bureau of Mines Inf. Circ. 7469, 1948.

PACKAGED FUEL

"Packaged fuel" is the trade name applied by the industry to a combination of briquetting and packaging of screenings or other raw fuels compressed into 3- to 4-inch cubes, wrapped (generally six to the package) in sturdy paper, and sealed with gummed tape.

The growth of the packaged-fuel industry from 1935 [8] through 1940 and its decline during the war years are illustrated in figure 2. A study of the development of the packaged-fuel industry from its beginning in 1928 to its peak in 1940 was made by V. F. Parry [9] of the Bureau of Mines; this study includes operations involved in the manufacture of packaged fuel and analysis of costs in typical plants.

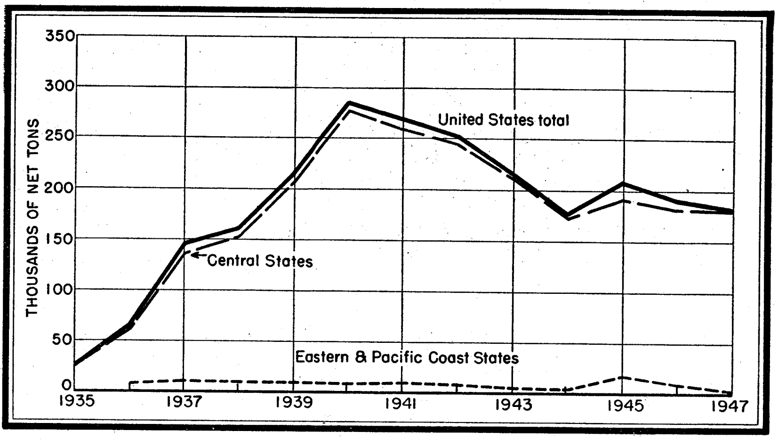

FIGURE 2.—Production of packaged fuel in the United States, by regions, 1935–47. (No production in Pacific Coast States, 1943–47.)

TABLE 12.—Salient statistics of the packaged-fuel industry in the United States, 1943–47

Year	Production (net tons)			Value of production	Plants in operation	Average value per net ton, f. o. b. plant	
	Eastern States	Central States	Total			Eastern States	Central States
1943	4,970	210,635	215,605	$2,366,733	72	$11.55	$10.96
1944	3,788	171,982	175,770	2,053,343	68	12.26	11.67
1945	16,606	191,537	208,143	2,518,636	61	12.86	12.04
1946	9,065	181,854	190,919	2,496,388	70	12.93	13.08
1947	2,153	180,728	182,881	2,882,105	62	16.58	15.75

[8] First canvass of the packaged-fuel industry by the Bureau of Mines.

[9] Parry, V. F., Technical and Economic Study of Packaged Fuel: Bureau of Mines Rept. of Investigations 3757, 1944, 45 pp.

DOMESTIC PRODUCTION

The 62 plants active in 1947 produced 182,881 net tons of packaged fuel valued at $2,882,105 (table 13). The national production decreased 4 percent from 1946, but the value increased 15 percent. There has been no production in the Pacific Coast States since 1942.

Output rose in 4 of the 11 producing States but declined in 7 States. Michigan and Wisconsin again led in production, and the largest individual producers were the Johnson Coal Cubing Co., Inc., Detroit, Mich., and the Cleveland-Cliffs Iron Co., Green Bay, Wis.

Shortages of raw fuels, binder, paper, and labor, as well as high manufacturing costs, were cited by operators as causes of decreased production and idleness.

Forty-seven plants operated from 9 to 12 months of the year, accounting for 95 percent of the total production.

The values received by the operators (tables 12 and 13) comprise cost of coal at the mine, freight rate, direct and indirect manufacturing costs, and profit. All of the producing States showed increases in average realization at the plant in 1947. The average realization at the plant by individual operators in 1947 ranged from $13 to $22 per ton.

TABLE 13.—Production of packaged fuel in the United States, 1946–47, by States

States	1946			1947		
	Plants	Net tons	Value	Plants	Net tons	Value
Eastern States	[1] 5	9,065	$117,206	[1] 3	2,153	$35,705
Central States:						
Illinois	3	1,454	23,814	2	(2)	(2)
Indiana	2	(2)	(2)	2	(2)	(2)
Iowa	1	(2)	(2)	1	(2)	(2)
Kentucky	1	(2)	(2)			
Michigan	27	55,883	741,486	24	66,156	1,036,844
Minnesota	4	29,319	413,443	4	24,155	416,084
Missouri	1	(2)	(2)	1	(2)	(2)
Nebraska	1	(2)	(2)	1	(2)	(2)
Ohio	16	29,239	377,736	15	27,704	443,106
Wisconsin	9	48,087	600,715	9	42,392	634,694
Undistributed [2]		17,872	221,988		20,321	315,672
Total Central States	65	181,854	2,379,182	59	180,728	2,846,400
Total United States	70	190,919	2,496,388	62	182,881	2,882,105

[1] 1946: Maine, 1; Pennsylvania, 1; and Virginia, 3. 1947: Maine, 1; and Virginia, 2.
[2] Data which the Bureau of Mines is not at liberty to publish separately are combined as "Undistributed."

Number of Plants.—Sixty-two plants produced packaged fuel in 1947 [10] (8 less than in 1946); 23 of these were in the Detroit and Cleveland areas and contributed 38 percent of the total production. The Simonson Cashway Co., St. Cloud, Minn., using Eberling equip-

[10] Years plants (active in 1947) started producing are given in the 1947 Packaged-Fuel Directory (which also shows type of raw fuels used), obtainable on request from the Bureau of Mines, Washington 25, D. C.

ment, began operations in January 1947. Nineteen plants were idle and six went out of business. One plant was reported under construction in 1947—the Chicago Packaged Fuel Co., Chicago, Ill., with equipment by Blaw-Knox Co., Pittsburgh, Pa.; this plant, using bituminous low-volatile coal and asphalt binder, expects to begin operating early in 1948.[11]

Capacity.—Fifty-five of the 62 plants active in 1947, with annual capacities up to 15,000 tons, produced 44 percent of the total output of packaged fuel; the other 7 active plants, with capacities ranging from 15,000 to over 60,000 tons (table 14), produced 56 percent of the output. The largest annual capacities in 1947 were reported for the plants of the Johnson Coal Cubing Co., Inc., Detroit, Mich., and the F. Hurlbut Co., Green Bay, Wis.

TABLE 14.—Annual capacity and production of packaged-fuel plants in the United States, 1943–47

	Active plants		Production		
	Number	Annual capacity (net tons)	Net tons	Percent of— Annual capacity	Percent of— Annual production
1943	72	460,000	215,605	46.9	100.0
1944	68	428,600	175,770	41.0	100.0
1945	61	452,320	208,143	46.0	100.0
1946	70	530,760	190,919	36.0	100.0
1947:					
Capacity of—					
Less than 5,000 tons	40	101,300	36,888	36.4	20.2
5,000 to less than 10,000	12	72,400	22,975	31.7	12.6
10,000 to less than 15,000	3	36,000	19,964	55.5	10.9
15,000 to less than 25,000	4	80,000	52,588	65.7	28.7
25,000 to less than 40,000	2				
40,000 to less than 60,000	--------	137,500	50,466	36.7	27.6
60,000 tons or more	1				
	62	427,200	182,881	42.8	100.0
Production of—					
Less than 500 tons	11	23,560	2,630	11.2	1.4
500 to less than 1,000	18	59,620	13,074	21.9	7.1
1,000 to less than 3,000	21	76,520	36,764	48.0	20.1
3,000 to less than 5,000	3	34,000	11,491	33.8	6.3
5,000 to less than 10,000	5	84,000	34,842	41.5	19.1
10,000 to less than 25,000	2	149,500	84,080	56.2	46.0
25,000 tons or more	2				
	62	427,200	182,881	42.8	100.0

[11] Black Diamond, Open Modern Coal-Packaging Plant: Vol. 120, No. 6, March 1948, pp. 24–25.

Processes.—No new processes were reported in use in 1947. Fifty-seven of the 62 active operations used the Eberling process;[12] 2 used Glenn-Smith equipment;[13] 1 used Leemon equipment;[14] and 2 used equipment designed by Johnson Coal Cubing Co., Inc.,[15] Detroit, Mich. (These processes are briefly discussed by V. F. Parry in his Report of Investigations 3757, previously cited.) Additional machinery was installed at 3 plants in 1947.

Raw Fuels.—Four kinds of raw fuels (table 15) entered into the manufacture of five types of packaged fuel in 1947 (table 16). Bituminous low-volatile coal at 57 plants, used either alone or in combination with other fuels, accounted for 94 percent of the total raw fuels used. Raw fuels, other than yard screenings, accounted for two-thirds of the raw fuels made into cubes in 1947.

The cubes measure approximately 3 to 4 inches. Fifty-seven plants wrapped 6 cubes to a package, 4 plants 8 to a package, and 1 wrapped 4 to a package; 23 plants reported wrapping by machine, 9 by hand, and 30 a combination of machine and hand. The packages weigh from 9 to 15 pounds, depending on number and size of cubes contained. Several hundred tons of cubes were sold in bulk (unwrapped); these were made with bituminous low-volatile and asphalt binder.

TABLE 15.—Raw fuels used in making packaged fuel in the United States in 1947

Character of raw fuels used	Plants	Net tons	Plants using—	Plants	Raw fuels used (net tons)		
					Yard screenings	Other raw fuels	Total
Bituminous low-volatile	57	171,469	Yard screenings exclusively (from own or other yards)	33	37,281		37,281
Bituminous high-volatile	4	3,325	Raw fuels (other than yard screenings) exclusively	10		89,671	89,671
Semianthracite	3	3,977	Both yard screenings and other raw fuels	19	21,190	33,734	54,924
Petroleum coke	7	3,105					
	[1] 62	181,876		62	58,471	123,405	181,876

[1] 53 plants used 1 kind of fuel only, 8 used 2 kinds (separately), and 1 used a mixture of 2 kinds; hence the sum of the items shown exceeds the total number of active plants.

[12] Eberling, C. M., Packaged Fuel Produced by the Eberling Process (Cleveland, Ohio): Coal Heat, vol. 28, No. 1, July 1935, pp. 64-66.
Coal Heat, Time to Consider the Future: Vol. 48, No. 3, September 1945, p. 55.

[13] Black Diamond, Briquetting Plant Solves Slack Problem: Vol. 98, 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.)
White Glove Packaged Fuel Division of Blaw-Knox Co. (Pittsburgh, Pa.), The Story of White Glove Packaged Fuel: Bull. 2085, c. 1946, 4 pp.

[14] 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.)

[15] Black Diamond, A Mammoth Package-Fuel Plant: Vol. 102, No. 7, Apr. 8, 1939, p. 23. Black Diamond, Packaging Coal at the Johnson Plant at Detroit: Vol. 115, No. 2, July 21, 1945, p. 20.

TABLE 16.—Classification of plants and production of packaged fuel in the United States, by kinds of raw fuel used, 1946–47

Raw fuel used	1946			1947		
	Plants	Packaged fuel produced		Plants	Packaged fuel produced	
		Net tons	Percent of total		Net tons	Percent of total
Bituminous low-volatile	63	165,734	86.8	56	165,936	90.7
Bituminous high-volatile	1			4		
Mixture of bituminous low- and medium-volatile	1			-------		
Mixture of bituminous low- and high-volatile	1			-------		
Mixture of bituminous low-volatile and Pennsylvania anthracite	1	17,185	9.0	-------	10,589	5.8
Mixture of bituminous low-volatile and petroleum coke	1			1		
Semianthracite	3	3,424	1.8	3	3,977	2.2
Petroleum coke	7	4,576	2.4	6	2,379	1.3
	[1] 70	190,919	100.0	[1] 62	182,881	100.0

[1] In 1946 and 1947, 2 types were made at 8 plants; hence the sum of the items shown exceeds the total number of plants active in the respective years.

Binders.—Starch, totaling 960 tons and averaging 15 pounds per ton of packaged fuel produced in 1947, is the principal binder employed (table 17). Asphalt (about 100 pounds per ton) and cement (about 70 pounds per ton) were also used.

TABLE 17.—Classification of packaged-fuel plants in the United States by type of binder used, 1944–47

	1944		1945		1946		1947	
	Plants	Percent of total packaged-fuel production	Plants	Percent of total packaged-fuel production	Plants	Percent of total packaged-fuel production	Plants	Percent of total packaged-fuel production
Type of binder used:								
Starch	66	77.4	58	72.5	65	72.7	58	77.9
Asphalt	2	22.6	3	27.5	3	26.0	2	22.1
Starch and asphalt	1		1		1	1.3	1	
Cement	-------	-------	-------	-------	2		2	
	[1] 68	100.0	[1] 61	100.0	[1] 70	100.0	[1] 62	100.0
Production (net tons)	-------	175,770	-------	208,143	-------	190,919	-------	182,881

[1] In 1944–47, 1 plant making 2 types of packaged fuel used starch binder for 1 and starch and asphalt for the other; hence the sum of the items shown exceeds the number of active plants.

SHIPMENTS

Local sales (called for by passenger car or delivered by truck) amounted to 147,599 tons and accounted for 81 percent of the 1947 total sales; other than local (shipped by truck to points in Wisconsin, Minnesota, Indiana, and Michigan), 13 percent; and shipments by rail (to points in Wisconsin, Minnesota, and Michigan), 6 percent (table 18).

TABLE 18.—Shipments of packaged fuel in the United States by method of transportation, 1943–47, 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
1946	150,770	25,262	176,032	14,555	190,587
1947	147,599	23,749	171,348	11,270	182,618

[1] Includes sales called for and delivered.

Gem Stones

By SYDNEY H. BALL

THE JEWELRY INDUSTRY IN 1947

JEWELERS in 1947 had more competition for the consumer's dollar from dealers retailing other durable goods, long unobtainable, and also found their customers more discriminative. Consequently, whereas retail sales as a whole increased 18 percent in value, jewelry sales were—in dollar value ($1,390,000,000)—about 19 percent below those enjoyed in 1946 and—in volume—owing to increased prices, perhaps 15 percent less. During the wartime boom the jewelers had little competition. They now have returned to their prewar position and must fight for their trade. Although Christmas sales were large, they were somewhat less than in 1946 and were characterized by the slowness with which expensive items moved—especially large diamonds. Retailers' stocks decreased somewhat in 1947, and wholesale jewelers' sales ($494,000,000) were 14 percent less than those of 1946. Factories were plagued by a shortage of skilled labor.

The profits of the industry were built on an exceptionally prosperous national economy—high industrial wages, a record national income, and record exports. Marriages were exceeded in number only by those of 1946.

Exports of jewelry were large, the chief customers—notwithstanding certain Government restrictions—being Brazil, Canada, and the Philippines.

FASHIONS IN JEWELS

Life in 1947 was more formal and entertainment more lavish than in wartime. A greater display of jewels was therefore the order of the day. Costumes required colorful jewelry by day and sparkling jewelry by night, in many instances with movable parts that shimmer in the light. More and more jewelry was selected to suit the type of the wearer; her complexion was as important in her choice of jewelry as in the choice of her gown.

Jewelry in demand during 1947 was notably graceful in lines and delicate in workmanship, emphasizing the femininity of the wearer.

Clips and pins, earrings, bracelets, and rings held their popularity, while bracelets hiding a tiny watch under a jeweled cover were new. A number of small clips of the same design were worn by some. Earrings frequently had long pendants or drops, similar to classical Greek or Roman designs. Choker necklaces remained popular, and bib necklaces of ancient Egyptian design became favorites. Snake necklaces of woven wire frequently carried detachable pendants or clips. Rings were often large. Link bracelets or wide, flexible bracelets with crestlike ornamentation, or tailored ones of bulky gold, were popular.

Ensembles were more and more in vogue—a necklace, a bracelet, a ring, and earrings all of the same design and mounted with the same kind of stone. Formal jewelry that can be broken into two or more pieces continues to gain in popularity—a necklace, for instance, that can also be used as clips and brooches.

The insistent demand for diamonds caused colorless gems to be by far the most widely used, with blue and red almost tied as a poor second, followed by green, yellow, and purple. Emeralds and colored diamonds seemed to be gaining in the finest jewelry. Opal was seen more commonly; aquamarine held its own; and topaz and citrine continued to lose ground.

DOMESTIC PRODUCTION

Although by no means an important factor in the national economy, the value of gem stones produced and their value after cutting has increased impressively for the past 3 years, due mainly to the awakened interest of Americans in the Western States to the beauty of such minerals and the fun of cutting them. Activity in this field is fostered by journals, technical societies, and educational institutions. An adequate supply of gasoline permits not only collectors—amateur miners—to visit the field, but brings to the door of lapidaries and curio shops their best customers, automobile tourists. A broadening demand and reduced imports from Europe have increased prices since the beginning of World War II. Some small mining companies are purchasing bulldozers and other mining machinery to be used on their properties.

No reliable statistics exist as to the value of the domestic product. Last year the writer estimated the value, in the rough, at $325,000. In 1947 it was more—perhaps $570,000—and, after processing, the value might have been several times this figure.

In Idaho, California (San Diego), and Maine, some of the old gem deposits changed hands, and production may increase in the future.

The myriad forms of agate, attractive and widely distributed, easily found and as easily cut, led the field, followed by jade, turquoise, and variscite. Of the States and Territories, Oregon, Wyoming, Washington, Colorado, Alaska, and Nevada produced in about that order of quantity of output.

Agate.—H. C. Dake, in a personal communication, states that he believes Oregon alone produced in 1947 agates to the value of $1,000,000. Oregon has many quartz operations, particularly in the central part of the State, equipped with bulldozers and power shovels, and also an enthusiastic group of lapidaries, amateur and professional, and curio venders. Certain Oregon beaches have also produced well. In "Gem Mining, a New Oregon Industry" (see Bibliography), Dr. Dake describes in detail the various agate-producing districts.

Washington produces considerable opalized wood and other agate gems, part of which are cut in the State. Idaho produces some quartz gem stones, and there are a number of lapidaries at Boise.

The fine moss agate of the Yellowstone Valley, Mont., is still being gathered, but the terrace gravels have been largely picked over. The 1947 production was worth perhaps $10,000. Montana moss agate is sold widely in the West. The west Texas region also produces considerable agate. Arizona has some fine agates, particularly from near Cave Creek. Complaints have been lodged with the Government that so much agatized wood is stolen from the Petrified Forest, an Arizona national park, that the beauty of the park is jeopardized. New Mexico, particularly Luna County, produced some agate, which was shipped to the west coast for cutting.

Turquoise.—In 1947 turquoise production, in dollar value, probably exceeded that of jade. Dan E. Mayers (see Bibliography) contributed interesting data on the American Indian and turquoise. The Southwest Gem & Jewelry Co. produced a fair amount of turquoise, perhaps 200 pounds, from its properties in Mineral Park, Ariz. Collection of turquoise from Castle Dome, N. Mex., was said to be perquisite of being a miner there. Later the company recovered turquoise as a byproduct. It is reported that most of the open-cut is now below the turquoise horizon. The company reported that during 1947 it "recovered several hundred pounds of rough turquoise, as it has for the last few years." G. M. Butler reported that the lapidaries of Miami and Globe, Ariz. treat the stones with an oily substance, improving both the color and the hardness of the chalky, feebly colored product. State highway engineers, drilling to locate the Pinto Creek bridge foundation near Miami, encountered an old tunnel. A cave-in followed, revealing the presence of turquoise among other minerals. The Colorado State Mineral Resources Board stated that in 1947 the King Mine, Manassa, Colo., produced turquoise valued at $30,000. An unusually large turquoise mass, weighing 10¾ pounds originally and 8¾ pounds after trimming, was included. The proprietors were offered $1,000 for it. A little turquoise was produced from the Hachita Mountains, N. Mex. Some development work was done on Los Cerrillos deposit, New Mexico, but net results were not encouraging.

Nevada produced but little in 1947. Some was mined in the Copper Basin district and cut there, but later in the year keen competition from Arizona forced a shut-down.

Jade.—B. D. Stewart, Department of Mines of Alaska, reported that the Kobuk River region produced much less jade in 1947 than in 1946, due to curtailed operations by the principal producer. The local demand exceeded supply, and there was none for export. In addition, at least one Eskimo collected and shipped some material. From $25,000 to $30,000 worth of jade being shipped to China in the spring of 1947 by the Arctic Exploration Co., Inc., was stolen but later recovered. It consisted of boulders weighing 200 to 1,500 pounds each.

In Wyoming there were a number of jade hunters around Lander, but as few large boulders and little high-grade gem material was recovered, results were disappointing compared to those of 1946. A new occurrence was reported in the Shirley Mountains.

The californite locality near Happy Camp in northern California, which furnishes a fair imitation of jade, has long been known, but James L. Kraft, reported boulders of true jade in the vicinity. The California Division of Mines reported that mineral collectors pick up boulders of nephrite from the beaches of Monterey County, between Big Sur and the San Luis Obispo County line. Austin F. Rogers described a massive rock, an intimate mixture of grossularite and idocrase (vesuvianite), from Placer County, Calif. It is white to gray and an attractive ornamental stone that might well serve as a substitute for jade.

Diamond.—The litigation between Glenn L. Martin, the airplane manufacturer, and the Diamond Corp. of America, which once held a 50-year lease on the principal Pike County, Ark., diamond deposit, during the summer of 1947 was dismissed, and $325,000 of the corporation's funds were released. In August 1945, according to the California Division of Mines, a small diamond was found in Yuba County a short distance below Parks Bar by Lewis Drade, while placering. Confirmation of the reported discovery of a 19½-carat stone in the summer of 1947 at Rock Flat 4 miles west of McCall, Idaho, is not yet available.

Other Gem Stones.—In 1947 the Montana sapphire mines reported no production. Synthetic sapphire producers have won the principal market, the industrial uses.

At one time Niagara Falls, N. Y., produced satin spar, which James Potter cut for the tourist trade. The local supply is now exhausted.

Mrs. E. M. Roe reported that in 1947, at Pipestone, Minn., more catlinite was mined than for some years by two Indians. Total production probably approached $5,000.

Other gem stones produced in small amounts in 1947 include *agate,* Colorado; *alabaster,* Montana; *amazon stone,* Colorado; *amethyst,* Colorado, Maine, North Carolina; *apatite* (green), Maine; *aquamarine,* Colorado, Georgia; *asteriated quartz,* Maine, North Carolina; *cesium beryl,* Maine; *garnet,* Colorado, New York, North Carolina; *kunzite,* California; *lapis lazuli,* Colorado; *moonstone,* New Mexico; *peridot,* Maine, New Mexico; *rose quartz,* Maine; *sapphire,* Colorado; *smoky quartz,* Maine, New Hampshire, North Carolina; *topaz,* California, Colorado, New Hampshire, Utah; *tourmaline,* California, Colorado, Maine; and *triphylite* (chatoyant), Maine.

CANADIAN GEM STONES

Time has not fulfilled the hopes of the earlier Canadian explorers. Canada is probably even poorer in gem stones than the United States. A couple of thousand dollars would doubtless cover the value of a normal year's production. There are relatively fewer lapidaries, professional or amateur, in Canada than in the United States; in consequence, a considerable percentage of the present small production is shipped across the border for cutting. Labrador has for decades been the premier source of labradorite; sodalite, albitic moonstone, ordinary moonstone, amazon stone, and chatoyant tremolite are found in the Bancroft area, Hastings County, Ontario; rock crystal near Black Rapids (Lyndhurst P. O.), Ontario, and agate in the Lake Superior region. Scapolite, rose quartz, rhodonite, and sphene (titanite) also occur. F. G. Smith informed the writer that he shipped from about 90 miles northwest of Yellowknife, Northwest Territories, some 200 pounds of iolite which could be cut into 200 carats of flawless gems worth perhaps $10 a carat.

GOVERNMENT REGULATIONS

Regulation of the jewelry industry did not decrease with VJ-day. With few exceptions, the laws attempt either to increase national revenue or to keep currency at home.

Cuba, the Union of South Africa, Palestine, and Singapore, however, reduced certain taxes and the United States some duties in accordance with the General Agreement on Tariffs and Trade, at Geneva, October 30, 1947. In both the United States and Canada, on the other hand, substantial luxury taxes continued to apply to jewelry sales. Peru, Trinidad, and Great Britain introduced or increased luxury taxes. A number of countries, particularly Latin American countries, prohibited the import of jewelry.

IMPORTS [1]

The value of imports of gem stones, real and imitation, exclusive of industrial diamonds, into the United States, as listed by the United States Department of Commerce, totaled $110,537,647, 42 percent less than in 1946. Diamonds comprised 87 percent of the total. Practically every class was less than in the previous year.

[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.

Precious and semiprecious stones (exclusive of industrial diamonds) imported for consumption in the United States, 1946–47 [1]

[U. S. Department of Commerce]

Commodity	1946		1947	
	Carats	Value	Carats	Value
Diamonds:				
Rough or uncut (suitable for cutting into gem stones), duty free	1,044,517	$48,668,843	1,075,478	$43,051,210
Cut but unset, suitable for jewelry, dutiable	604,638	117,968,206	347,810	53,471,539
Emeralds:				
Rough or uncut, duty free	544,711	579,745	7,385	258,062
Cut but not set, dutiable	11,902	210,274	4,133	82,747
Pearls and parts, not strung or set, dutiable:				
Natural		619,463		360,963
Cultured or cultivated		1,280,867		737,753
Other precious and semiprecious stones:				
Rough or uncut, duty free		329,552		298,393
Cut but not set, dutiable		8,932,862		3,662,382
Imitation, except opaque, dutiable:				
Not cut or faceted		68,108		118,168
Cut or faceted:				
Synthetic		1,640,426		483,313
Other		8,044,674		7,688,827
Imitation, opaque, including imitation pearls, dutiable		298,545		15,566
Marcasites, dutiable:				
Real		344,907		300,175
Imitation		31,174		8,549
		189,017,646		110,537,647

[1] In the corresponding table in Minerals Yearbook, 1946, p. 549, revisions for 1945 are as follows: Diamonds, rough and uncut, (carats) 895,219, (value) $43,131,784; cut but unset, (carats) 377,594, (value) $63,815,581. Emeralds, cut but not set, (carats) 107,591. Other precious and semiprecious stones, rough or uncut, $135,062; cut but not set, $5,158,408; cut or faceted, other, $252,388. Total value, $114,128,803.

DIAMOND

Nineteen forty-seven was a good year for diamond wholesalers, a fair or better year for the producers and retailers, and a poor year for master cutters and their employees.

World production was about 4 percent less than in 1946. Union of South Africa and Tanganyika Territory fell off somewhat, but Venezuela percentwise increased markedly. Output from the Belgian Congo, largely industrial stones, continued on the low side.

Sales of rough by the principal wholesalers, the subsidiaries of the Diamond Corp., were £24,500,000, as compared with £30,000,000 in 1946, but the difference was largely made up by rough purchased by the cutters from overstocked American brokers and cutters and from sellers of "outside goods" in the first half of the year. Rough stocks were again depleted.

Retail sales in the United States were good, although less than in 1946. At Christmastime, however, high-priced items moved slowly.

Prices of rough were stable, but some of the less expensive smalls were raised by the beginning of 1948. Cut, particularly that of mediocre quality, declined in the first 7 months of the year, but by the year end had regained its loss.

Industrial imports were lower in weight, but as better stones were bought the dollar value of imports showed only a small decline.

Share Dealings.—The shares of the leading diamond mining companies on the London Stock Exchange, their principal market, lost

Diamonds (exclusive of industrial diamonds) imported for consumption in the United States, 1946–47,[1] by countries

[U. S. Department of Commerce]

Country	Rough or uncut			Cut but unset		
	Carats	Value		Carats	Value	
		Total	Average		Total	Average
1946						
Argentina				114	$20,754	$182.05
Belgian Congo	5,649	$48,834	$8.64			
Belgium	3,104	135,882	43.78	288,929	51,150,251	177.03
Brazil	59,142	2,766,768	46.78	15,939	3,228,079	202.53
British East Africa	12,685	636,129	50.15			
British Guiana	3,246	175,033	53.92	752	84,802	112.77
British Malaya	2,500	20,169	8.07	617	177,379	287.49
Canada				127	8,674	68.30
Cuba	383	4,743	12.38	38,325	7,502,503	195.76
Denmark				4	610	152.50
Egypt				34	10,082	296.53
France				6,042	1,186,641	196.40
Greece				240	16,444	68.52
Hungary				107	4,575	42.76
India				929	183,941	198.00
Iran				200	40,243	201.22
Japan				3	1,215	405.00
Mexico				313	62,566	199.89
Netherlands	124	15,335	123.67	37,473	7,724,355	206.13
Palestine and Trans-Jordan	3,566	115,927	32.51	121,627	21,972,027	180.65
Portugal				671	146,431	218.23
Siam				40	9,411	235.28
Sweden				10	2,183	218.30
Switzerland				7,776	1,470,574	189.12
Union of South Africa	935,824	44,015,089	47.03	56,120	16,783,704	299.07
U. S. S. R.				4,796	1,002,000	208.92
United Kingdom	10,693	351,113	32.84	23,198	5,134,475	221.33
Venezuela	7,601	383,821	50.50	252	44,287	175.74
Total 1946	1,044,517	48,668,843	46.59	604,638	117,968,206	195.11
1947						
Austria				2	300	150.00
Belgium	3,482	45,579	13.09	205,650	30,368,217	147.67
Brazil	29,322	533,796	18.20	7,227	900,317	124.58
British Guiana	822	39,155	47.63	223	26,356	118.19
British Malaya				320	62,884	196.51
British West Africa	1,680	11,680	6.95			
Canada				7	1,924	274.86
China				1,033	245,648	237.80
Cuba				6,422	866,997	135.00
Egypt				6	4,126	687.67
France	131	13,293	101.47	4.339	756,758	174.41
French West Indies	21,093	351,188	16.65			
Germany				1	250	250.00
Hungary				125	23,374	186.99
India				136	28,158	207.04
Italy				9	3,861	429.00
Mexico	70	16,455	235.07	1,021	318,211	311.67
Netherlands				24,011	3,742,952	155.88
Palestine and Trans-Jordan				35,474	4,297,767	121.15
Portugal				96	13,940	145.21
Siam				102	4,902	48.06
Switzerland				4,798	625,621	130.39
Syria				10	2,000	200.00
Union of South Africa	963,969	40,421,913	41.93	38,255	8,749,590	228.72
U. S. S. R.				9,270	707,959	76.37
United Kingdom	10,725	480,310	44.78	9,273	1,719,427	185.42
Venezuela	44,184	1,137,841	25.75			
Total 1947	1,075,478	43,051,210	40.03	347,810	53,471,539	153.74

[1] In the corresponding table in Minerals Yearbook, 1946, p. 550, revisions for 1945 are as follows: Rough and uncut: Belgian Congo, (carats) 15,054, (value) $108,985, (average value) $7.24; Union of South Africa, (carats) 830,851, (value) $41,277,299, (average value) $49.68. Total, (carats) 895,219, (value) $43,131,784 (average value) $48.18. Cut but unset: Belgium and Luxembourg, (carats) 104,953, (value) $14,544,028, (average value) $138.58; Brazil, (carats) 28,573, (value) $4,653,438, (average value) $162.86; India, (value) $135,764, (average value) $193.12; Palestine and Trans-Jordan, (carats) 106,036, (value) $17,716,906, (average value) $167.08. Total, (carats) 377,594, (value) $63,815,581, (average value) $169.01.

about 7 percent during 1947, as compared with an over-all loss of 2 or 3 percent on the New York Stock Exchange. Quotations were at their low in July–August, after which investment buying and Indian speculation caused a moderate improvement up to the year end. All the principal companies except Premier paid dividends.

Imports.—Imports of gem-grade diamonds into the United States decreased from $166,637,049 in 1946 to $96,522,749 in 1947, a loss of 42 percent. The dollar value of rough was off 12 percent and that of cut, 55 percent. In both cut and rough, quality deteriorated. In 1946 Belgium furnished 43 percent of the cut and in 1947, 57 percent. Palestine fell from 19 percent to 8, while Union of South Africa gained a bit (from 14 percent to 16). Cuba and Brazil lost their importance.

Judging from prices per carat, the Union of South Africa and United Kingdom furnished the best cut and Cuba and Palestine the poorest.

Cutting.—The gross overstaffing of the cutting industry has become apparent, and employment shrank from about 30,200 employees in 1946 (excluding those in Borneo and India) to 26,500 in 1947. Wages continued to fall—principally owing to competition caused by shortage of rough—and strikes, lock-outs, and lay-offs still consumed at least one-third of the men's time. Cuba and Brazil almost disappeared as cutting centers, and Palestine found the political situation withering. The United States continued unsurpassed as a cutter of large stones.

World Production.—Accurate figures regarding diamond production are not available for all countries, but the estimates in the following

World production of diamonds, 1943–47, by countries, in metric carats

[Including industrial diamonds]

Country	1943	1944	1945	1946	1947
Africa:					
Angola	794, 990	799, 120	803, 887	[1] 806, 961	799, 210
Belgian Congo	4, 881, 639	7, 533, 365	10, 386, 000	6, 033, 452	5, 474, 469
French Equatorial Africa	56, 183	60, 000	82, 849	87, 381	[1] 90, 000
French West Africa	36, 193	69, 726	79, 802	51, 834	[1] 90, 000
Gold Coast [2]	1, 317, 798	1, 165, 858	812, 451	653, 196	852, 493
Sierra Leone	834, 492	608, 744	504, 309	559, 229	605, 554
South-West Africa	94, 427	154, 379	152, 629	163, 611	180, 739
Tanganyika	52, 998	90, 667	115, 666	[1] 119, 446	74, 825
Union of South Africa:					
Mines	84, 342	552, 974	878, 713	1, 025, 019	918, 042
Alluvial	217, 987	380, 708	262, 529	256, 768	[3] 286, 692
Total Union of South Africa	302, 329	933, 682	1, 141, 242	1, 281, 787	1, 204, 734
Brazil [1]	275, 000	301, 000	275, 000	325, 000	275, 000
British Guiana	18, 272	[2] 13, 911	15, 442	22, 413	24, 669
Venezuela	22, 846	22, 037	12, 769	20, 912	61, 634
Other countries	6, 804	12, 000	2, 000	[4] 1, 600	[5] 3, 500
Grand total	8, 694, 000	11, 764, 000	14, 384, 000	10, 127, 000	9, 737, 000

[1] Estimated.
[2] Exports.
[3] Includes an estimate of 100,000 carats for State Mines of Namaqualand.
[4] Partly estimated; includes India, Borneo, Australia (New South Wales), and U. S. S. R.
[5] Includes India, Russia, Borneo, New South Wales, and United States.

table are believed to be fairly reliable. World production (gems and industrials) in 1947 is estimated to have been 9,737,000 carats (2.15 short tons), worth at the mine some $75,105,000, which compares with 10,127,000 carats (2.23 short tons) in 1946. This is about 96 percent of the 1946 production as to weight and 92 percent as to value. By weight, 1,120 pounds were gem stones and 3,173 pounds industrials.

Belgian Congo was the leading producer, by weight (56 percent), although it represented only 12 percent of the value. On the other hand, the output of the British Commonwealth, which was only 30 percent of the weight, represented 68 percent of the value. The Belgian Congo, the Union of South Africa, and Tanganyika produced less than in the previous year, while the Gold Coast, Sierra Leone, Southwest Africa, and Venezuela produced more.

Industrial Diamonds.—It appears that during the recent World War brokers of industrial diamonds and manufacturers of tools utilizing them overstocked, contributing to the decline in the quantity of industrials imported in 1947. Imports were much below those of 1942–44, whereas values were comparable. Early in 1948 production and consumption were in approximate balance, assuming that manufacturers are ingenious enough to use the grades available.

Industrial diamonds are being stockpiled by the Munitions Board.

The year saw many advances in the use of industrials mechanically, but only one new use, as counters for alpha, beta, and gamma rays, replacing in some instances the Geiger-Muller counter. As the diamond is sensitive to radioactivity, fine colorless crystals form the most sensitive and enduring counters.

The use of the diamond drill in oil-well and blast-hole drilling increased.

Figure 1, originally prepared by Herbert Backman several years ago, shows the tremendous increase in use and the sharp decline in the price per carat of American imports in the past 29 years.

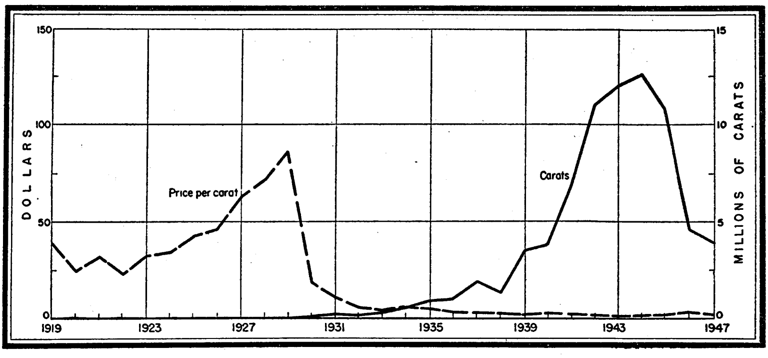

FIGURE 1.—United States imports and average price per carat of industrial diamonds, 1919–47.

Imports of industrial diamonds into the United States during the past 5 years are shown in the accompanying table.

Industrial diamonds (glaziers', engravers', and miners') imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Carats	Value		Year	Carats	Value	
		Total	Average			Total	Average
1943	12,084,133	$21,890,568	$1.81	1946	4,625,282	$14,297,536	$3.09
1944	12,614,507	22,894,244	1.81	1947	3,920,012	12,840,866	3.28
1945	10,733,411	12,823,962	1.19				

In 1947 the United States exported 92,626 carats of industrial diamonds valued at $512,273 or $5.53 per carat.

RUBY, SAPPHIRE, AND EMERALD

Compared with the diamond, the 1947 sales of rubies, sapphires, and emeralds were small. As most of the deposits of the noble gems do not lend themselves to large-scale operations, precious-stone mining by large companies is confined to the diamond, notwithstanding the fact that fine emeralds and rubies bring higher prices than most fine diamonds. Fine rubies come from Burma; sapphires from Siam, Ceylon, Indochina, and Kashmir (rumor has it that the deposits of the last two countries are virtually exhausted), and emeralds from Colombia and the U. S. S. R. Political conditions in most eastern countries are not conducive to successful mining, and the Colombian emerald mines are not being operated. But fine gems are not only in demand, they are also in short supply—a deficiency met only partly by stones from outmoded jewelry.

The gem gravels of Ceylon furnish not only rubies and sapphires but also many other gem stones. The gem diggers of the Ratnapura district, while active, are not increasing their output, notwithstanding the very high prices gems bring. The mining is done by Singhalese diggers, who work only in certain seasons. The annual value of production is from £66,000 to £82,500, unless exceptionally valuable stones are found.

C. C. Morton (Queensland Government Mining Journal, vol. 47, November 1946, p. 340) describes the Willow sapphire field, Central Queensland. The gems occur in white clay at from 1 to 10 feet below the surface. The good stones are yellows and blues, although the dominant colors are green or blue-green. One yellow weighed about 218 carats. Sapphires were first found at Withersfield, Queensland, in 1870. Partial records of the production of sapphires and associated gems in Queensland from 1892 to the end of 1946 totaled £657,180.

Transvaal, South Africa, produces a few gem beryls, some of which are dark enough to be classed as emeralds; on the average, they are of mediocre grade. The principal producer is the Somerset mine of the South Africa Beryl Mining Co. If the stock on hand brings a satisfactory price (the stock is about 100,000 carats), the Beryl mine (Beryl Mining Co., Ltd.), may be reopened and cutting be done in the company's own shop.

In the first half of 1947, South Africa produced 7,260 carats of emeralds as compared with 5,572 carats in the corresponding period of 1946.

Neither the Colombian Government mine, Muzo, nor the company-owned Chivor mines has been operated for some time, although in 1947 the Government gave the right to the Banco de Republico to exploit Muzo, and it is reported that the bank, in turn, has contracted for the mining, grading, and cutting of the stones. A decree effective August 1, 1947, is aimed at suppressing the rather large black market in emeralds, which has existed for some years in Colombia, by controlling the mining, sale, possession, export, and cutting of rough emeralds. (Information received in part through the courtesy of Clinton Bernard.)

LESSER GEMS

The American Gem Society, by a vote of its members, has discontinued the use of the term "semiprecious," as the adjective is considered to be meaningless.

The finest of opals, the Australian, is growing in popularity and increasing in price, partly due to the purchases by GI's stationed "down under." There is some evidence that the Lightning Ridge, Queensland, black opal deposits are playing out. In the heyday of the field (1910), a thousand miners worked the field; today, only 20 to 30, and buyers avidly snap up the few gems found, even at present high prices. The "Shallow Four Mile" workings, once largely neglected, are the site of today's main workings. From 1892 to the end of 1946, Queensland had an official opal production of £189,150.

New Zealand jade (nephrite) used to be recovered as a byproduct of gold sluicing, but with the decline in alluvial mining, the supply does not satisfy local demand.

H. Buttgenbach described a fine topaz crystal weighing 2½ kilograms found near the Gitshie River, a branch of the Kungwe, in the Ruanda, Belgian Congo.

A large, fine aquamarine brooch was presented to Mrs. Harry Truman when, late in 1947, she and President Truman visited Brazil for the Pan American conference. Raymond M. Miller reports that Brazilian gem merchants still export quantities of blue topaz, particularly to the Central American and Cuban markets, as aquamarine. In Brazil, he says, aquamarine sells at three times the price of blue topaz.

M. F. Beliakov reports lazulite in a quartz vein in the vicinity of Mount Sura-iz, northern Urals. The quality of some warrants its use in jewelry.

Edward R. Swoboda[2] describes the garnet deposits of Brazil opened up since the war-boom development of the national lapidary industry. Both fine essonites and almandites are produced.

In 1947 andalusite of fine color but small size appeared on the American market. The American Gem Society believes it comes from the gravel near Santo Teresa, State of Esperitu Santo, Brazil. The discovery was made in wartime prospecting for strategic minerals. The stone ranges in color from brick-red to yellowish-green and is quite brilliant.

Raymond M. Miller reported that the recent find of large pockets of deep-colored amethyst near Bahia has caused a fall in the price of that stone in Brazil. The Bahia amethyst, when burned, turns to a fine "citrine." Natural citrine also occurs near Bahia.

The best Ceylonese gem zircon, one of the dominion's widely disseminated gems, is found in Dediyagalemukulane, in the Southern Province.

It is stated that India yearly exports 118,000 rupees worth (about $35,000) of agate.

SYNTHETIC GEM STONES

Nineteen forty-seven was a year of great advance in making synthetic gem stones. Late in September the Linde Air Products Co. astonished gem experts by putting on the market synthetic star sapphires and rubies. Both "star" and color are well-developed in many examples. Production was limited, but the synthetic stars can be sold at one-tenth or even one one-thousandth of the price of the natural gem. By microscopic examination, the differentiation of natural and synthetic stones is easy. While one cabochon stone weighed 109.25 carats, most of the cut stones released weighed from 4 to 15 carats. The stones, clearly advertised as synthetic, were being sold through a single channel.

Carroll F. Chatham of San Francisco improved appreciably the size and quality of his synthetic emeralds; these can readily be differentiated from the natural gems by the microscope. Such synthetic gems are still relatively small.[3]

During the war, German scientists found that bearings could be shaped from synthetic spinel with the use of only 30 percent of the diamond dust required for sapphire or ruby. Later, upon being heated to 950° to 1,050° C., the spinel bearings hardened and replaced sapphire bearings satisfactorily.

[2] Jewelers' Circular-Keystone, March 1947, pp. 270–272.
[3] Pough, Frederick H., Jewelers' Circular-Keystone, 1947, pp. 176, 178, 224–226.

Linde Air Products Co. and the National Lead Co. in 1947 produced synthetic rutile of several colors. While not as yet on the market, eventually gems of high brilliancy, but rather too soft for many jewelry purposes, may be available.

During the recent World War, both Great Britain and the United States became self-sufficient in producing synthetic corundum and in shaping it for watch and instrument jewels. In 1946 import of foreign synthetics was resumed, and in October 1946 prices dropped markedly. The synthesis of corundum continued after the war in America, and ruby and sapphire were used in medium-price jewelry, for bearings, in various tools, gages, and tips for micrometers and for small mortars and pestles.

A Swiss manufacturer has produced ball bearings from synthetic corundum. In comparison with steel balls, they are hard and have a high modulus of elasticity, great chemical resistance, and physical stability.

It is reported that during the war Germans produced a sintered-ruby material superior as an abrasive to other aluminum oxide abrasives.

RELATIVE VALUE OF GEM STONES

Gem stones are valued for many reasons but mainly for their beauty and rarity. Value is so dependent on perfection that it is difficult to rank gems rigidly. A fine spinel may well be more valuable than a diamond of mediocre quality. In a broad way, the noble gems rank highest, about as follows: Deeply and attractively colored diamonds (fancies), emeralds, rubies, colorless diamonds, and sapphires. The other gems follow in about this order: Imperial jade, star ruby, black opal, cat's eye, alexandrite, star sapphire, spinel, demantoid, kunzite, morganite, peridot, aquamarine, topaz, white opal, jade, tourmaline, amethyst, zircon, garnet, citrine, turquoise, and moonstone. To assign a dollar value to the foregoing would have little meaning. A pound of "fancies" might be worth $11,350,000, or $5,000 a carat, and a pound of turquoise but $15, or, say, 1 cent a carat.

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Gold and Silver

By CHARLES WHITE MERRILL AND HELENA M. MEYER

GENERAL SUMMARY

UNITED STATES mine production of gold in 1947 increased 34 percent compared with 1946, continuing the uptrend from the low reached in 1945. Nevertheless, output remained below that for any year between 1930 and 1942. Silver production in 1947 increased 56 percent from the low point reached in 1946 and was the largest since 1943. The gold-mining industry had returned to unrestricted operations when War Production Board Order L-208 was rescinded, effective July 1, 1945; but many mines, productive in prewar years, did not resume work or did so on a restricted scale only. Higher prices for equipment and supplies and higher wages, combined with the difficulties of recruiting efficient labor forces, made former operators reluctant to reopen mines with narrow prewar profit margins. Continued inflation during 1947 with little evidence that inflationary forces soon would be arrested, discouraged those who might otherwise have promoted new gold-producing enterprises. Moreover, in many instances the years of idleness had resulted in deterioration of plants and mine workings which required very large capital outlays for rehabilitation.

The expanded output of silver in 1947 is explained largely by the relatively tranquil labor-management relations at mines and smelters where byproduct silver is recovered, compared with the disturbed conditions in 1946. In addition, the higher Treasury buying price for silver established in July 1946 was reflected in stimulated silver output in 1947.

California remained in first place as a gold producer, but outputs in Utah and South Dakota were very nearly as large. The three States furnished 60 percent of domestic mine production. California output came principally from straight gold mines (both placer and lode), Utah production was recovered mainly from copper ore mined in the West Mountain (Bingham) district, and South Dakota production came almost entirely from gold ore produced at the Homestake mine. Idaho continued to be the leading silver producer, followed in importance by Utah and Montana. These three States supplied 68 percent of the domestic output. About one-half of the Idaho production was recovered from dry ores, but most of the rest from the three States was a byproduct of ores treated principally for base metals.

The recovery of gold was divided fairly evenly among smelting of crude ores and concentrates (only a very small part of which was recovered by the direct smelting of ore), placer methods, and amalgamation-cyanidation mills. Over 82 percent of the domestic silver output was recovered by the smelting of concentrates and nearly all of the remainder by the direct smelting of ore.

Gold production outside the United States increased slightly in 1947 compared with 1946, largely because of estimates of Russian output reflecting a belief in postwar recovery there. World silver production in 1947 increased 24 percent compared to 1946 and was the highest since 1944, although lower than in any year in the period 1893–1944. All of the World increase in 1947 can be accounted to North America and over half of it in the United States, where the quantity increase in 1947 over 1946 exceeded that of any other country.

Shaft sinking and continued exploratory drilling in the vicinity of Odendaalsrus, Orange Free State, 150 miles southwest of Johannesburg, brought encouraging results. A large gold field was forecast, and a boom of major proportions continued.

Owing to restrictions on the international movement of gold and silver and to measures taken by governments to stabilize the exchange value of currencies, gold and silver have lost much of their monetary significance in recent years. The eagerness of individuals to acquire these metals, however, appears to have increased, particularly where the monetary regulations are the most arbitrary. The press reported very high prices for both metals in a number of foreign markets. These prices were sustained, moreover, by various government regulations that restricted the movement of metals to markets and the conversion of proceeds of sales to the national currency of the seller. Moreover, some of the reported trading was conducted in black markets. Reports of high prices for gold led some domestic producers to advocate regulations under the Gold Reserve Act that would permit the free export of newly mined 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.

In Canada some relief was provided its gold miners in the form of a Government subsidy to be paid for 3 years from December 1947. The subsidy will be half the excess of the individual miner's production cost over $18 per fine ounce and will be paid on output exceeding two-thirds of production in the year ended June 30, 1947. The importance of gold mining as a source of employment and the need for gold in balancing Canada's international trade were the principal reasons given for the subsidy program. Both the International Monetary

Fund and the United States Government, the latter as the largest buyer of gold, indicated disfavor toward any tendency for countries to become dependent on subsidized gold mining in seeking equilibrium in their balances of international payments.

Salient statistics of gold and silver in the United States,[1] 1943–47

	1943	1944	1945	1946	1947
Mine production, fine ounces:					
Gold	1,363,815	998,394	954,572	1,574,505	2,109,185
Silver	41,460,826	34,473,540	29,024,197	22,914,604	35,823,563
Ore (dry and siliceous) produced (short tons):					
Gold ore	3,766,149	1,964,680	1,364,308	2,395,500	3,523,715
Gold-silver ore	553,566	364,698	276,530	389,681	366,454
Silver ore	643,271	290,297	343,458	209,626	344,649
Percentage derived from—					
Dry and siliceous ores:					
Gold	38	30	30	40	39
Silver	26	17	24	24	26
Base metal ores:					
Gold	50	58	51	23	29
Silver	74	83	76	75	74
Placers:					
Gold	12	12	19	37	32
Silver	(2)	(2)	(2)	(2)	(2)
Net industrial consumption:					
Gold	$86,343,353	$97,298,283	$108,944,332	$153,687,000	$48,900,000
Silver, fine ounces	118,000,000	120,100,000	126,300,000	87,000,000	98,500,000
Imports:					
Gold	$101,792,745	$113,836,359	$93,718,050	$532,961,768	$2,079,588,406
Silver	$27,902,960	$23,373,037	$27,278,396	$57,577,888	$68,140,343
Exports:					
Gold	$32,854,590	$959,227,923	$199,967,940	$221,467,636	$213,240,800
Silver	$30,689,397	$126,915,344	$90,936,901	$36,454,690	$30,648,742
Monetary stocks:[3]					
Gold	$21,938,000,000	$20,619,000,000	$20,065,000,000	$20,529,000,000	$22,754,000,000
Silver, fine ounces	2,687,000,000	2,345,000,000	2,005,000,000	1,951,000,000	1,953,000,000
Price, average, per fine ounce:					
Gold	$35.00	$35.00	$35.00	$35.00	$35.00
Silver	$0.711+	$0.711+	$0.711+	$0.808	$0.905
World production, fine ounces:[4]					
Gold	28,800,000	26,300,000	26,100,000	27,500,000	28,800,000
Silver	217,100,000	186,200,000	150,770,000	126,001,000	156,782,000

1 Philippine Islands and Puerto Rico excluded.
2 Less than 0.5 percent.
3 Owned by Treasury Department; privately held coinage not included.
4 Estimated.

Effective November 24, 1947, the Provisional Regulations issued under the Gold Reserve Act of 1934 were amended by the Secretary of the Treasury and approved by the President. The principal effect of the amendments was to suppress trade in gold procured ostensibly for the arts and industrial use but channeled into premium price markets either for domestic hoarding or foreign trade. This move by the Secretary of the Treasury responded to a request of the International Monetary Fund that its members take measures to reduce international transactions in gold at premium prices. The amended regulations also clarified certain other procedures under the Gold Reserve Act, including the conditions under which domestic companies could participate in gold transactions growing out of their smelting and refining of the metal from foreign raw materials.

International trade in silver was subject to so many restrictions that no world market could exist early in 1947. For example, the

Indian Government prohibited the importation of silver for private account. As a result, late in April the price of silver in India rose to $1.45 an ounce, calculated at the official rate of exchange. Similar aberrations developed in other markets, caused both by monetary and silver trade regulations.

Silver's traditional use in coinage was restricted further during 1947. Australia reduced the silver content of its coins from 0.925 to 0.500 fine, and New Zealand substituted a cupronickel alloy for a silver-alloy coinage. On the other hand, Mexico undertook a coinage program that consumed nearly 15,000,000 ounces of silver during 1947.

The Treasury buying price for gold and silver throughout 1947 continued at $35 and $0.9050505+ per fine ounce, respectively. The price for silver that could not qualify for Treasury purchase fluctuated. The New York "official" price for 0.999 fine silver opened 1947 at $0.8275 and after a recession rose to $0.8625 on March 6 for the year high. An irregular decline followed carrying the price to the year low of $0.59750 on June 20. An irregular recovery resulted in the price reaching $0.74625 on November 3, where it remained unchanged until December 31.

The net inflow of gold and silver, reestablished in 1946 after a period when war expenditures had depleted the United States holdings, increased in volume in 1947. The gain in gold was the largest since 1940 and carried the total United States stock close to its all-time high established in October 1941. In fact, if the gold recently transferred to the International Monetary Fund is included as a part of the total United States holdings, an all-time high was reached in 1947.

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 deviations 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 43 years, 1905–47, show a total excess of gold of 242,974 ounces (a difference of 0.16 percent) and a total excess of silver of 14,430,439 ounces (a difference of 0.61 percent).

Gold and silver produced in the United States, 1905–47, in fine ounces, according to mine and mint returns in terms of recovered metals

Year	Mine		Mint	
	Gold	Silver	Gold	Silver
1905–42	140, 349, 672	2, 210, 977, 772	140, 647, 046	2, 223, 826, 249
1943	1, 377, 579	41, 486, 897	1, 394, 522	40, 900, 121
1944	998, 394	34, 473, 540	1, 022, 238	35, 651, 049
1945	968, 062	29, 024, 197	928, 893	29, 063, 255
1946	1, 574, 505	22, 914, 604	1, 462, 354	21, 103, 269
1947	2, 109, 185	35, 823, 563	2, 165, 318	38, 587, 069
Total	147, 377, 397	2, 374, 700, 573	147, 620, 371	2, 389, 131, 012

MINE PRODUCTION

During 1943–45, for the first time on record, over half of the domestic gold output was recovered from base-metal ores, but in 1946 and again in 1947 both dry ores and placer gravels exceeded base-metal ores in yield of gold. This recovery in gold mining, however, did not restore the industry to the prewar level. High wages, difficulties in recruiting labor forces, and high prices for equipment and supplies, together with an unchanged gold price, retarded recovery. Production during 1947 was less than half of the all-time peak established in 1940.

Silver production, which had declined without interruption from 1940 to 1946, reversed the trend in 1947 and increased from 22,914,604 ounces to 35,823,563 ounces. An analysis of silver production, by ores, shows that almost three-fourths was recovered from base-metal ores in 1947. Moreover, all of the silver recovered at placers and part of that produced from dry ores were byproducts of operations carried on chiefly for gold.

All tonnage figures used in this report 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 chapter.

Mine production of gold and silver in the United States, in 1947, by months, in fine ounces

	Gold	Silver		Gold	Silver
January	141, 965	2, 629, 238	August	208, 071	3, 132, 253
February	136, 509	2, 702, 925	September	198, 794	2, 965, 737
March	145, 514	2, 846, 690	October	221, 414	3, 251, 512
April	165, 759	3, 166, 348	November	172, 668	3, 064, 172
May	164, 835	3, 127, 664	December	177, 539	3, 060, 760
June	171, 503	3, 013, 525			
July	204, 614	2, 862, 739	Total	2, 109, 185	35, 823, 563

Mines are grouped into two main classes—placers and lodes. 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, in addition to those worked chiefly for one or both of the precious metals, include those that yield ore mined chiefly for copper, lead, zinc, or other metals but contribute the precious metals as byproducts. As far as possible, the mine unit used is not the operator but the mining claim or group of claims.

PRINCIPAL MINING DISTRICTS AND LEADING MINES

One of the anomalies of the war economy was 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 1946, however, Lawrence County regained the lead as the result of reviving gold mining at the Homestake mine, aided by the depressing effects of prolonged labor strikes at the Utah Copper mine. In 1947, despite an all-time record for the West Mountain district, continued expansion of output in Lawrence County kept that district in first place. More than half of the domestic mine output was mined in the four leading districts in 1947. Included in the first four districts is the Yukon River Basin, Alaska, with 226,708 ounces.

The leading silver districts for many years have included many more noted for base-metal output than silver yield, and this condition was unchanged in 1947.

Mine production of recoverable gold in the United States by districts that produced 10,000 fine ounces or more during any year, 1943–47, in fine ounces [1]

District or region	State	1943	1944	1945	1946	1947
Lawrence County	South Dakota	106,444	11,621	55,947	312,246	407,192
West Mountain (Bingham)	Utah	343,551	312,493	248,923	140,877	384,414
Folsom	California	16,065	23,789	32,851	93,718	102,121
Grass Valley-Nevada City	do	20,605	(2)	31,064	49,033	68,383
Yuba River	do	(2)	(2)	(2)	(2)	(2)
Cripple Creek	Colorado	45,105	30,886	28,524	47,640	58,158
Robinson (Ely)	Nevada	64,323	48,120	45,063	39,234	39,490
Upper San Miguel	Colorado	20,204	18,542	17,779	24,648	38,155
Yellow Pine	Idaho	5,480	7,753	4,862	10,842	31,006
Ajo	Arizona	45,108	29,020	24,772	33,083	30,477
Republic	Washington	22,638	20,479	17,363	18,563	22,590
Oroville	California	14,533	9,859	4,217	17,891	22,589
Warren (Bisbee)	Arizona	57,042	38,401	15,863	5,680	20,131
Summit Valley (Butte)	Montana	16,020	14,441	12,052	6,882	19,777
Animas	Colorado	21,188	28,450	21,870	15,905	18,496
La Grange	California	4,445	5,018	7,544	(2)	(2)
Bullion	Nevada	7,936			12,473	17,058
Park City region	Utah	19,559	15,149	13,822	16,956	17,052
Snelling	California	81	5	(2)	3,732	(2)
Tintic	Utah	22,470	11,417	14,536	17,799	15,385
California (Leadville)	Colorado	23,150	20,149	15,706	10,749	[3] 14,803
Chelan Lake	Washington	41,920	26,198	40,207	32,353	12,024
Fairplay	Colorado	8	2	7,338	(2)	(2)
Klamath River	California	2,629	3,256	(2)	5,853	11,295
Cosumnes River	do	91		389	(2)	10,691
Sheepeater	Montana		7,143	7,812	9,822	10,140
Camanche	California	5,071	(2)	(2)	13,933	9,229
Mother Lode	do	16,420	7,140	5,126	7,271	9,020
Verde (Jerome)	Arizona	18,117	8,620	8,602	8,132	6,931
Middle Boise	Idaho	13,868	4,650	666	9,694	6,779
Manhattan	Nevada	11,777	7,689	9,870	13,478	1,618
Old Hat	Arizona	16,185	6,389	471	321	639
Potosi	Nevada	35,047	(2)	10,752	17	

[1] Exclusive of Alaska.
[2] Bureau of Mines not at liberty to publish.
[3] Includes a very small quantity from St. Kevin district.

Of the 25 leading gold-producing mines, 10 were lode gold mines, 5 were placers worked by connected-bucket dredges, 4 were copper mines, and 1 was a lead-zinc mine; 5 produced more than 1 type of ore. The 6 leading mines contributed over half of the total gold produced in the United States in 1947 and the 25 on the list, 69 percent.

Only 4 of the 25 leading silver-producing mines depended exclusively on silver ore; ores valuable chiefly for copper, lead, zinc, and gold supplied most of the silver production. The 3 leading mines contributed one-fourth of the total silver produced in the United States in 1947; the 9 leading mines one-half; and the list of 25, two-thirds. 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.

Mine production of recoverable silver in the United States by districts and regions that produced 200,000 fine ounces or more during any year, 1943–47, in fine ounces

District or region	State	1943	1944	1945	1946	1947
Coeur d'Alene Region	Idaho	10,302,840	8,669,371	7,115,646	5,655,672	9,234,906
Summit Valley (Butte)	Montana	6,485,123	5,955,608	4,936,770	2,417,422	5,251,095
West Mountain (Bingham)	Utah	5,404,365	4,671,478	3,628,229	2,030,182	4,816,611
Warren (Bisbee)	Arizona	2,252,250	1,550,506	963,180	721,135	1,522,558
Park City Region	Utah	2,001,555	1,429,650	1,033,830	1,009,422	1,352,748
Coso (Darwin)	California	138,662	252,900	575,069	871,091	1,093,709
Tintic	Utah	1,554,989	1,070,214	1,086,435	619,724	1,076,726
Copper Mountain (Morenci)	Arizona	195,248	281,153	345,863	265,151	540,232
Warm Springs	Idaho	715,074	618,947	460,357	418,599	427,242
Pioche	Nevada	408,721	444,309	350,259	403,358	426,229
Upper San Miguel	Colorado	210,763	169,650	274,559	355,604	392,540
Big Bug	Arizona	244,191	229,490	320,559	338,062	386,452
Verde (Jerome)	do	1,036,194	589,538	475,290	418,578	367,778
Animas	Colorado	323,706	228,015	301,957	339,088	362,888
Ajo	Arizona	478,284	319,320	285,719	390,401	353,789
Creede	Colorado	630,952	518,161	433,177	355,110	317,712
Pioneer (Superior)	Arizona	476,751	386,429	251,062	243,667	314,126
Rush Valley	Utah	(1)	(1)	(1)	(1)	(1)
California (Leadville)	Colorado	379,513	496,634	417,427	332,024	[2] 261,173
Yellow Pine	Idaho	173,354	117,156	42,909	78,094	255,043
Red Cliff	Colorado	176,116	134,211	49,171	57,353	233,351
Bayhorse	Idaho	211,119	270,644	200,631	84,052	204,264
Flint Creek	Montana	245,447	249,141	208,260	10,255	173,716
Harshaw	Arizona	204,404	176,438	144,841	105,672	168,800
Central	New Mexico	181,264	216,554	(1)	(1)	167,538
Robinson (Ely)	Nevada	254,046	213,663	199,970	151,548	161,806
Virginia City	Montana	2,610	16,020	86,175	236,318	96,515
Roaring Fork	Colorado	302,386	126,232	78,362	41,630	27,757
Barker	Montana	212,625	4,067	5,535	3,588	6,484
Silver Peak	Nevada	209,070	696	90	31	47
Hog Heaven	Montana	490,050	93,330	40,500	42,323	

[1] Bureau of Mines not at liberty to publish.
[2] Includes a very small quantity from St. Kevin district.

Twenty-five leading gold-producing mines in the United States in 1947, in order of output

Rank	Mine	District	State	Operator	Source of gold
1	Homestake	Whitewood	South Dakota	Homestake Mining Co	Gold ore.
2	Utah Copper	West Mountain (Bingham)	Utah	Kennecott Copper Corp	Copper ore.
3	Fairbanks Unit	Fairbanks	Alaska	U. S. Smelting, Refining & Mining Co	Dredge.
4	Natomas	Folsom	California	Natomas Co	Do.
5	Yuba Unit	Yuba River	do	Yuba Consolidated Gold Fields	Do.
6	Idaho-Maryland-New Brunswick	Grass Valley-Nevada City	do	Idaho-Maryland Mines Corp	Gold ore.
7	Ajax, etc	Cripple Creek	Colorado	Golden Cycle Corp	Do.
8	Yellow Pine	Yellow Pine	Idaho	Bradley Mining Co	Do.
9	New Cornelia	Ajo	Arizona	Phelps Dodge Corp	Copper ore.
10	Smuggler-Union, etc	Upper San Miguel	Colorado	Telluride Mines, Inc	Gold ore.
11	Ruth and Copper Flat Pit	Robinson (Ely)	Nevada	Kennecott Copper Corp	Copper ore.
12	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp	Copper, zinc-lead ores.
13	Knob Hill	Republic	Washington	Knob Hill Mines, Inc	Gold ore.
14	United States and Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co	Gold-silver, lead, zinc-lead ores.
15	Goldacres	Bullion	Nevada	Consolidated Goldacres Co	Gold ore.
16	Empire-Star Group	Grass Valley-Nevada City	California	Empire Star Mining Co. Ltd., and lessees	Do.
17	Shenandoah, etc	Animas	Colorado	Shenandoah-Dives Mining Co	Do.
18	Park Galena and Mayflower	Park City Region	Utah	New Park Mining Co	Gold, zinc-lead ores.
19	Butte Unit	Oroville	California	Yuba Consolidated Gold Fields	Dredge.
20	Consolidated Coppermines Group.	Robinson (Ely)	Nevada	Consolidated Coppermines Corp	Copper ore.
21	Cresson	Cripple Creek	Colorado	Cresson Consolidated Gold Mining & Milling Co.	Gold ore.
22	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Copper, zinc-lead ores.
23		Tuluksuk Aniak	Alaska	New York-Alaska Gold Dredging Corp	Dredge.
24	Resurrection	California (Leadville)	Colorado	Resurrection Mining Co	Zinc-lead ore.
25	Holden	Chelan Lake	Washington	Howe Sound Co	Copper, zinc-copper ores.

Twenty-five leading silver-producing mines in the United States in 1947, in order of output

Rank	Mine	District	State	Operator	Source of silver
1	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Copper, zinc-lead ores.
2	Utah Copper	West Mountain (Bingham)	Utah	Kennecott Copper Corp	Copper ore.
3	Sunshine	Coeur d'Alene Region	Idaho	Sunshine Mining Co	Silver ore.
4	United States & Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co	Gold-silver, lead, zinc-lead ores.
5	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp	Copper, lead, zinc-lead ores.
6	Polaris	Coeur d'Alene Region	Idaho	Sunshine Mining Co	Silver ore.
7	Bunker Hill and Sullivan	do	do	Bunker Hill & Sullivan Mining & Concentrating Co.	Zinc-lead ore.
8	Darwin Group	Coso (Darwin)	California	Anaconda CopperMining Co	Lead ore.
9	St. Germain and Purim	Coeur d'Alene Region	Idaho	Silver Dollar Mining Co	Silver ore.
10	Chief, Gemini, etc	Tintic	Utah	Chief Consolidated Mining Co	Silver, lead, zinc-lead ores.
11	Morenci	Copper Mountain	Arizona	Phelps Dodge Corp	Copper ore.
12	Page	Coeur d'Alene Region	Idaho	Federal Mining & Smelting Co	Zinc-lead ore.
13	Park Utah	Park City Region	Utah	Park Utah Consolidated Mining Co	Do.
14	Triumph	Warm Springs	Idaho	Triumph Mining Co	Do.
15	Iron King	Big Bug	Arizona	Shattuck Denn Mining Co	Copper, zinc-lead ores
16	United Verde	Verde	do	Phelps Dodge Corp	Copper ore.
17	Park Galena and Mayflower	Park City Region	Utah	New Park Mining Co	Gold, zinc-lead ores.
18	New Cornelia	Ajo	Arizona	Phelps Dodge Corp	Copper ore.
19	Silver King	Park City Region	Utah	Silver King Coalition Mines Co	Silver, lead, zinc-lead ores.
20	Commodore, etc	Creede	Colorado	Emperius Mining Co	Silver ore.
21	Pioche group	Pioche	Nevada	Combined Metals Reduction Co. and Raymond Ely West Mining Co.	Zinc-lead ore.
22	Magma	Pioneer	Arizona	Magma Copper Co	Copper ore.
23	Sherman	Coeur d'Alene Region	Idaho	Day Mines, Inc	Zinc-lead ore.
24	Yellow Pine	Yellow Pine	do	Bradley Mining Co	Gold ore.
25	Star	Coeur d'Alene Region	do	Sullivan Mining Co	Zinc-lead ore.

Mine production of recoverable gold in the United States, 1937–47, with production of maximum year, and cumulative production from earliest record to end of 1947, by States, in fine ounces

	Maximum production [1]		Production by years											Total production from earliest record to end of 1947
	Year	Quantity	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	
Western States and Alaska:														
Alaska	1906	1,066,030	627,940	664,973	676,737	755,970	695,467	487,621	99,583	49,296	68,117	226,781	279,988	26,363,416
Arizona	1937	332,694	332,694	305,043	316,453	294,807	315,392	253,651	171,810	112,162	77,223	79,024	95,860	10,964,019
California	1852	3,932,631	1,174,578	1,311,129	1,435,264	1,455,671	1,408,793	847,997	148,328	117,373	147,938	356,824	431,415	102,312,634
Colorado	1900	1,391,364	368,905	367,468	366,852	367,336	380,029	268,627	137,558	111,455	100,935	142,613	168,279	39,226,222
Idaho	1871	212,850	81,861	103,513	116,662	146,480	149,816	95,020	30,808	25,008	17,780	42,975	64,982	7,905,731
Montana	1865	870,750	202,252	203,313	264,173	272,602	246,475	146,892	59,586	50,021	44,597	70,507	90,124	17,142,245
Nevada	1910	913,265	281,332	296,434	361,518	383,933	366,403	295,112	144,442	119,056	92,265	90,680	89,063	25,606,064
New Mexico	1915	70,681	41,171	43,050	36,979	35,943	27,845	11,961	5,563	6,918	5,604	4,009	3,146	2,185,981
Oregon	1940	113,402	52,662	81,729	93,372	113,402	96,565	46,233	1,097	1,369	4,467	17,598	18,979	5,710,531
South Dakota	1939	618,536	581,544	594,847	618,536	586,662	600,637	522,098	106,444	11,621	55,948	312,247	407,194	21,453,495
Texas	1929	1,279	562	439	324	312	306	236	4			9	45	8,335
Utah	1947	421,662	322,759	200,630	277,751	355,494	356,501	391,544	390,470	344,223	279,979	178,533	421,662	11,064,640
Washington	1939	90,420	36,310	74,175	90,420	82,136	84,176	75,396	65,244	47,277	57,860	51,168	34,965	2,213,635
Wyoming	1869	7,498	1,776	798	583	740	478	23		20	2	105	1,486	79,527
Total			4,106,346	4,247,541	4,655,624	4,851,488	4,728,883	3,442,411	1,360,937	995,799	952,715	1,573,073	2,107,188	272,236,475
West Central States: Missouri	1900	33												33
States east of the Mississippi:														
Alabama	1936	4,726	2,460	41	3	5	30	1			5	1		49,495
Georgia	1882	12,094	743	872	670	961	311	30	12	5		21	76	870,623
Indiana	(2)	(2)			4	5								(3)
Maryland	1937	1,040	1,040	855	71									6,102
Michigan	1890	4,354	51											33,297
North Carolina	1887	10,884	949	1,878	495	1,943	3,244	4,077	131	21				1,164,588
Pennsylvania	1942	2,499	1,348	1,422	1,815	1,840	2,422	2,499	2,218	2,115	1,588	1,150	1,518	[4] 26,802
South Carolina	1941	15,508	2,482	11,681	13,833	13,076	15,508	7,824	147					318,801
Tennessee	1930	696	263	236	163	173	227	159	303	222	148	95	303	21,268
Vermont	1946	165							17	100	104	165	100	[5] 519
Virginia	1938	2,943	1,396	2,943	364	458	240	109	50	132	12			167,558
Total			10,732	19,928	17,418	18,461	21,982	14,699	2,878	2,595	1,857	1,432	1,997	2,659,053
Grand total			4,117,078	4,267,469	4,673,042	4,869,949	4,750,865	3,457,110	1,363,815	998,394	954,572	1,574,505	2,109,185	274,895,561

[1] For Missouri and States east of the Mississippi figures are peaks since 1880, except Pennsylvania and Vermont, for which the figures are peaks since 1905. For Alaska, Nevada, and Oregon figures are likewise peaks since 1880 only.
[2] Figure not available.
[3] Small; figure not available.
[4] 1908–47 only.
[5] 1905–47 only.

Mine production of recoverable silver in the United States, 1937–47, with production of maximum year, and cumulative production from earliest record to end of 1947, by States, in fine ounces

	Maximum production [1]		Production by years											Total production from earliest record to end of 1947
	Year	Quantity	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	
Western States and Alaska:														
Alaska	1916	1,379,171	494,340	479,853	201,054	191,679	191,522	119,704	42,788	13,362	9,983	41,793	66,150	19,856,448
Arizona	1937	9,422,552	9,422,552	7,479,153	7,824,004	7,075,215	7,498,260	7,064,467	5,713,889	4,394,039	3,558,216	3,268,765	4,569,084	297,256,498
California	1924	3,629,223	2,888,265	2,590,804	2,599,139	2,359,776	2,154,188	1,450,440	609,075	778,936	986,798	1,342,651	1,597,442	109,797,530
Colorado	[2] 1893	[2] 25,838,600	6,260,693	7,932,095	8,496,488	9,710,709	7,301,697	3,096,211	2,664,142	2,248,830	2,226,780	2,240,151	2,557,653	732,984,331
Idaho	1937	19,587,766	19,587,766	18,993,676	17,222,370	17,552,240	16,672,410	14,644,890	11,700,180	9,931,614	8,142,667	6,491,104	10,345,779	530,831,191
Montana	1892	19,038,800	11,812,093	6,403,962	9,087,571	12,361,050	12,386,925	11,188,118	8,450,370	7,093,215	5,942,070	3,273,140	6,326,190	755,476,013
Nevada	1913	16,090,083	4,864,750	4,355,471	4,316,029	5,175,928	5,830,238	3,723,435	1,620,280	1,259,636	1,043,380	1,250,651	1,377,579	590,981,291
New Mexico	1885	2,343,800	1,243,766	1,229,860	1,400,878	1,407,839	1,328,317	676,170	463,583	535,275	465,127	338,000	515,833	68,270,564
Oregon	1941	276,158	60,564	100,507	105,388	219,112	276,158	87,376	10,523	20,243	10,461	6,927	30,379	5,255,691
South Dakota	1900	536,200	139,638	162,295	167,584	175,514	170,771	186,937	35,886	5,445	26,564	86,901	111,684	9,799,693
Texas	1938	1,433,008	1,325,660	1,433,008	1,341,945	1,326,150	1,096,027	672,781	10,284	5,355	23,265	42,922	20,547	33,288,910
Utah	1925	21,276,689	12,869,117	9,682,732	10,758,657	12,172,299	11,395,485	10,574,955	9,479,340	7,593,075	6,106,545	4,118,453	7,780,032	726,952,551
Washington	1902	721,450	126,304	380,938	442,063	365,175	402,030	369,038	370,440	321,608	281,444	264,453	293,736	13,123,609
Wyoming	1901	21,400	203	328	75	114	94	52	----	3	31	26	95	74,787
Total	----	----	71,095,711	61,224,682	63,963,245	70,092,800	66,704,122	53,854,574	41,170,780	34,200,636	28,823,331	22,765,937	35,592,183	3,893,949,107
West Central States: Missouri	1938	292,000	179,700	292,000	213,400	147,306	169,027	69,106	111,285	92,243	94,822	69,401	93,600	4,255,597
States east of the Mississippi:														
Alabama	1936	869	457	4	----	3	3	----	----	----	1	----	----	5,239
Georgia	1904	1,500	49	71	58	630	38	7	----		----	----	13	10,960
Illinois	1924	8,891	887	576	675	4,766	8,138	104	2,153	2,437	2,198	2,302	1,790	139,132
Maryland	1917	1,092	40	24	2	----	----	----	----	----	----	----	----	2,595
Michigan	1916	716,640	25,454	93,634	101,878	88,657	60,796	61,674	48,479	54,218	21,863	----	3,089	10,256,112
New York	1937	41,500	41,500	37,200	37,250	35,720	37,734	40,012	38,004	25,238	14,271	15,786	22,409	411,531
North Carolina	1906	30,769	5,538	5,500	3,961	6,480	7,439	8,259	7,169	1,461	----	----	----	357,223
Pennsylvania	1942	15,501	9,497	9,360	13,558	13,064	15,016	15,501	13,095	13,545	10,434	7,887	9,863	191,417
South Carolina	1940	8,047	624	3,951	5,480	8,047	6,525	5,064	135	----	----	----	----	35,325
Tennessee	1920	110,719	49,057	38,333	31,994	38,610	39,161	34,671	52,058	45,907	35,391	18,016	79,147	3,117,497
Vermont	1946	35,275	----	----	----	----	----	----	2,721	18,862	20,586	35,275	21,469	[3] 125,521
Virginia	1944	18,993	111	502	1,780	271	135	1,793	14,947	18,993	1,300	----	----	79,389
Total	----	----	133,214	189,155	196,636	196,248	174,985	167,085	178,761	180,661	106,044	79,266	137,780	14,731,941
Grand total	----	----	71,408,625	61,705,837	64,373,281	70,436,354	67,048,134	54,090,765	41,460,826	34,473,540	29,024,197	22,914,604	35,823,563	3,912,936,645

[1] States east of the Mississippi figures are peaks since 1896, except New York and Pennsylvania which are peaks since 1905. The Illinois figure is the peak since 1907. Alaska, California, Nevada, and Oregon are peaks since 1880.
[2] Corrected figure.
[3] Includes a small quantity by New Hampshire.

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

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 in 1947. These tables were compiled from the individual State chapters in this volume, in which more detailed data are presented.

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 base metal that by itself it would not satisfy the requirements for a smelter charge as in either lead 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; and ore that carries any grade of lead exclusively is called a lead ore. Zinc smelting ores (chiefly oxides) had ranged from 16 to 45 percent zinc, but with the development of slag fuming, which permits some oxidized ore in the charge and with high zinc prices, the minimum has declined to as low as 5 percent recoverable 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 1947 [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	8,327	0.342	0.081						
Arizona	27,722	.102	.281	27,933	0.050	2.689	17,535	0.021	7.720
California	438,812	.253	.101	3,053	.431	15.964	7,927	.011	5.076
Colorado	804,673	.139	.490	161,581	.107	2.902	38,818	.011	13.876
Idaho	618,877	.064	.484	629	.146	5.571	146,259	.001	35.015
Montana	186,813	.155	.260	53,385	.080	4.885	47,532	.020	6.273
Nevada	425,347	.077	.242	11,647	.146	9.358	25,094	.023	7.281
New Mexico	238	.710	.252	315	.210	12.692	612	.007	4.355
Oregon	1,360	.745	2.462	820	.130	1.889	988	.174	21.492
South Dakota	935,634	.435	.119						
Texas							962	.001	18.146
Utah	5,755	2.038	6.223	107,064	.064	2.837	58,922	.038	6.426
Washington	63,968	.357	2.085	27	.037	2.333			
Wyoming	6,059	.244	.016						
Total	3,523,585	.220	.335	366,454	.090	3.481	344,649	.014	19.546
States east of the Mississippi	130	.585	.100						
Grand total	3,523,715	.220	.335	366,454	.090	3.481	344,649	.014	19.546

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 1947—Continued

State	Copper ore: Short tons	Copper ore: Average ounces per ton: Gold	Copper ore: Average ounces per ton: Silver	Lead ore: Short tons	Lead ore: Average ounces per ton: Gold	Lead ore: Average ounces per ton: Silver	Lead-copper ore: Short tons	Lead-copper ore: Average ounces per ton: Gold	Lead-copper ore: Average ounces per ton: Silver
Western States and Alaska:									
Alaska	-	-	-	5,064	0.138	4.400	-	-	-
Arizona	37,810,448	0.002	0.068	24,478	.057	3.870	12	-	8.417
California	15,993	.023	1.239	87,913	.020	13.801	-	-	-
Colorado	16,572	.052	12.273	47,628	.057	3.954	6	-	42.333
Idaho	3,303	.161	1.348	165,218	.002	3.858	27	0.37	225.296
Montana	1,838,580	.007	.971	12,508	.058	5.665	-	-	-
Nevada	5,828,016	.007	.049	24,139	.023	10.085	-	-	-
New Mexico	6,772,030	-	.026	12,323	.015	2.553	-	-	-
Oregon	109	.358	6.615	-	-	-	-	-	-
South Dakota	-	-	-	-	-	-	-	-	-
Texas	68	-	2.059	772	.056	3.087	-	-	-
Utah	29,021,293	.013	.107	27,194	.075	9.022	-	-	-
Washington	83	1.277	3.361	7,946	-	2.222	3	-	35.000
Wyoming	-	-	-	-	-	-	-	-	-
Total	81,306,495	.006	.100	415,183	.025	6.665	48	.021	136.313
States east of the Mississippi	6,326,245	-	.016	36,795	-	.001	-	-	-
Grand total	87,632,740	.006	.094	451,978	.023	6.122	48	.021	136.313

State	Zinc ore: Short tons	Zinc ore: Average ounces per ton: Gold	Zinc ore: Average ounces per ton: Silver	Zinc-lead, zinc-copper, and zinc-lead-copper ores: Short tons	Zinc-lead, zinc-copper, and zinc-lead-copper ores: Average ounces per ton: Gold	Zinc-lead, zinc-copper, and zinc-lead-copper ores: Average ounces per ton: Silver	Total ore: Short tons	Total ore: Average ounces per ton: Gold	Total ore: Average ounces per ton: Silver
Western States and Alaska:									
Alaska	[2] 500	0.002	0.360	-	-	-	13,891	0.255	1.666
Arizona	16,619	.003	.617	711,533	0.019	2.336	38,636,280	.002	.118
California	49,651	[3] .074	[3] 2.742	45,440	.011	1.561	648,789	.183	2.425
Colorado	223,753	.014	1.205	251,663	.058	1.948	1,544,694	.098	1.654
Idaho	[4] 67,133	-	.379	2,716,251	.002	1.562	3,717,697	.012	2.782
Montana	[5] 10,758	.005	3.047	950,437	.016	4.024	3,100,013	.020	2.039
Nevada	3,913	.007	1.810	223,479	.017	1.989	6,541,635	.013	.210
New Mexico	489,149	.002	.435	78,278	.002	1.103	7,352,945	-	.070
Oregon	-	-	-	-	-	-	3,277	.406	8.194
South Dakota	-	-	-	3,750	.013	.143	939,384	.433	.119
Texas	-	-	-	2,750	-	.207	4,552	.010	4.514
Utah	[6] 94,685	.004	.659	1,068,201	.030	3.418	30,383,114	.014	.256
Washington	25,357	-	.025	578,792	.021	.245	676,176	.052	.434
Wyoming	-	-	-	-	-	-	6,059	.244	.016
Total	981,518	.008	.771	6,630,574	.015	2.205	93,568,506	.015	.379
States east of the Mississippi	2,095,153	-	-	1,245,754	-	.019	[7] 9,704,077	-	.013
Grand total	3,076,671	.003	.246	7,876,328	.012	1.859	103,272,583	.014	.345

[1] Missouri excluded.
[2] Estimated.
[3] Includes metal recovered from tungsten ore.
[4] Includes 65,409 tons of old lead-smelter slag.
[5] Includes 7,403 tons of zinc slag fumed.
[6] Includes 66,422 tons of zinc 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 base-metal 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 bimetal classification is not used unless the metal of lower 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 States east of the Rocky Mountains 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, 1943–47, by percent from sources and in total fine ounces

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	
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
1946	37.5	39.5	16.1	.4	.4	6.1	1,574,505
1947	32.2	38.5	23.8	.5	.4	4.6	2,109,185

Mine production of silver in the United States, 1943–47, by percent from sources and in total fine ounces

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	
1943	(1)	26.1	33.7	8.1	1.2	31.0	41,460,826
1944	(1)	17.1	34.4	12.0	2.2	34.3	34,473,540
1945	0.1	24.3	31.4	4.4	2.0	37.8	29,024,197
1946	.3	24.4	24.4	7.5	2.3	41.1	22,914,604
1947	.2	25.7	23.1	8.0	2.1	40.9	35,823,563

1 Less than 0.1 percent.

Mine production of gold in the United States in 1947, by States and sources, in fine ounces, in terms of recovered metals

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
Alaska	276,443	2,847		697		1		279,988
Arizona	314	4,572	75,711	1,398		53	13,812	95,860
California	312,538	112,568	371	1,752		[1] 3,665	521	431,415
Colorado	17,573	129,428	859	2,735		3,173	14,511	168,279
Georgia		76						76
Idaho	19,776	39,771	201	295	1	9	4,929	64,982
Montana	27,434	34,095	12,872	729		58	14,936	90,124
Nevada	7,001	35,076	42,673	555		28	3,730	89,063
New Mexico	23	239	1,756	191		757	180	3,146
Oregon	17,648	1,292	39					18,979
Pennsylvania			[2] 1,518					1,518
South Dakota		407,145					49	407,194
Tennessee			303					303
Texas		1		43			1	45
Utah	11	20,805	366,289	2,031		345	32,181	421,662
Vermont			100					100
Washington	77	22,812	106			6	11,964	34,965
Wyoming	7	1,479						1,486
Total	678,845	812,206	502,798	10,426	1	8,095	96,814	2,109,185

[1] Includes gold recovered from tungsten ore.
[2] From magnetite-pyrite-chalcopyrite ore.

Mine production of silver in the United States in 1947, by States and sources, in fine ounces, in terms of recovered metals

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
Alaska	43,014	672		22,284		180		66,150
Arizona	21	218,286	2,583,264	94,728	101	10,256	1,662,428	4,569,084
California	24,014	133,251	19,811	1,213,277		[1] 136,144	70,945	1,597,442
Colorado	3,451	1,402,213	203,389	188,318	254	269,733	490,295	2,557,653
Georgia		13						13
Idaho	4,105	5,424,275	4,452	637,415	6,083	25,441	4,244,008	10,345,779
Illinois				40			1,750	1,790
Michigan			3,089					3,089
Missouri				[2] 93,600	(2)			93,600
Montana	5,242	607,479	1,784,945	70,864		32,776	3,824,884	6,326,190
Nevada	2,737	394,505	285,249	243,440		7,082	444,566	1,377,579
New Mexico	10	6,723	178,794	31,458		212,539	86,309	515,833
New York							22,409	22,409
Oregon	3,527	26,131	721					30,379
Pennsylvania			[3] 9,863					9,863
South Dakota		111,149					535	111,684
Tennessee			79,147					79,147
Texas		17,456	140	2,383			568	20,547
Utah		718,224	3,102,648	245,351		62,439	3,651,370	7,780,032
Vermont			21,469					21,469
Washington	10	133,461	279	17,659	105	630	141,592	293,736
Wyoming	1	94						95
Total	86,132	9,193,932	8,277,260	2,860,817	6,543	757,220	14,641,659	35,823,563

[1] Includes silver recovered from tungsten ore.
[2] A little silver recovered from lead-copper ore from one mine included with that from lead ore.
[3] From magnetite-pyrite-chalcopyrite ore.

Gold and silver produced in the United States from ore and old tailings, in 1947, by States and by methods of recovery, in terms of recovered metals[1]

State	Total ore, 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, 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	13,891	8,327	2,688	592	5,564	993	857	22,544	----------	----------	----------
Arizona	[2] 34,964,480	22,334	1,284	7,090	34,231,377	1,268,436	65,551	3,190,591	710,769	28,711	1,371,127
California	648,789	478,729	103,235	36,765	90,946	[3] 22,159	[3] 11,063	[3] 376,716	79,114	4,579	1,159,947
Colorado	1,544,694	775,397	80,969	16,315	732,332	146,366	66,451	2,188,742	36,965	3,286	349,145
Idaho	[4] 3,717,697	30,280	3,235	1,912	3,591,511	290,878	41,039	10,127,129	95,906	932	212,633
Montana	[5] 3,100,013	149,982	17,040	11,033	2,789,311	367,367	31,372	5,607,199	153,317	14,278	701,334
Nevada	6,541,635	438,083	30,462	152,414	5,961,737	220,924	45,920	595,629	141,815	5,680	626,799
New Mexico	7,352,945	150	14	1	7,243,140	302,472	1,090	341,887	109,655	2,019	173,935
Oregon	3,277	1,144	328	100	(6)	108	270	2,975	1,557	733	23,777
South Dakota	939,384	935,634	407,145	111,149	3,750	90	49	535	----------	----------	----------
Texas	4,552	----------	----------	----------	2,750	82	1	568	1,802	44	19,979
Utah	30,383,114	----------	----------	----------	30,145,074	1,019,624	399,046	6,649,824	[7] 238,040	22,605	1,130,208
Washington	676,176	48,496	2,717	16,938	612,175	46,661	28,279	256,009	15,505	3,892	20,779
Wyoming	6,059	6,059	1,424	80	----------	5	34	4	(8)	21	10
Total	89,896,706	2,894,615	650,541	354,389	85,409,667	3,686,165	691,022	29,360,352	1,584,445	86,780	5,789,673
States east of the Mississippi	[9] 9,704,077	130	76	13	[9] 9,687,527	722,085	1,921	137,767	16,420	----------	----------
Grand total	99,600,783	2,894,745	650,617	354,402	95,097,194	4,408,250	692,943	29,498,119	1,600,865	86,780	5,789,673

[1] Missouri excluded.
[2] Excludes 3,671,800 tons of copper ore leached from which no gold or silver was recovered.
[3] Includes concentrates and gold and silver from tailings; ore not included with material treated.
[4] Includes 65,409 tons of old lead-smelter slag.
[5] Includes 7,403 tons of slag fumed.
[6] Bureau of Mines not at liberty to publish.
[7] Includes 66,422 tons of old slag.
[8] Less than ½ ton.
[9] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

Gold and silver produced at amalgamation and cyanidation mills in the United States and percentage of gold and silver recovered from all sources, 1943–47 [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
1943	168,772	44,114	143,092	420,528	12.4	0.1	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	0.1
1946	278,293	54,255	229,040	223,926	17.7	.3	14.5	1.0	30.3	98.4	37.5	.3
1947	378,578	80,756	272,039	273,646	17.9	.2	12.9	.8	37.0	98.8	32.2	.2

[1] Missouri 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 1947, by States

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	8,327	2,688	592	------	------	------	0.96	0.89	------	------
Arizona	456	329	80	21,878	955	7,010	.34	------	1.00	0.15
California	471,238	67,030	12,326	31,598	36,205	24,439	15.54	.77	8.39	1.53
Colorado	561,380	36,271	10,188	[1] 420,026	44,698	6,127	21.55	.40	26.56	.24
Idaho	27,780	3,099	1,830	2,500	136	82	4.77	.02	.21	------
Montana	10,603	3,056	1,767	139,379	13,984	9,266	3.39	.03	15.52	.15
Nevada	5,639	2,345	1,371	432,444	28,117	151,043	2.63	.10	31.57	10.96
New Mexico	150	14	1	------	------	------	.45		------	------
Oregon	324	288	50	820	40	50	1.44	.16	.21	.16
South Dakota	849,123	262,257	52,057	935,386	144,888	59,092	64.41	46.61	35.58	52.91
Washington	57	625	453	48,439	2,092	16,485	1.79	.15	5.98	5.61
Wyoming	[2] 6,059	500	28	(2)	924	52	33.65	29.47	62.18	54.74
Total	1,941,136	378,502	80,743	2,032,470	272,039	273,646	17.95	.23	12.90	.76
States east of the Mississippi	130	76	13	------	------	------	3.81	.01	------	------
Grand total	1,941,266	378,578	80,756	2,032,470	272,039	273,646	17.95	.23	12.90	.76

[1] Chiefly sand and slimes from ore first roasted and amalgamated.
[2] Of 6,059 tons treated by amalgamation, 5,999 treated by amalgamation followed by cyanidation.

PLACERS

Almost one-third of the gold produced in 1947 was derived from placer mines. Of the 678,845 ounces of placer gold, 514,370 ounces or 76 percent was recovered by connected-bucket dredges. Although this dredge output was nearly fivefold that of 1944, the wartime low, it was far below the all-time high of 904,149 ounces established in 1940. A number of dredge properties remained idle during 1947 because of the unfavorable economic situation for gold production. As gold dredges are not converted easily to other uses, many idle properties had much of their operating equipment intact. It appeared probable, therefore, that gold output from this type of mining would be expanded if the ratio of gold price to dredging cost should improve appreciably.

The quantity of gold recovered by connected-bucket dredges from the inception of the industry as a commercial factor in 1896 to the end of 1947 is recorded as 20,427,652 (revised) ounces, originating by States as follows: California, 12,303,002 ounces; Alaska, 5,575,017 (revised, including the production from single-dipper dredges and some gold by hydraulicking); Montana, 760,783; Idaho, 645,424; Oregon, 495,949; Colorado, 479,859 (revised); other States, 167,618 (revised).

The second most important source of placer gold was dragline dredging, a method that had had a phenomenal rise from 1933 until World War II. Following a low point reached in 1945, recovery was proving very rapid. Another method employing mechanical earth-moving equipment was the nonfloating-washing-plant classification. These methods accounted for approximately $2 million each in 1947. Of the other methods hydraulicking was the most productive.

California produced 46 percent of the United States placer gold in 1947 and Alaska 41 percent. Other larger producers named in order of importance were Montana, Idaho, Oregon, Colorado, and Nevada. In 1947 California was the leader in all but three methods of placer gold production. Alaska led in hydraulic and nonfloating-washing-plant production and Nevada in dry placering.

The accompanying table shows the placer gold produced in the United States, classified by mining methods, in 1943–47.

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

Gold production at placer mines in the United States, by classes of mines and methods of recovery, 1943–47

Class and method	Mines producing	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered: Fine ounces	Gold recovered: Value	Gold recovered: Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Connected-bucket dredges:						
1943	20	22	23,857,123	109,964	$3,848,740	$0.161
1944	17	20	25,843,685	104,284	3,649,940	.141
1945	36	49	41,214,846	154,472	5,406,520	.131
1946	59	75	108,347,919	470,491	16,467,185	.152
1947	59	78	120,423,626	514,370	18,002,950	.149
Dragline dredges:						
1943	[1] 3	[1] 2	[2] 3,180,000	[1] 14,266	[1] 499,310	.157
1944	[1] 2	[1] 2	[2] 1,213,000	[1] 6,241	[1] 218,435	.180
1945	10	10	457,600	2,699	94,465	.206
1946	70	69	7,441,360	42,094	1,473,290	.198
1947	83	77	10,825,484	59,774	2,092,090	.193
Becker-Hopkins dredges:						
1943–45	---	---	---	---	---	---
1946	1	1	5,000	32	1,120	.224
1947	---	---	---	---	---	---
Suction dredges:						
1943–45	---	---	---	---	---	---
1946	3	3	37,900	267	9,345	.247
1947	12	10	79,590	588	20,580	.259
Nonfloating washing plants:						
1943	[1] 23	[1] 22	[2] 713,230	[1] 3,535	[1] 123,725	.173
1944	[1] 17	[1] 17	[2] 288,500	[1] 1,585	[1] 55,475	.192
1945	36	36	1,143,300	9,228	322,980	.282
1946	88	88	3,394,600	39,255	1,373,925	.405
1947	127	126	3,725,650	53,809	1,883,315	.505
Gravel hydraulically handled:						
Hydraulic:						
1943	99	---	883,450	11,006	385,210	.436
1944	[1] 37	---	[2] 253,717	[1] 1,099	[1] 38,465	.152
1945	128	---	1,205,320	14,220	497,700	.413
1946	200	---	2,731,700	32,411	1,134,385	.415
1947	224	---	2,844,047	38,722	1,355,270	.477
Small-scale hand methods:						
Wet:						
1943	[1] 125	---	[2] 138,620	[1] 3,648	[1] 127,680	.921
1944	[1] 84	---	[2] 115,225	[1] 2,192	[1] 76,720	.666
1945	156	---	121,590	3,115	109,025	.897
1946	225	---	674,280	5,434	190,190	.282
1947	226	---	773,245	10,904	381,640	.494
Dry:						
1943	7	---	1,190	78	2,730	2.294
1944	5	---	1,000	68	2,380	2.380
1945	1	---	100	2	70	.700
1946	17	---	7,400	262	9,170	1.239
1947	19	---	2,800	161	5,635	2.013
Underground placers:						
Drift:						
1943	[1] 24	---	[2] 6,945	[1] 1,182	[1] 41,370	5.957
1944	[1] 16	---	[2] 6,395	[1] 522	[1] 18,270	2.857
1945	15	---	5,513	927	32,445	5.885
1946	26	---	12,407	358	12,530	1.010
1947	28	---	7,248	517	18,095	2.497
Unclassified placers:						
1943	61	---	(3)	14,685	513,975	(3)
1944	189	---	(3)	7,331	256,585	(3)
1945–47	---	---	---	---	---	---
Grand total placers:						
1943	362	---	[2] 28,780,558	158,364	5,542,740	[2] .175
1944	367	---	[2] 27,721,522	123,322	4,316,270	.146
1945	382	---	44,148,269	184,663	6,463,205	.146
1946	689	---	122,652,566	590,604	20,671,140	.169
1947	778	---	138,681,690	678,845	23,759,575	.171

[1] Data for Alaska not separately available; included under "Unclassified placers."
[2] Data for Alaska not available and not included.
[3] Data not available.

REFINERY PRODUCTION

The accompanying table contains official estimates of production of gold and silver in the United States, made by the Bureau of the Mint, based upon arrivals at United States mints and assay offices and at privately owned refineries. The mints and assay offices determine the State source of all newly mined unrefined material at the time deposits are received. The State source of material received by privately owned refineries is determined from information submitted by them and by intervening smelters, mills, etc., involved in the reduction processes.

Gold and silver refined in the United States [1] 1943–47, and approximate distribution of source, by States and Territories, in 1947, in fine ounces

[U. S. Bureau of the Mint]

State or Territory	Gold	Silver
1943	1, 394, 522	40, 900, 121
1944	1, 022, 238	35, 651, 049
1945	928, 893	29, 063, 255
1946	1, 462, 354	21, 103, 269
1947:		
Alaska	319, 781	72, 056
Arizona	105, 143	4, 870, 385
California	422, 473	1, 937, 346
Colorado	174, 571	2, 966, 715
Georgia	75	13
Idaho	59, 997	10, 700, 950
Illinois		6, 829
Missouri		166, 879
Montana	87, 812	6, 068, 633
Nevada	105, 083	2, 106, 402
New Mexico	10, 212	616, 549
New York		16, 001
Oregon	18, 231	32, 076
Pennsylvania	1, 436	9, 401
South Dakota	411, 209	111, 197
Tennessee	304	80, 359
Texas	56	30, 621
Utah	402, 327	8, 395, 806
Vermont	98	21, 262
Virginia	2	2, 160
Washington	44, 998	375, 339
Wyoming	1, 510	90
Total	2, 165, 318	38, 587, 069

[1] Includes Philippine Islands production, 1943–45.

Gold and silver produced in the United States, 1792–1947 [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
1874–1947	216, 931, 860	5, 190, 154, 875	3, 804, 176, 912	2, 848, 455, 441
Total	278, 140, 308	6, 455, 441, 875	3, 950, 705, 012	3, 042, 491, 441

[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.
[3] Silver valued in 1934 and thereafter at Government's average buying price for domestic product.

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 that are available to industry and the arts without smelter or refinery preparation. In contrast, the gold and silver that enter 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 comparatively 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 marriage rate and widespread prosperity have increased the sale of jewelry, watches, and many luxury items made from gold. The issue of gold for use in industry and the arts was less than half as large in 1947 as in 1946, but the return of gold from industrial use increased. As a result the net consumption of gold for nonmonetary purposes was less than one-third as large in 1947 as in 1946. Nevertheless, the net absorption by industry and the arts comprised two-thirds of the total new gold produced from domestic mines during 1947.

Net industrial consumption of gold and silver in the United States, 1943–47

[U. S. Bureau of the Mint]

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
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
1946	45, 999, 837	199, 686, 837	153, 687, 000	36, 646, 860	123, 646, 860	87, 000, 000
1947	49, 229, 578	98, 129, 578	48, 900, 000	27, 866, 359	126, 366, 359	98, 500, 000

Silver.—The 1947 consumption of silver in industry and the arts was below that for the war years, although it was above that for 1946 and greatly above the prewar level. The consumption exceeded any annual output ever achieved by domestic mines.

Widespread prosperity and a high marriage rate sustained the demand for sterling and plated silverware, jewelry, watch cases, church articles, pens, pencils, and other items largely in the luxury class. Consumption was large in photography, particularly for motion pictures. The industrial uses of silver had grown greatly during the war and continued to absorb much silver in 1947.

MONETARY STOCKS

Gold holdings of the United States rose $2,225,000,000 (11 percent) from $20,529,000,000 on January 1, 1947, to $22,754,000,000 on January 1, 1948, 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 U. S. S. R. Currency stabilization funds secretly held add to the difficulties in reaching an approximation.

Foreign gold reserves increased rapidly after the United States entry into the war late in 1941, largely because United States war purchases abroad so greatly exceeded commercial exports in value. During the war period foreign reserves increased nearly $5,000,000,000, and United States reserves decreased over $2,500,000,000. Sharing prominently in the increase were Switzerland, Sweden, Turkey, Iran, Spain, Union of South Africa, and Latin American countries. In 1946, however, there was a reversal in the direction of the flow of gold, and in 1947 the largest United States net increase since 1940 was recorded. United States net imports for the year were nearly twice world output.

United States Treasury silver holdings increased 2,000,000 fine ounces during 1947 to 1,953,000,000 ounces. Not included in the holdings are 410,553,011 ounces released under lend-lease agreements that provide for return of the silver.

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; on July 31, 1946, the President approved an act (Public Law 579, 79th Congress) which provided that the seigniorage to be deducted for silver mined after July 1, 1946, and delivered to the Treasury be reduced from 45 percent to 30 percent. The effect was to raise the price of domestically mined silver to 90.50505+ cents an ounce; there was no price change in 1947.

According to the Director of the Mint, the following prices for silver prevailed in London and New York (exchange-free-New York on London, $4.03) in 1946 and 1947: London price, per ounce, 0.999 fine, opened in 1946 at 44.0d., rose to 55.5d. in August, became unstable in February 1947, and sank irregularly to a low of 37.0d. at midyear, recovered to 45.125d. in November, and dropped again to 45.0d., a price that continued into 1948. New York price per ounce—0.999 fine—opened in 1946 under price control at $0.70750 and rose to $0.90125 in July; thereafter, because of the lapse of price control on July 1 followed by its revival July 26 and the passage of the new silver purchase act July 31, the price fluctuated widely. From July 31 until early in December 1946 the price (with one brief lapse on October 3) remained at $0.90125. Thereafter the price moved downward irregularly, establishing a low of $0.59750 during June 1947 followed by a sustained rise to $0.74625 in November, which price continued stable into 1948.

FOREIGN TRADE [1]

In 1946 there were relatively small excesses of imports over exports of both gold and silver. In 1947, however, the excesses increased, and that for gold reached the highest level since 1940. The gains from imports plus the output from domestic mines greatly exceeded consumption in the arts and industries in the case of gold, and thus gold monetary stocks increased. Consumption of silver, however, exceeded the supply from mine output plus net imports by over one-fourth, with the result that total stocks were drawn upon.

Value of gold and silver imported into and exported from the United States, 1946–47, by classes

[U. S. Department of Commerce]

	Imports	Exports	Excess of imports over exports [1]
1946			
Gold:			
Contained in ore and base bullion	$37,379,928	$9,070	$37,370,858
Bullion refined	344,707,863	221,309,154	123,398,709
United States coin	70		70
Foreign coin	150,873,907	149,412	150,724,495
	532,961,768	221,467,636	311,494,132
Silver:			
Contained in ore and base bullion	21,855,000	7,146	21,847,854
Bullion refined	28,894,402	30,098,634	−1,204,232
United States coin	890,581	1,143,000	−252,419
Foreign coin	5,937,905	5,205,910	731,995
	57,577,888	36,454,690	21,123,198
1947			
Gold:			
Contained in ore and base bullion	34,945,046	120,750	34,824,296
Bullion refined	1,904,557,160	189,104,113	1,715,453,047
United States coin	294	638	−344
Foreign coin	140,085,906	24,015,299	116,070,607
	2,079,588,406	213,240,800	1,866,347,606
Silver:			
Contained in ore and base bullion	21,615,718		21,615,718
Bullion refined	39,243,429	21,206,271	18,037,158
United States coin	969,008	710,650	258,358
Foreign coin	6,312,188	8,731,821	−2,419,633
	68,140,343	30,648,742	37,491,601

[1] Excess of exports over imports indicated by minus sign.

[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.

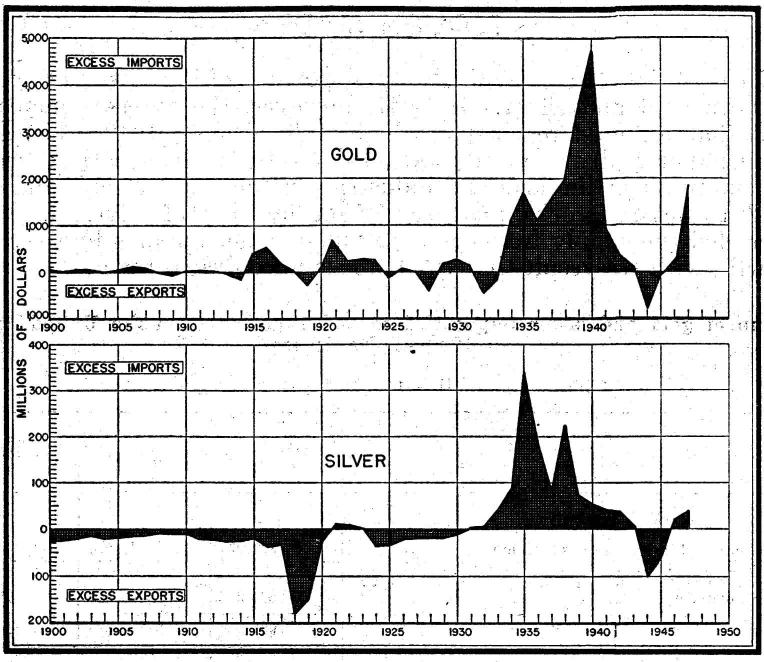

FIGURE 1.—Gold and silver imports and exports, with net movements, 1900–47.

WORLD REVIEW

The uninterrupted decline in world output of gold since 1940 was arrested in 1946, but the increases achieved in 1946 and 1947 were too small to give early promise of a return to prewar production levels. The decline in world silver production, also uninterrupted since 1940, was arrested in 1947, but the total for that year was far below the prewar average. Factors adverse to both gold and silver production—including labor shortages, rising costs, shortage of supplies and equipment, and rising taxes—appear to have been world-wide.

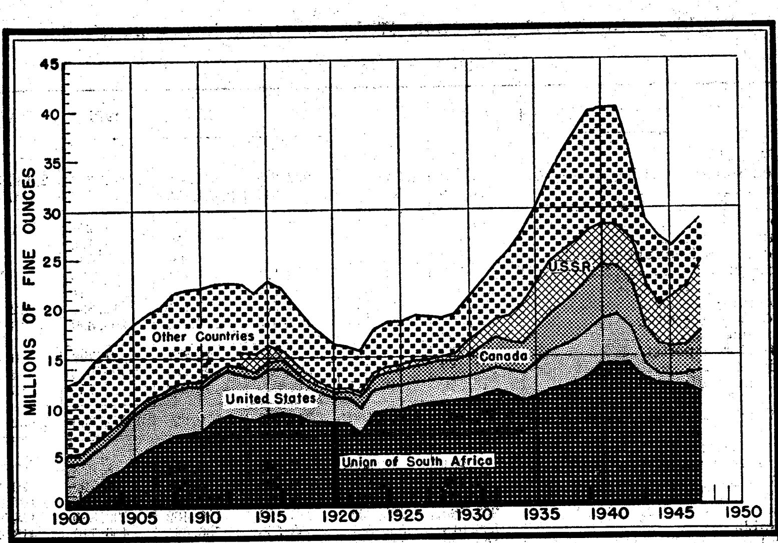

FIGURE 2.—World production of gold, 1900–47.

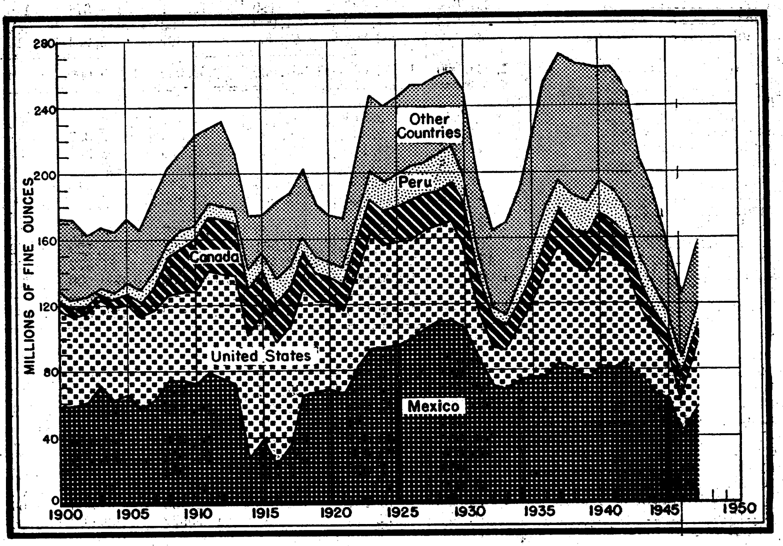

FIGURE 3.—World production of silver, 1900–47.

World production of gold, 1942–47, by countries, in fine ounces [1]

[Compiled by B. B. Mitchell]

Country [1]	1942	1943	1944	1945	1946	1947
North America:						
United States (including Alaska) [2]	3,583,080	1,380,758	1,022,238	915,403	1,462,354	2,165,318
Canada	4,841,306	3,651,301	2,922,911	2,696,727	2,832,554	3,070,221
Central America and West Indies:						
Costa Rica [3]	14,864	6,957	3,606	3,054	1,251	1,988
Cuba	[4] 195	51	39	[3] 423	1,105	364
Dominican Republic (exports)	6,709	816	683	486	646	—
Guatemala	729	409	[3] 126	[3] 66	[3] 36	[3] 35
Haiti	432	310	161	[3] 73	41	—
Honduras	29,084	20,734	19,774	17,078	12,833	12,037
Nicaragua (exports)	246,368	220,430	222,635	206,360	203,390	213,454
Panama	98	—	—	—	—	—
Salvador (exports)	31,070	28,411	22,813	16,526	21,798	10,755
Mexico	801,357	631,537	508,882	499,301	420,500	464,739
Newfoundland	15,750	18,735	18,329	15,354	15,751	13,583
Total	9,571,100	5,960,500	4,742,200	4,370,900	4,972,300	5,952,500
South America:						
Argentina	20,994	16,300	5,369	3,381	8,038	(5)
Bolivia	20,194	8,374	6,265	5,888	16,700	20,108
Brazil	229,068	[6] 191,300	[6] 178,300	[6] 212,200	[6] 175,000	[6] 167,000
Chile	253,590	269,807	243,883	180,462	230,880	168,855
Colombia	596,618	565,501	553,530	506,695	466,710	418,456
Ecuador	102,363	111,101	85,039	68,038	75,254	57,250
Guiana:						
British	29,267	19,470	18,986	22,533	19,793	21,111
French	27,200	20,609	18,583	20,641	19,741	14,918
Netherlands (Surinam)	7,883	5,795	5,723	5,895	4,648	4,134
Peru	257,610	199,637	175,180	172,661	158,378	116,016
Uruguay	1,022	[6] 1,000	[6] 1,000	[6] 1,000	(5)	(5)
Venezuela	88,150	62,802	59,064	58,397	36,904	16,659
Total	1,634,000	1,472,000	1,351,000	1,258,000	1,213,000	1,013,000
Europe:						
Austria	868	2,315	—	—	—	(5)
Finland	4,536	9,337	9,800	6,633	7,327	11,285
France	44,336	34,112	21,959	39,738	48,355	32,890
Germany	5,742	(5)	(5)	(5)	(5)	(5)
Hungary	[7] 61,350	[7] 61,350	[7] 28,215	193	1,318	1,993
Italy	13,310	11,992	[6] 12,860	[6] 12,860	(5)	(5)
Portugal	—	—	—	—	—	15,754
Rumania	83,817	82,370	74,590	90,987	80,377	74,686
Spain	—	—	1,961	2,025	3,729	2,714
Sweden	175,029	156,606	112,560	85,585	91,372	75,586
U. S. S. R. [6 8]	4,000,000	4,000,000	4,000,000	5,000,000	6,000,000	7,000,000
Total	4,400,000	4,400,000	4,300,000	5,200,000	6,200,000	7,200,000
Asia:						
China	355,536	88,184	—	—	—	(5)
Cyprus	9,957	5,480	958	—	—	—
Formosa	98,870	52,364	25,917	592	7,750	13,115
India	260,302	252,228	188,206	168,366	131,775	171,704
Indochina, French [9]	354	64	13	—	—	—
Japan	661,855	230,071	168,438	65,300	43,154	57,597
Korea	868,069	490,009	656,678	96,452	193,000	329,000
Malayan Union	938	2,028	1,111	264	407	5,312
Netherlands Indies	58,000	(5)	(5)	(5)	(5)	(5)
Philippines, Republic of	[10] 158,726	[10] 13,764	—	[10] 12,490	360	64,441
Saudi Arabia	31,352	42,643	[4] 8,683	[4] 37,972	48,000	(5)
U. S. S. R.	(8)	(8)	(8)	(8)	(8)	(8)
Total	2,504,000	1,177,000	1,050,000	382,000	425,000	641,000

See footnotes at end of table.

World production of gold, 1942–47, by countries, in fine ounces[1]—Continued

Country [1]	1942	1943	1944	1945	1946	1947
Africa:						
Bechuanaland	15,441	12,966	11,575	11,297	9,739	7,381
Belgian Congo [11]	499,944	451,171	364,204	346,971	331,304	301,445
Cameroun, French	23,052	21,798	20,416	16,300	11,927	11,574
Egypt	1,768	890	1,036	3,014	2,793	2,090
Eritrea	5	83	169	[6] 322	3,411	3,674
Ethiopia	[6] 48,000	[6] 48,000	[6] 48,000	[6] 63,720	[4] 42,032	[6] 48,000
French Equatorial Africa	94,234	93,462	84,106	76,069	71,535	70,170
French West Africa	7,202	7,973	8,777	6,945	7,009	5,562
Gold Coast	778,925	567,282	523,225	539,252	585,910	505,153
Kenya	56,771	45,118	42,259	38,517	29,892	21,959
Liberia	22,469	30,823	30,772	[4] 9,016	16,506	16,987
Madagascar	8,874	9,195	9,388	6,430	3,890	(5)
Morocco, French	27,007	2,476	2,572	161	(5)	(5)
Nigeria	38,497	15,323	7,916	8,108	4,881	2,203
Portuguese East Africa	6,533	6,481	7,577	7,897	5,766	4,441
Portuguese West Africa	4,144	2,000	1,296	822	552	360
Rhodesia:						
Northern	1,134	703	307	265	[12] 6,838	[12] 779
Southern	760,030	656,684	592,729	568,241	544,596	522,735
Sierra Leone	11,444	2,748	1,026	274	183	2,400
South-West Africa	212	155	97	83	67	34
Sudan	5,196	2,127	1,820	1,623	3,670	3,725
Swaziland	1,129	2,734	2,299	3,583	4,914	5,637
Tanganyika (exports)	106,835	72,723	55,148	49,302	48,428	47,356
Uganda (exports)	9,468	3,820	2,593	2,295	2,176	1,535
Union of South Africa	14,126,852	12,804,379	12,279,629	12,224,629	11,927,165	11,200,281
Total	16,655,000	14,861,000	14,099,000	13,985,000	13,665,000	12,790,000
Oceania:						
Australia:						
Commonwealth [13]	1,153,787	751,279	656,867	657,212	824,480	937,654
New Guinea	------	------	------	------	661	59,202
Fiji	90,973	61,505	40,407	94,964	82,402	94,353
New Zealand	165,987	149,150	142,287	128,364	119,271	112,260
Total	1,410,747	961,934	839,561	880,540	1,026,814	1,203,469
World total [1] [6]	36,200,000	28,800,000	26,300,000	26,100,000	27,500,000	28,800,000

[1] Figures used derived in part from American Bureau of Metal Statistics and the Annual Report of the Director of the Mint. For some countries accurate figures are not possible to obtain owing to clandestine trade in gold. Data not available for Bulgaria, Norway, Sarawak, and Yugoslavia; estimate not included in total. In addition, production in Burma, Czechoslovakia, Netherlands Indies, and Papua was negligible; and Siam produced none in 1942–47.

[2] Refinery production. Excludes production of the Philippines.

[3] Imports into United States.

[4] Exports.

[5] Data not available; estimate included in total.

[6] Estimate.

[7] Includes gold mined in Transylvania which temporarily formed part of Hungary.

[8] Output from U. S. S. R. in Asia included with U. S. S. R. in Europe.

[9] Lode only.

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

[11] Includes Ruanda-Urundi.

[12] Included in above data is yield from Nkana mine refinery slimes accumulated during the war: 6,594 ounces in 1946 and 547 in 1947.

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

World production of silver, 1942–47, by countries, in fine ounces [1]

[Compiled by B. B. Mitchell and P. Roberts]

Country [1]	1942	1943	1944	1945	1946	1947
North America:						
United States [2]	55,859,658	40,874,050	35,651,049	29,046,047	21,103,269	38,587,069
Canada	20,695,101	17,344,569	13,627,109	12,942,906	12,544,100	11,773,619
Central America and West Indies:						
Costa Rica [3]	6,119	1,154	3,506	1,380	604	1,470
Cuba	[3] 36,238	[3] 142,420	[3] 42,985	[3] 107,195	127,222	146,932
Honduras	3,478,831	3,161,901	3,115,352	3,003,495	2,682,910	2,403,500
Nicaragua (exports)	265,179	251,901	248,529	240,197	260,637	213,417
Salvador (exports)	191,184	202,064	305,922	223,705	313,180	265,104
Mexico	84,864,616	76,633,062	65,460,073	61,097,727	43,263,132	58,843,863
Newfoundland	1,106,121	1,258,708	1,163,206	1,076,129	1,107,827	956,052
Total	166,503,000	139,870,000	119,618,000	107,739,000	81,403,000	113,191,000
South America:						
Argentina	2,844,344	2,319,194	[4] 2,000,000	[4] 1,700,000	(5)	(5)
Bolivia (exports)	8,121,438	7,299,730	6,797,631	6,683,561	6,106,165	6,234,093
Brazil	25,733	30,048	28,722	28,385	21,968	20,293
Chile	1,317,058	1,093,543	1,094,894	1,033,539	869,437	981,048
Colombia	246,281	209,950	197,323	168,699	152,651	110,122
Ecuador	260,771	362,013	441,345	235,500	192,200	156,931
Peru	16,035,022	14,659,742	15,832,440	12,997,741	12,334,150	11,385,979
Total	28,851,000	25,974,000	26,392,000	22,847,000	21,277,000	20,388,000
Europe:						
Austria	3,119	11,028	13,960			(5)
Czechoslovakia [4]	740,000	740,000	675,000	300,000	600,000	(5)
Finland	22,570	59,093	41,185	33,115	140,209	188,821
France	364,429	310,737	240,134	350,025	304,853	(5)
Germany	5,639,300	(5)	(5)	(5)	(5)	(5)
Hungary	805,215	1,124,311	[6] 614,300	[6] 3,200	14,854	(5)
Italy	662,132	[4] 321,500	[4] 64,300	[4] 32,200	(5)	(5)
Norway	253,991	231,485	170,399	131,818	202,550	(5)
Rumania	89,604	78,994	71,310	189,610	(5)	481,264
Spain	143,714	656,422	778,016	497,661	669,009	638,192
Sweden	1,476,426	1,306,220	1,292,299	1,135,178	1,294,935	(5)
United Kingdom	47,082	33,885	33,742	26,808	23,285	(5)
Total	10,248,000	8,874,000	7,995,000	4,700,000	4,850,000	5,163,000
Asia:						
Burma	1,225,000	(5)	(5)	(5)	(5)	(5)
China	[7] 39,018	(5)	(5)	(5)	(5)	(5)
Cyprus	38,851	17,282	4,882			
Formosa	256,476	224,367	127,873	3,156	(5)	(5)
India	20,098	18,611	14,239	14,154	(5)	(5)
Indochina, French	32		(5)	(5)	(5)	(5)
Japan	13,012,306	6,376,553	5,029,341	[8] 853,377	1,281,625	1,909,433
Korea	3,088,947	2,829,265	2,577,525		[4] 130,500	[4] 195,400
Philippines, Republic of	231,197	26,071		17,208	3,600	6,586
Saudi Arabia	41,973	47,008	[9] 7,290	[9] 28,255	29,475	(5)
Total	17,954,000	10,539,000	8,761,000	1,416,000	1,960,000	2,656,000

See footnotes at end of table.

World production of silver, 1942–47, by countries, in fine ounces[1]—Continued

Country [1]	1942	1943	1944	1945	1946	1947
Africa:						
Algeria	17,876	15,432	48,612	14,661	(5)	(5)
Bechuanaland	1,267	1,221	1,319	1,237	1,704	1,086
Belgian Congo	3,768,067	3,105,762	2,609,033	4,141,016	5,047,666	4,057,295
Gold Coast (exports)	66,580	50,288	56,820	36,666	54,525	(5)
Kenya	15,602	16,354	11,500	16,659	5,493	3,859
Morocco, French	84,556	85,714	65,427	107,609	(5)	(5)
Nigeria	[4] 5,200	[4] 2,100	1,079	(5)	(5)	(5)
Portuguese East Africa	907	559	844	998	805	671
Rhodesia:						
Northern	104	41	----------	2,269	[10] 634,392	[10] 73,277
Southern	163,776	119,322	103,776	95,975	95,168	91,900
Swaziland	----------	----------	78	163	----------	211
Tanganyika (exports)	25,088	18,304	17,120	21,377	21,096	20,794
Tunisia	51,023	8,906	35,205	34,369	(5)	(5)
Uganda (exports)	1,127	468	306	275	205	(5)
Union of South Africa	1,477,557	1,334,042	1,213,051	1,243,426	1,203,978	1,147,694
Total	5,679,000	4,759,000	4,164,000	5,717,000	7,215,000	5,602,000
Oceania:						
Australia:						
Commonwealth [11]	14,241,811	10,329,830	9,365,726	8,076,740	9,045,280	9,527,140
New Guinea	[12] 46,284	----------	----------	----------	----------	(5)
Fiji	28,911	19,047	9,355	29,398	26,351	33,177
New Zealand	311,360	280,786	328,281	244,544	224,341	221,984
Total	14,628,000	10,630,000	9,703,000	8,351,000	9,296,000	9,782,000
World total [1] [4]	250,000,000	217,100,000	186,200,000	150,770,000	126,001,000	156,782,000

[1] Silver is also produced in Bulgaria, Greece, Hong Kong, Malayan Union, Netherlands Indies, Poland, Portugal, Sarawak, Sierra Leone, South-West Africa, Turkey, U. S. S. R., and Yugoslavia; production data are not available, but estimates are included in totals for 1942–44.
[2] Excludes Republic of the Philippines.
[3] Imports into the United States. Scrap is included in this figure in many instances, most notably in the case of Cuba.
[4] Estimate.
[5] Data not available; estimate included in total.
[6] Data represent Trianon Hungary subsequent to October 1944.
[7] Data represent areas designated as Free China during the period of Japanese occupation.
[8] January to March, inclusive.
[9] Exports.
[10] Recovered from an accumulation of refinery slimes.
[11] Includes New South Wales, Northern Territory, Queensland, South Australia, Tasmania, Victoria, and Western Australia.
[12] Fiscal year ended May 31 of year stated.

NORTH AMERICA

Canada.—Gold output increased slightly in 1947, for the second successive year, following an uninterrupted decline from 1941 through 1945. Silver output, on the other hand, continued the downtrend in progress since 1940, and was the smallest since 1906. Output of gold in 1946 and 1947, distributed by Provinces was as follows:

Province or Territory:	*1946 (fine ounces)*	*1947 (fine ounces)*
Alberta	110	78
British Columbia	136, 242	249, 011
Manitoba	79, 402	72, 906
Northwest Territories	23, 420	62, 517
Nova Scotia	4, 321	1, 271
Ontario	1, 813, 333	1, 944, 819
Quebec	618, 339	598, 127
Saskatchewan	112, 101	93, 747
Yukon	45, 286	47, 745
Total	2, 832, 554	3, 070, 221

Government interest in increasing gold production in Canada was evidenced by a bill proposed during the year to pay a subsidy as an aid in counteracting increased costs of production.

Gold production in Canada comes chiefly from gold mines, all but 49,050 ounces of Ontario's output in 1947 being so credited. The leading gold-producing districts in Ontario in 1947 were the Porcupine, Kirkland Lake, Larder Lake, and Patricia. In Quebec, 465,177 ounces were credited to gold mines and the remainder to base-metal mines. British Columbia produced 243,279 ounces from lode mines and 5,732 ounces from placer operations. In Saskatchewan all but 4 ounces was credited to other than gold mines.

Silver is produced in Canada chiefly as a byproduct in the treatment of base metal and gold ores. About half of the production came from mines in British Columbia, of which by far the largest producer continued to be the Sullivan mine of the Consolidated Mining & Smelting Co. of Canada, Ltd., at Kimberly. In Ontario, most of the silver output came from the nickel-copper mines of the International Nickel Co. of Canada, Ltd., and of Falconbridge Nickel Mines, Ltd., in the Sudbury area. In Quebec, the copper-gold mine of Noranda Mines, Ltd., at Noranda is the principal source of silver. Virtually all of the silver in Saskatchewan came from that part of the copper-zinc deposits of Hudson Bay Mining & Smelting Co., Ltd., that lies within the Province. These deposits at Flin Flon were also the source of a large part of Manitoba's production.

Mexico.—The uninterrupted decline since 1942 in gold and silver output in Mexico was reversed in 1947; silver production rose 36 percent. Mexico easily maintained its position as the leading source of silver in the world. Most of the gold is purchased by the Bank of Mexico, and only a small part is exported. On the other hand, a large part of the silver is exported. Of that remaining in the country the larger part is retained in the reserves of the Bank of Mexico, some is used for coinage, and some is used in the arts and by industry. During 1947 Mexico resumed the coinage of silver by the issuance of 1- and 5-peso coins. These were placed in circulation about September 1. In anticipation of this move, the Government purchased over 4,000,000 ounces of silver.

Of particular interest was the announcement on October 1 of the purchase by the Mexican Government of the Real del Monte mine, Pachuca district, Hidalgo, from the United States Smelting, Refining & Mining Co. at a reported price of $2,060,000. This mine and its neighbor, the Santa Gertrudis mine, had been the world's two most productive silver mines in many recent years. The Government planned to continue operation at the nationalized property.

SOUTH AMERICA

Brazil.—The St. John d'El Rey Mining Co., operating in Minas Gerais, dominated gold production in Brazil by a wide margin, as for many years.

British Guiana.—Between 1884 and 1941 British Guiana produced 3,028,745 ounces of gold, according to the Handbook of Natural Resources of British Guiana, as abstracted in a recent periodical.[2] Annual production increased from 250 ounces in 1884 to a maximum of 138,527 ounces in 1893–94; thereafter it declined progressively to 6,083 ounces in 1928. Largely because of the increase in the average price of gold and the development of dredging operations by the British Guiana Consolidated Goldfields Co., the gold industry revived and by 1938 annual production had increased to 41,919 ounces. Subsequently output declined.

Colombia.—Colombia exceeds, by a wide margin, all other countries in South America in production of gold. Output rose from a low of 40,000 ounces in 1928, with only one slight interruption in 1935, until the all-time peak of 656,019 ounces was reached in 1941. After 1941 production declined uninterruptedly to 418,456 ounces in 1947.

Peru.—The production of silver in Peru depends almost entirely upon the production of lead and copper with which the silver is associated in complex ores. Smelter output of both lead and copper dropped in 1947, and production of silver followed the same pattern. As usual, Peru produced more than half of the total silver in South America. Peru also supplies an important quantity of gold. Production of this metal continued the decline in progress since 1941.

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[2] South African Mining and Engineering Journal, Mineral Resources of British Guiana: Vol. 58, part 2, No. 2867, Jan. 24, 1948, pp. 555, 557.

AFRICA

Southern Rhodesia.—Gold production in the first 6 months of 1947 was 261,235 fine ounces, and total output from 1898 through June was 28,620,308 ounces.[3] Maximum annual production of 930,356 ounces was reached in 1916 and the most recent high was 826,485 ounces in 1940, but thereafter output declined without interruption. Production of gold for 1947 was 522,735 ounces.

Union of South Africa.—Production of gold in the Union of South Africa has trended downward without interruption since 1941. The stimulus gold mining received through the revaluation of gold in the early 1930's apparently has been counteracted by increased costs of production since that time. Of Witwatersrand gold-mining companies which operated throughout 1947, six recorded a profit of less than a shilling a ton, and another showed a loss. These seven mines contributed 841,945 ounces to the total.

The following data, prepared by the Transvaal Chamber of Mines, compare mining results in 1945, 1946, and 1947:

	1945	1946	1947
Ore milled (tons)	58, 897, 600	56, 927, 500	53, 712, 300
Gold recovered (fine ounces)	12, 213, 545	11, 917, 914	11, 197, 638
Gold recovered (dwt. per ton)	3. 997	4. 024	3. 982
Working revenue	£101, 847, 382	£99, 249, 814	£92, 740, 023
Working revenue per ton	34s 7d	34s 10d	34s 7d
Working cost	£69, 941, 061	£72, 920, 881	£71, 309, 136
Working cost per ton of ore	23s 9d	25s 7d	26s 7d
Working cost per ounce of metal	118s 10d	127s 4d	133s 4d
Working profit	£31, 906, 321	£26, 328, 933	£21, 430, 887
Working profit per ton	10s 10d	9s 3d	8s 0d
Dividends	£13, 056, 263	£13, 406, 349	£11, 845, 035

The figures for gold recovered include 443,641 ounces in 1945, 455,634 ounces in 1946, and 497,029 ounces in 1947 from miscellaneous producers whose operations are not represented in other data in the table. The dividend figures include intercompany payments; the net dividends were £12,505,386 in 1945, £12,811,101 in 1946, and £11,268,022 in 1947.

[3] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 6, December 1947, pp. 12–13.

The gold-mining industry was handicapped again by a severe shortage of native labor; the supply reportedly[4] represented only about 80 percent of requirements. Another factor detrimental to production was the diversion of a disproportionate part of the labor force to replenish ore reserves, seriously depleted during the war when production had been permitted to take precedence. A shortage of technical personnel also presented a problem. Mining suffered a serious set-back in the early months of the year from the prolonged strike of a large section of underground workers, the effects of which were claimed to persist throughout the greater part of the year.

On the Far West Rand substantial progress was made in bringing Libanon to production and in opening West Driefontein.

The outstanding feature of the year in mining expansion, however, was the big advance made in the opening of the Orange Free State gold field. There appears, however, to be no prospect of early production. Sir Ernest Oppenheimer, Chairman of the Anglo American Corp., at the official opening of the new railroad line from Whites to Odendaalsrus in the Free State gold field on June 7, 1948, said:[5]

. . . I think . . . I should say something about the potentialities and the part the new discovery will play in the economic life of the Free State, and of the Union as a whole. Never has a gold field been proved by so extensive a drilling programme as this one. Not all the information gained is favourable; for instance, temperatures at depth will be higher than on the Rand. Then we also know that considerable faulting has taken place. These problems offer, however, no unsurmountable difficulties for our highly qualified technical staff, but will result in somewhat higher working costs.

On the other hand, drilling results have shown that we can expect higher yields per ton than are current on the old Rand, and this will more than compensate for these adverse factors. Until recently, we have spoken of a proved field 26 miles long and 7 miles wide which, when brought to production, will yield upwards of £50,000,000 of gold per annum. Recently, favourable drilling results have been obtained outside the original area, and it seems now probable that this new field will exceed our most sanguine expectations. . . .

According to official statistics of the Department of Mines,[6] the

[4] The Mining Journal (London) Annual Review, 1948, South Africa in 1947: April 1948, p. 73.
[5] South African Mining and Engineering Journal, Odendaalsrus Line Opened: Vol. 59, No. 2887, June 12, 1948, p. 425.
[6] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 3, September 1947, pp. 7-13.

four Provinces—Cape, Orange Free State, Natal, and Transvaal—constituting the Union of South Africa, produced, from the earliest records to the end of 1946, a total of 444,754,157 fine ounces of gold, nearly all of which was from the Transvaal Province. In addition to gold, from 1902 to the end of 1946 the Union produced 44,559,336 ounces of silver derived largely from gold bullion but including some silver obtained from base-metal ores.

ASIA

Republic of the Philippines.—Resumption of gold mining in the Philippines made substantial progress in 1947, but on the whole the rate of recovery was disappointing. Only a few of the 33 mines that produced 1,130,000 ounces in 1941 were back in operation nearly 3 years after liberation of the islands from Japanese control, according to Boericke.[7] Lack of working capital, increased costs of labor and supplies, difficulties and delays in obtaining equipment, and political uncertainty in connection with the setting up of a new government were given as impediments to the reestablishment of gold mining on a large scale. Of the gold mines in production in 1947, Benguet Consolidated and Balatoc mines of the Hausserman group had adequate funds in the United States. Atok Mining Co., which operated the Big Wedge mine in Baguio, found its surface plant in better condition after the war than others in the same area but had to obtain financial aid through the issuance of stock. This policy was followed also by the Mindanao Mother Lode Mining Co. and by Surigao Consolidated, two successful prewar gold-mining operations in Mindanao. Two gold dredges began work successfully in 1947 in the Surigao area. The Tambis dredge is a small bucket-line operation. A dragline dredge was at work on the Cansuran River below the old hydraulicking grounds of the old North Mindanao Co. No attempt was made to rehabilitate the large Coco Grove gold dredges in the Paracale field. The Antipolo mine, about 70 kilometers south of Manila, was taken over by the Soriano group and put in production late in the year. Lepanto is classed as a copper mine, but a substantial recovery of gold is made as a byproduct. Rehabilitation work at Lepanto promised production early in 1948.

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[7] Boericke, W. F., Rehabilitation of Mines in Philippines Progresses: Eng. and Min. Jour., vol. 149, No. 3, Mar. 1, 1948, p. 60.

OCEANIA

Australia.—Production of gold increased notably in 1947 to 937,654 ounces, the advance exceeding 1946 by 100,000 ounces. Extensive exploratory work in several localities showed varying results. Dredging was on the upgrade, with improvement in yardage and grade at the Harrietville (Tronoh) Co.'s dredge. The rich area of Victoria Gold Dredging was virtually exhausted, but the parent company, Gold Mines of Australia, was equipping two new areas, each of approximately 20,000,000 cubic yards, averaging 3 grams per cubic yard.

Gypsum

By LAWRENCE G. HOUK AND M. G. DOWNEY

GENERAL SUMMARY

PRODUCTION, imports, and value of sales of gypsum each established a record high in 1947. Stimulated by the high level of building activity, demand was strong throughout the year. Mine output rose to 6,208,216 short tons, 10 percent over 1946; imports increased 48 percent to 2,157,049 short tons, and value of sales amounted to $128,415,479—32 percent above 1946.

The apparent consumption of gypsum for all purposes increased 21 percent over 1946. Year-end stocks were 1,361,874 short tons, 317,791 tons greater than at the end of 1946. Prefabricated products represented about 43 percent, building plasters 29, uncalcined uses 25, and industrial uses 3 percent of the total tonnage used. The physical volume of business in prefabricated gypsum products rose 23 percent, uncalcined 19, and building plasters 14, while industrial uses were unchanged compared with 1946. The value of sales of prefabricated gypsum products and uncalcined gypsum increased 37 percent each, building plasters 18 percent, and sales for industrial uses 9 percent above 1946.

The average value reported for crude gypsum mined in 1947 was $2.66 (1946–$2.21). Calcined gypsum value rose from $7.02 in 1946 to $7.73 in 1947.

Salient statistics of the gypsum industry in the United States, 1943–47

	1943	1944	1945	1946	1947
Active establishments [1]	85	77	75	80	93
Crude gypsum: [2]					
Mined short tons	3,877,541	3,761,234	3,811,723	5,629,398	6,208,216
Imported do	231,323	342,462	508,762	1,457,140	2,157,049
Apparent supply do	4,108,864	4,103,696	4,320,485	7,086,538	8,365,265
Calcined gypsum produced: [3]					
Short tons	2,557,730	2,363,143	2,485,090	4,169,662	5,010,918
Value	$14,751,587	$13,841,399	$14,473,566	$29,272,960	$38,726,405
Gypsum products sold: [3]					
Uncalcined uses:					
Short tons	1,233,727	1,056,276	1,147,797	1,641,279	1,950,181
Value	$3,114,789	$2,953,564	$3,432,727	$5,105,789	$7,012,106
Industrial uses:					
Short tons	163,500	200,473	157,796	207,178	207,226
Value	$2,258,981	$2,550,649	$2,326,363	$3,160,988	$3,430,022
Building uses:					
Value	$53,722,762	$50,196,006	$54,389,504	$88,927,786	$117,973,351
Total value	$59,096,532	$55,700,219	$60,148,594	$97,194,563	$128,415,479
Gypsum and gypsum products—					
Imported for consumption	$304,154	$394,603	$548,707	$1,833,088	$2,521,740
Exported	$283,720	$489,980	$1,502,668	$1,065,248	$1,600,578

[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.

Throughout 1947 the gypsum industry continued to modernize older plants and construct new ones in an effort to supply the urgent demands of the building industry. Capital expenditures for plant rehabilitation, expansion, and new equipment increased capacity in the calcined and board departments.

During the war the ratio of lath to wallboard was about 1:2, just the reverse of the prewar proportion. Now the ratio is about 1:1.2. Return to the prewar ratio has been delayed by the shortage of construction materials and by high prices. Houses can be constructed faster and cheaper with wallboard (dry-wall construction) than with lath and plaster (wet-wall construction).

Representatives of the gypsum producers and distributors were called to Washington by a joint congressional committee on housing to discuss prices in the industry and the possibility of reducing prices to bring down home-construction costs, speed up production, and channel shipments to areas where there are shortages, thereby promoting the objectives sought by the anti-inflation law enacted by the Congress.[1]

The United States was the largest producer of crude gypsum accounting for 42 percent of the estimated world total. The Nation's total available supply, 8,365,265 short tons, was about 56 percent of the estimated world production, exclusive of Russia, Poland, Czechoslovakia, and Mexico.

DOMESTIC PRODUCTION

Crude Production.—Production of crude gypsum increased 10 percent and the value 33 percent in 1947. The quantity mined in the United States surpassed the former record, established in 1925, by more than a half-million tons. The 6,208,216 short tons of crude gypsum were mined from 63 operations including 36 open quarries,

Crude gypsum mined in the United States, 1945–47, by States

State	1945			1946			1947		
	Active mines	Short tons	Value	Active mines	Short tons	Value	Active mines	Short tons	Value
Arizona	1			2			3	23,980	$128,725
Arkansas	1	120,422	$160,156	1	212,231	$456,361	1	231,745	468,951
Kansas	2			2			2		
California	5	455,319	967,507	6	574,345	1,315,699	12	811,798	1,996,157
Colorado	3			3			3		
Montana	2	129,587	243,214	2	199,895	474,704	2	205,979	644,583
South Dakota	1			1			1		
Wyoming	1			2			3	22,643	112,238
Iowa	5	430,843	569,964	5	560,094	1,172,500	4	656,982	1,677,217
Michigan	4	640,186	862,028	4	1,120,070	2,171,979	4	1,031,157	2,760,825
Nevada	3	368,246	732,253	3	490,253	1,164,083	7	526,972	1,377,143
New York	7	557,902	1,262,989	7	814,999	1,961,157	7	949,375	2,613,094
Ohio	2	477,595	1,356,592	2	584,755	1,482,269	2	589,808	1,837,846
Virginia	2			2			2		
Oklahoma	2	223,983	317,752	2	301,123	612,148	2	326,144	912,764
Utah	2			2			2		
Texas	6	407,640	511,869	6	771,633	1,630,929	6	831,633	2,000,341
	49	3,811,723	6,984,324	52	5,629,398	12,441,829	63	6,208,216	16,529,884

[1] Oil, Paint and Drug Reporter, vol. 153, No. 4, Jan. 26, 1948, p. 5.

19 underground mines, and 8 quarry-mine combinations. Fifteen of the 17 producing States increased production over 1946; in 2 States (Michigan and Virginia) production was lower. Michigan was the leading State, followed by New York, Texas, California, Iowa, and Nevada. Four mines in Michigan provided 1,031,157 short tons, 17 percent of the United States total; 7 operations in New York, 15 percent; 6 in Texas, 13 percent; 12 in California, 13 percent; 4 in Iowa, 11 percent; and 7 in Nevada, 8 percent. The gypsum mines and quarries continued to mechanize and modernize transportation, drilling, and loading equipment to increase production.

Calcined Production.—The tonnage of calcined gypsum increased 20 percent and the value 32 percent above 1946. Fifty-three calcining plants in 25 States produced 5,010,918 short tons of calcined gypsum valued at $38,726,405 in 1947. New York was the leading State followed by Texas, Iowa, and Michigan.

There were in operation during the year 211 active calcining units, of which 174 were kettle-type, 14 rotary kilns, and 23 other types. The average mill value of calcined gypsum, which in most instances is a "transfer value" assigned by producers who also mine the crude, was $7.73, an increase of 71 cents over 1946.

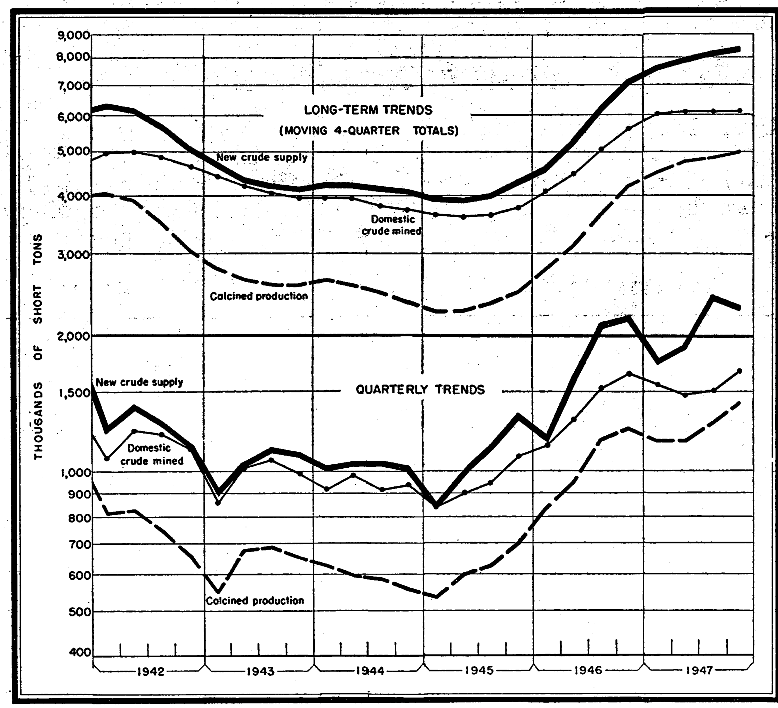

FIGURE 1.—Trends of new crude supply, domestic crude mined, and production of calcined gypsum, 1942–47 by quarters.

Calcined gypsum [1] produced in the United States, 1946–47, by districts

District	1946		1947	
	Short tons	Value	Short tons	Value
New Hampshire, Massachusetts, and Connecticut	155,268	$1,228,340	181,646	$1,561,512
Eastern New York, New Jersey, Pennsylvania, Maryland, Georgia, and Florida [2]	623,875	4,862,620	1,027,684	9,143,770
Western New York	545,686	3,735,566	625,513	4,267,028
Ohio and Virginia	379,531	2,858,570	384,241	3,128,910
Michigan and Indiana	639,764	4,554,987	605,774	4,734,377
Iowa	443,966	3,066,319	530,472	4,000,575
Kansas and Oklahoma	216,003	1,654,360	266,308	2,115,216
Texas	518,587	3,291,439	547,350	3,803,464
Colorado, Wyoming, South Dakota, Montana, and Utah	150,638	1,086,582	169,653	1,354,308
California, Nevada, and Arizona [2]	496,344	2,934,177	672,277	4,617,245
	4,169,662	29,272,960	5,010,918	38,726,405

[1] Made from domestic, imported, and byproduct crude gypsum.
[2] No production from Arizona and Maryland in 1946.

Active calcining plants and equipment in the United States, 1945–47, by States

State	1945			1946			1947		
	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	10	4	4	10	5
Iowa	5	15	4	5	17	4	5	17	2
Michigan	4	19		4	19		4	19	
New York	7	20	6	7	20	6	7	22	6
Texas	4	27		5	28		5	31	
Other States [2]	21	54	20	25	64	23	28	75	24
	44	142	34	50	158	37	53	174	37

[1] Includes rotary and beehive kilns, grinding-calcining units, and hydrocal cylinders.
[2] Calcining plants in 1945–47: 1 each in Connecticut, Georgia, Indiana, Massachusetts, New Jersey, Oklahoma, and South Dakota; 2 each in Colorado, Kansas, Montana, Nevada, Ohio, and Utah. In addition—1945: 2 in Virginia; 1946: 1 each in Florida, New Hampshire, Pennsylvania, and Wyoming, and 2 in Virginia; 1947: 1 each in Arizona, Florida, Maryland, New Hampshire, Pennsylvania, and Wyoming, and 3 in Virginia.

CONSUMPTION AND USES

The value of all gypsum products sold or used in the United States in 1947 was $128,415,479, a 32-percent increase over 1946. Prefabricated gypsum products gained 23 percent in volume, uncalcined 19, and building plasters 14; industrial uses were unchanged. A tonnage break-down of prefabricated uses indicates that lath gained 49 percent, tile 42, sheathing board 40, and wallboard 12. Laminated board declined 92 percent. In the group of uncalcined products, portland-cement retarder increased 18 percent in quantity, and agricultural gypsum 22 percent. Other uses (filler, rock dust, in brewers fixe, color manufacture, and unspecified) decreased 2 percent.

Industrial plasters as a group were practically unchanged; plate glass and terra cotta plasters registered a 1 percent decline, pottery plasters increased 9 percent, and orthopedic and dental plasters were unchanged. Other industrial uses (statuary, industrial casting and molding plasters, dead-burned filler, and granite polishing) declined 3 percent. The various types under the building-plaster heading increased as follows: Base coat 14 percent, sanded 13, mixing plants 13,

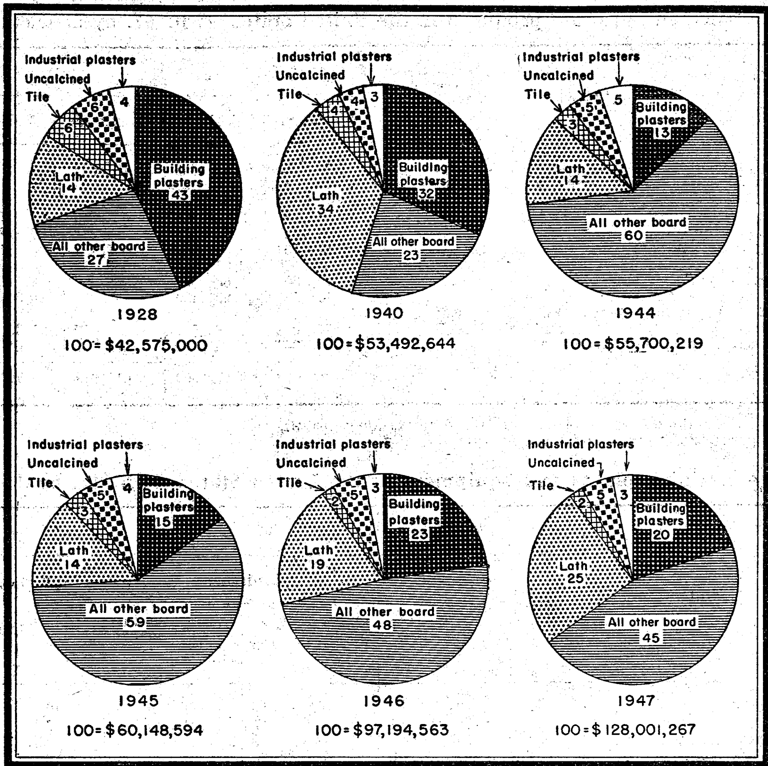

FIGURE 2.—Percentage distribution of total sales value, f. o. b. plant, of gypsum products in 1928, 1940, and 1944–47, by groups of products.

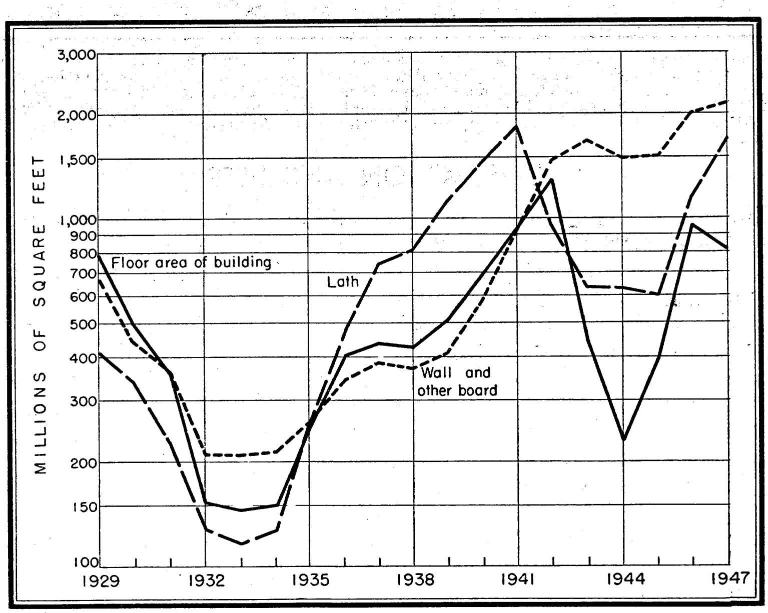

FIGURE 3.—Trends in sales of gypsum lath and wallboard and other boards (includes wallboard, laminated board in terms of component board, and sheathing) compared with Dodge Corp. figures on floor area of residential and nonresidential building, 1929–47.

gaging and molding plasters 6, prepared finishes 60, insulating and roof deck combined with other unclassified uses 2, and keene's cement 37 percent above the volume of 1946.

The principal gypsum products maintained about the same volume ratio to each other as in 1946. The shifts in the sales-value pattern in 1928, compared with prewar, wartime, and postwar periods is shown in figure 2. Of interest is the almost equal movement of lath and plaster. Greatly increased board sales (includes wallboard, sheathing, and laminated board) began early in the war years, and their portion of total gypsum product sales reached a peak in 1943 when the heaviest wartime temporary construction was in progress, and declined slightly to the 1947 level. Very little movement is noted in tile, uncalcined gypsum, and industrial plasters during this period.

Gypsum products (made from domestic, imported, and byproduct crude gypsum) sold or used in the United States, 1946–47, by uses

Use	1946			1947				
	Short tons	Value		Short tons	Value		Percent of change in—	
		Total	Average		Total	Average	Tonnage	Average value
Uncalcined:								
Portland-cement retarder	1,135,853	$2,949,860	$2.60	1,341,859	$4,445,877	$3.31	+18	+27
Agricultural gypsum	471,902	1,855,515	3.93	575,626	2,236,994	3.89	+22	−1
Other uses [1]	33,524	300,414	8.96	32,696	329,235	10.07	−2	+12
Total uncalcined uses	1,641,279	5,105,789	------	1,950,181	7,012,106	------	+19	------
Industrial:								
Plate-glass and terra-cotta plasters	36,654	284,716	7.77	36,364	376,543	10.35	−1	+33
Pottery plasters	44,808	627,913	14.01	48,934	735,588	15.03	+9	+7
Orthopedic and dental plasters	13,322	439,471	32.99	13,329	421,761	31.64	------	−4
Other industrial uses [2]	112,394	1,808,888	16.09	108,599	1,896,130	17.46	−3	+9
Total industrial uses	207,178	3,160,988	------	207,226	3,430,022	------	(4)	------
Building:								
Cementitious:								
Plasters:								
Base-coat	1,507,115	16,088,863	10.68	1,724,888	19,029,965	11.03	+14	+3
Sanded	113,983	864,579	7.59	128,849	1,110,294	8.62	+13	+14
To mixing plants	15,553	121,857	7.83	17,503	154,763	8.84	+13	+13
Gaging and molding	165,061	2,230,931	13.52	174,337	2,356,757	13.52	+6	------
Prepared finishes	11,753	445,864	37.94	18,816	607,345	32.28	+60	−15
Insulating and roof-deck	70,956	623,844	8.79	93,812	2,038,018	10.57	+2	+20
Other [3]	21,326	1,190,576	55.83			55.84		------
Keene's Cement	32,476	482,717	14.86	44,470	798,753	17.96	+37	+21
Total cementitious	1,938,223	22,049,231	------	2,202,675	26,095,895	------	+14	------
Prefabricated:								
Lath	865,682	18,550,334	[5] 16.17	1,290,083	32,241,998	[5] 18.92	[6] +48	+17
Wallboard	1,517,035	43,699,483	[5] 22.99	1,698,671	53,122,413	[5] 25.96	[6] +8	+13
Sheathing board	79,673	2,021,691	[5] 26.29	111,895	3,534,686	[5] 33.20	[6] +38	+26
Laminated board	22,837	792,560	[5] 37.18	1,877	202,683	[5] 116.42	[6] −92	+213
Tile	108,721	1,814,487	[7] 47.92	153,986	2,775,676	[7] 67.37	[6] +42	+41
Total prefabricated	2,593,948	66,878,555	------	3,256,512	91,877,456	------	[6] +23	------
Total building uses	------	88,927,786	------	------	117,973,351	------	------	------
Grand total value	------	97,194,563	------	------	128,415,479	------	------	------

[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] Includes joint filler, patching and painter's plaster, and unclassified building plasters.
[4] 0.02 percent.
[5] Average value per M square feet.
[6] Percent of change in square footage.
[7] Average value per M square feet of partition tile only.

UNCALCINED GYPSUM

Raw gypsum is universally employed to retard the set of portland cement, and this use in 1947 represented 69 percent of the total sales of raw or uncalcined gypsum. Cement producers purchase gypsum on a basis of its sulfur trioxide (SO_3) content, generally specifying that it be between 36 and 42 percent, which corresponds approximately to rock gypsum 75 to 90 percent pure. Because excessive quantities of gypsum are detrimental to the cement, the standard specifications limit the content of sulfur trioxide in portland cement to 2 percent by weight.

Ground gypsum has been used as fertilizer or "land plaster" in the United States since the end of the eighteenth century. Experiments by agricultural authorities have shown that gypsum acts both as a direct and indirect fertilizer and is beneficial to soils in mechanical ways. As a direct fertilizer, gypsum is said to be a source of sulfur trioxide which is an essential food for plants such as cereals, hays, legumes, cotton, tobacco, and peanuts. Indirectly gypsum provides plant food by the liberation of soluble potash in usable form following its reaction with insoluble potash silicates and by stimulating the growth of nitrogen-fixing bacteria in the soil, thus increasing the supply of available nitrogen.

It is regarded as a specific for black-alkali soils, in which it reacts with the deleterious sodium carbonate to form calcium carbonate and sodium sulfate. Gypsum acts as a preservative and sanitary agent when sprinkled over stable manure by changing the volatile ammonium carbonate into nonvolatile ammonium sulfate, thus retaining the nitrogen and checking decomposition of the organic materials and humus in the manure.

Crude gypsum, selected for its whiteness and finely ground to a flour and screened, is used for many purposes, such as filler for paper, textiles, paint, buttons, poker chips, phonograph records, and blasting powder. Because gypsum is neutral, it is a desirable inert material for chemicals and is used as a diluent in various insecticides and drugs. Finely ground gypsum is also used to condition brewer's water and as the chief constituent of blackboard chalk.[2]

CALCINED GYPSUM

Gypsum that has been heated enough to be partly dehydrated is known as calcined gypsum or plaster of paris. Standard specifications (A. S. T. M. Designation C 23–30) state that calcined gypsum, after it has been mixed with water and the paste allowed to set, shall have a tensile strength of not less than 200 pounds per square inch and a compressive strength of not less than 1,000 pounds per square inch. Calcined gypsum by itself has limited use; but when it is ground and minor amounts of other substances are added as accelerators, retarders, fillers, and binders, its uses are varied and extensive and may be divided roughly into those for manufacturing and those for building purposes.

INDUSTRIAL PLASTERS

Calcined gypsum is prepared for manufacturing uses by grinding and the addition of accelerator or retarder as required. It is employed chiefly to make molds and casts and to hold articles for polishing.

[2] Moyer, Forrest T., Gypsum and Anhydrite: Bureau of Mines Inf. Cir. 7049, February 1939, pp. 13–23

To hold glass during polishing it must be finely ground and free from grit in order not to scratch the glass embedded in it; it is used similarly to hold precious stones or metals for polishing or engraving.

It has several properties that make it an excellent economical material for molds used in the manufacture of other articles. Standard specifications for gypsum plaster (A.S.T.M. Designation C 60–30) used for the manufacture of pottery molds state that it shall contain not less than 90 percent by weight of calcined gypsum ($CaSO_4$:1/2H_2O), shall all pass a No. 30 sieve and not less than 94 percent a No. 100 sieve, shall set in not less than 20 or more than 40 minutes, and shall have a tensile strength after setting of not less than 250 pounds per square inch. Gypsum plaster is also used to make molds for rubber stamps, hat manufacturing, and art and scientific work. Molds for nonferrous metal castings are prepared by mixing molding plaster with a refractory material.

BUILDING USES

The most important uses of calcined gypsum are in the preparation of gypsum products for building purposes. Calcined-gypsum products are noted for their lightweight, fire-resisting, low-heat-conducting, soundproofing, and verminproofing qualities.

Building Plasters.—The principal use of calcined gypsum is as a plaster for covering interior walls and ceilings of buildings. These wall plasters are prepared from calcined gypsum by adding a retarding agent to control the time of set and a binder to increase the cohesiveness of the plaster when it is made plastic with water. Wall plasters may be classified as base-coat, ready-sanded, prepared-finish, molding, insulating, and acoustical plasters for interior use and as staff or stucco for exterior use.

Keene's Cement.—Keene's cement is prepared from crude gypsum, selected for color and purity, by calcination at high temperature (595° C. or 1,100° F.) until all the chemically combined water is driven off and the material becomes anhydrous. This calcined product is finely ground; and accelerators of set, such as potash salts or alum, are added. The finished material has unique properties that distinguish it from the ordinary gypsum plaster. It will keep indefinitely, can be retempered (made plastic again) after the initial set has developed, possesses a high compressive and tensile strength, and will take a polish.

Gypsum Board.—The three general types of gypsum board now manufactured are lath or plasterboard, wallboard, and sheathing board. They are designed for different uses, but all consist essentially of a layer of gypsum plaster enclosed between sheets of slightly absorbent, fibrous, unsized paper. Gypsum boards can be cut and nailed as easily as lumber.

Ten companies operating 41 board machines in 1947 produced nearly 4 billion square feet of board (including lath, wallboard, sheathing, and laminated board), an average of about 94 million square feet per machine per year. During the year 8 board machines were operating in New York, 6 in California, 4 each in Michigan and Texas, 3 in Iowa, 2 each in Ohio and Virginia, and 1 each in Florida, Georgia, Indiana, Maryland, Massachusetts, Montana, Nevada, New Hampshire, New Jersey, Oklahoma, Pennsylvania, and Wyoming.

Gypsum board and tile sold or used in the United States, 1943–47, by types

Year	Lath			Wallboard		
	M square feet	Value		M square feet	Value	
		Total	Average [1]		Total	Average [1]
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
1946	1,147,353	18,550,334	16.17	1,900,779	43,699,483	22.99
1947	1,703,818	32,241,998	18.92	2,046,216	53,122,413	25.96

Year	Sheathing			Laminated board			Tile [2]		
	M square feet	Value		M square feet	Value		M square feet	Value	
		Total	Average [1]		Total	Average [1]		Total	Average [3]
1943	231,356	$4,683,376	$20.24	[4] 200,815	$5,450,818	$27.14	11,639	$1,112,654	$42.78
1944	114,704	2,300,069	20.05	[4] 167,580	4,714,096	28.13	15,067	1,426,560	41.63
1945	100,627	2,304,165	22.90	[4] 116,908	4,002,216	34.23	17,988	1,824,736	42.62
1946	76,914	2,021,691	26.29	[4] 21,317	792,560	37.18	18,865	1,814,487	47.92
1947	106,482	3,534,686	33.20	[4] 1,741	202,683	116.42	26,769	2,775,676	67.37

[1] Per M square feet, f. o. b. producing plant.
[2] Includes partition, roof, floor, soffit, shoe, and all other gypsum tiles and planks.
[3] Per M square feet, f. o. b. producing plant, of partition tile only.
[4] Reported as area of component board and not of finished product.

Gypsum lath or plasterboard usually is manufactured in ⅜-inch thickness and is intended for use as a strong, fireproof plaster base in place of wood or metal lath. It provides a uniform surface with an exceptionally strong bond for succeeding plaster coats and requires less plaster than other types of lath. Other advantages of its use are that it is easily and quickly erected, does not warp or buckle after wet plaster is applied, is waterproof, and increases the heat- and sound-insulating qualities of the finished wall.

Gypsum wallboard is designed for use on interior walls, ceilings, or partitions without addition of plaster. The standard thickness manufactured is three-eighths inch. It has a surface suitable to receive final decoration, is fireproof and verminproof, does not expand or contract, is easy to install, and has good sound- and heat-insulating qualities.

Gypsum sheathing board consists of a gypsum core encased in a tough, fibrous covering, the outer surface and ends of which are moistureproofed. The usual thickness manufactured is one-half inch. It is used for sheathing on frame structures under shingles, stucco, or brick veneer, and as an exterior finish on temporary structures. Gypsum sheathing board is fireproof, moistureproof, and windproof. It is permanent and has good insulating qualities and superior strength.

Gypsum Tiles and Blocks.—Gypsum tiles and blocks are made in various sizes and designs for flooring, roofing, furring, non-load-bearing partitions, and fireproof covering of columns, beams, and shafts. They are light in weight, fire-resistant, and sound- and heat-insulating; are readily laid; and can easily be cut with a hand saw.

PRICES

The average value reported by crude-gypsum producers was \$2.66 per short ton in 1947 (\$2.21 in 1946). As about three-quarters of the gypsum produced in the United States is captive tonnage, the reported value before 1946 was in some cases a bare cost figure, in others a transfer value, and in others the theoretical market value. In 1946 producers were asked to estimate theoretical market value of crude even though they used it themselves. The average value of portland-cement retarder in 1947 was 27 percent higher at \$3.31 per ton; and that of agricultural gypsum (land plaster) declined 1 percent to \$3.89. The average values of all industrial plasters increased in 1947 with the exception of dental and orthopedic plasters, which declined 4 percent. The average value of all building plasters increased, with the exception of prepared finishes, which declined 15 percent from the average value of 1946. The gains in average values of prefabricated products (lath, board, and tile) were more substantial than those made in any of the other groups of gypsum products.

PLANT EXPANSIONS

To meet the unprecedented demand for gypsum and gypsum products, the industry continued its program of constructing new and modernizing older plants.

A nearly completed expansion program by the National Gypsum Co., costing about \$30,000,000, will provide a new plant at Baltimore, Md., additional facilities at Rotan, Tex., and modernization and expansion at Medicine Lodge, Kans.; Niles, Ohio; Kalamazoo, Mich.; and Savannah, Ga. Three freighters recently purchased will transport Nova Scotia gypsum to east-coast plants.[3] The United States Gypsum Co. \$42,000,000 expansion program will provide plants at Altavista, Va., and other locations; completion of construction now under way of mills at Rahway, N. J., Norfolk, Va., and Los Angeles, Calif., and of plants in the Imperial Valley, California, and at Sigurd, Utah; modernization and enlargement of existing facilities; and the purchase of two new 10,000-ton cargo ships.[4] The Sigurd, Utah, plant will duplicate the company Heath, Mont., plant and will manufacture plaster of all types, gypsum tile, and board. The plant at Nephi, Utah, will continue to operate at capacity.[5]

The Western Gypsum Co. is reported spending approximately 1 million dollars on a new plaster- and gypsum-board plant near Sigurd, Utah. The company will continue to operate the modernized plant of the American Keene Cement & Plaster Co. while the new plant is being completed.[6]

The Standard Gypsum Co. of Long Beach, Calif., started operation of the newest board plant on the west coast. Gypsum rock is obtained on San Marcos Island and delivered to the plant in a converted Victory ship with self-loading facilities.[7]

The Sulphur Springs Gypsum Co. of Thermopolis, Wyo., reopened the Brutch property.[8] The Gypsum Products Co. (formerly Wy-

[3] Pit and Quarry, vol. 39, No. 11, May 1947, p. 53, and Rock Products, vol 50, No. 3, March 1947, p. 62.
[4] Pit and Quarry, vol. 39, No. 8, February 1947, p. 62.
[5] Eng. and Min. Jour. vol. 148, No. 1, January 1947, p. 120.
[6] Eng. and Min. Jour., vol. 148, No. 7, July 1947, p. 126.
[7] Pit and Quarry, vol. 40, No. 3, September 1947, pp. 114–117.
[8] Pit and Quarry, vol. 39, No. 8, February 1947, p. 59.

oming-Midland Gypsum Co.) started mining operations at Cody, Wyo.[9] The Northwest Gypsum Co., Spokane, Wash., announced plans for developing gypsum deposits near Weiser, Idaho.[10]

The Pacific Portland Cement Co. reported sale of its mill and gypsum properties at Empire, near Gerlach, Nev., to the United States Gypsum Co.[11]

Colombia Gypsum Products, Inc., of Bremerton, Wash., plans a processing plant at Spokane. Raw materials will be shipped from the company holdings in British Columbia, which are said to contain 40,000,000 tons of high-grade gypsum.[11]

FOREIGN TRADE[12]

The United States imported 26 percent of its supply of crude gypsum and anhydrite in 1947. Canada supplied over 93 percent and Mexico 6 percent, with minor amounts from the Dominican Republic, the United Kingdom, and China. Imports of ground, calcined, and Keene's cement were small.

Gypsum and gypsum products imported, for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Crude (including anhydrite)		Ground		Calcined		Keene's cement		Alabaster manufactures[1] (value)	Other manufactures, n. e. s. (value)	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value			
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	16,388	548,707
1946	1,457,140	1,621,666	354	7,308	255	6,918	162	3,686	119,937	73,573	1,833,088
1947	2,157,049	2,269,583	477	13,228	130	3,793	(2)	27	204,954	30,155	2,521,740

1 Includes imports of jet manufactures, which are believed to be negligible.
2 Less than 1 ton.

Crude gypsum (including anhydrite) imported for consumption in the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada	502,530	$507,212	1,429,057	$1,559,544	2,020,886	$2,109,882
China			(1)	34	(1)	23
Dominican Republic	3,652	15,274	9,312	42,005	9,782	39,931
Mexico			9,519	9,120	126,374	119,344
Newfoundland and Labrador	2,580	2,580	9,252	10,963		
United Kingdom					7	403
	508,762	525,066	1,457,140	1,621,666	2,157,049	2,269,583

1 Less than 1 ton.

9 Pit and Quarry, vol. 39, No. 11, May 1947, p. 85.
10 Rock Products, vol. 51, No. 6, June 1948, p. 96.
11 Pit and Quarry, vol. 40, No. 12, June 1948, p. 60.
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.

Gypsum and gypsum products exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Crude, crushed, or ground		Calcined		Plasterboard and wallboard		Other manufactures, n. e. s. (value)	Total value
	Short tons	Value	Short tons	Value	Square feet	Value		
1943	5,300	$22,405	2,436	$98,229	2,953,173	$84,163	$78,923	$283,720
1944	870	18,604	5,620	166,145	7,236,665	180,021	125,210	489,980
1945	1,067	18,909	8,961	248,853	31,835,980	1,017,677	217,229	1,502,668
1946	4,071	56,524	15,555	343,795	12,405,583	417,750	247,179	1,065,248
1947	9,717	79,278	23,491	542,756	19,417,487	646,448	332,096	1,600,578

Virtually all Canadian imports were destined to the east coast, the Customs District of New York taking 810,341 short tons, Georgia 277,554 short tons, and Philadelphia 240,122 short tons. The remainder was brought in through the Florida, Maryland, Massachusetts, Maine and New Hampshire, Virginia, Puerto Rico, Connecticut, and Buffalo districts. Most of the Mexican imports were landed on the west coast at Los Angeles.

WORLD REVIEW

New building and reconstruction in 1947 throughout the civilized world brought the estimated total world production of gypsum to 13,500,000 metric tons, a 2,000,000-ton increase over 1946. The United States was the leading producer, supplying 42 percent. These estimates of the world total do not include the output of Russia, Poland, Czechoslovakia, and Mexico.

Australia.—A gypsum wallboard plant was recently completed at Concord, West Sidney, Australia. Raw material will be obtained from New South Wales.[13]

Canada.—The Gypsum, Lime & Alabastine, Canada, Ltd., of Toronto, was taking bids for $400,000 improvements at its Montreal plant. Present 15,000-tonnage capacity will be doubled. The old storage building will be razed for plant expansion and an additional gypsum calcining kettle and a dryer will also be installed. This company is also exploring the possibilities of developing an export trade for gypsum from a gypsum deposit near Mabou, Nova Scotia.[14]

France.—There is said to be 70 to 80 million tons of gypsum in a deposit in the Paris Basin, and conditions for exploitation are ideal from the transportation standpoint. It has been estimated that there is a shortage of over 60,000 tons of plaster, needed for reconstruction in France.[15]

India.—Gypsum is found in various parts of India but production has been chiefly from Jhelum district, Punjab, Bikaner, and Jodhpur States, and the Trichinopoly district, Madras.[16]

[13] Rock Products, vol. 51, No. 2, February 1948, pp. 110–112.
[14] Rock Products, vol. 50, No. 1, January 1947, p. 85; Rock Products tip sheet, August 1947, p. 1.
[15] Bureau of Mines, Mineral Trade Notes, vol. 24, No. 6, June 1947, pp. 35–36.
[16] South African Min. and Eng. Jour., vol. 58, part 1, No. 2840, July 19, 1947, p. 631.

World production of gypsum, 1941–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1941	1942	1943	1944	1945	1946	1947
Algeria	23,375	23,720	17,920	(2)	(2)	(2)	31,000
Anglo-Egyptian Sudan	748	1,558	3,641	(2)	2,106	3,063	(2)
Argentina [3]	88,076	88,688	87,461	106,313	91,504	(2)	(2)
Australia:							
New South Wales	23,458	19,564	36,862	20,540	23,137	(2)	(2)
South Australia	115,323	58,124	40,157	47,294	66,653	91,878	108,672
Victoria	16,013	9,130	9,073	8,717	11,755	15,184	23,262
Western Australia	9,666	2,924	950	3,662	7,349	15,596	20,608
Austria	(2)	(2)	(2)	(2)	(2)	(2)	14,753
Belgian Congo	2,533	2,937	—	—	—	—	(2)
Brazil	[4] 48,700	(2)	(2)	(2)	(2)	(2)	(2)
Canada	1,415,600	723,137	390,833	486,571	753,615	1,838,895	[5] 2,168,303
Chile	33,866	33,634	39,472	38,670	47,162	(2)	(2)
China	[6] 37,100	[6] 37,900	(2)	(2)	(2)	(2)	50,000
Colombia	(2)	(2)	(2)	(2)	(2)	(2)	17,372
Cuba [4]	12,000	4,300	3,200	10,000	10,400	14,300	14,900
Cyprus (exports)	180	273	134	3,492	2,608	15,464	7,844
Dominican Republic	[7] 3,040	(2)	[7] 916	[7] 2,146	[7] 3,258	[7] 10,974	13,393
Egypt	130,942	118,931	91,881	106,299	96,565	78,316	80,000
Eire	24,660	16,567	21,453	21,394	23,400	37,894	(2)
France	(2)	840,030	722,217	703,412	244,000	448,950	585,000
Germany	(2)	(2)	181,458	(2)	(2)	[8] 71,000	(2)
Greece	(2)	(2)	(2)	(2)	(2)	(2)	[4] 5,000
India	53,910	64,386	83,587	85,049	92,229	77,643	(2)
Indochina, French	—	3,000	720	(2)	(2)	(2)	(2)
Italy	328,445	(2)	(2)	(2)	(2)	(2)	(2)
Japan [9]	208,149	186,584	156,571	123,833	83,421	43,260	54,455
Kenya	(2)	(2)	40	254	159	421	(2)
Morocco:							
French	(2)	(2)	(2)	(2)	—	—	[7] 25,631
Spanish	(2)	(2)	3,300	(2)	(2)	1,219	(2)
New Caledonia	—	24,000	16,800	16,692	8,030	6,750	2,705
Palestine	4,841	8,118	5,990	7,428	7,542	14,512	(2)
Peru	22,472	19,514	20,326	25,070	42,223	43,391	[4] 50,000
Portugal	15,307	17,961	27,699	29,134	—	—	(2)
Rumania	69,590	33,650	44,044	(2)	(2)	(2)	(2)
Siam	(2)	(2)	589	133	(2)	87	71
Spain	792,135	862,047	1,105,818	1,254,830	1,038,616	1,098,013	(2)
Sweden	(2)	(2)	740	173	288	(2)	(2)
Switzerland	35,000	38,000	42,000	46,000	97,000	68,000	165,000
Syria	1,000	5,000	2,500	(2)	—	1,200	(2)
Union of South Africa (sales)	48,326	50,823	47,608	57,426	62,321	(2)	80,166
United Kingdom:							
Great Britain	1,196,900	1,231,613	1,389,914	1,344,485	1,347,888	1,715,060	1,764,609
Northern Ireland	(2)	(2)	556	(2)	71	—	—
United States	4,344,062	4,261,540	3,517,628	3,412,116	3,457,919	5,106,877	5,631,969
Total (estimate) [1]	10,700,000	10,100,000	8,500,000	8,800,000	8,100,000	11,500,000	13,500,000

[1] In addition to the countries listed gypsum is produced in Ethiopia, Iraq, Luxembourg, Mexico, Poland, Tunisia, U. S. S. R., and Yugoslavia; but production data are not available, and no estimates for these countries are included in world totals shown.
[2] Data not available; estimate by author of chapter included in total.
[3] Rail and river shipments.
[4] Estimate.
[5] Sales.
[6] Data represent areas designated as Free China during period of Japanese occupation.
[7] Exports.
[8] Russian zone only.
[9] Preliminary.

Sweden.—In Sweden gypsum was so scarce during the war that it was synthesized from lime and sulfuric acid. This gypsum is of high purity; and, though costly in comparison to natural gypsum, it is expected that production will continue as a byproduct in the utilization of waste sulfuric acid. The gypsum is used for surgical, industrial, and chemical purposes.[17]

[17] Pit and Quarry, vol. 39, No. 11, May 1947, p. 61.

Helium [1]

By C. W. SEIBEL AND H. S. KENNEDY

GENERAL SUMMARY

TO AN increasing extent, industry is accepting the advantages to be gained in using helium as an inert shield for arc welding, particularly for the welding of magnesium and more recently for welding aluminum. It is estimated that about half of the helium sold commercially in fiscal year 1947 was used in welding. This percentage is likely to increase. Substantial volumes are used for inflating of Navy-surplus blimps operated by private advertising concerns, and it is encouraging that more and more helium is being used for relieving a number of respiratory ailments. The estimated commercial sales in the fiscal year 1948 are 18 million cubic feet, of which about 2 million will go to medical use. Research is being continued by the Bureau of Mines and by industry on new and improved uses for helium.

War Program.—Helium was used during the war principally to inflate blimps for antisubmarine patrol, as well as barrage and meteorological balloons, to fill various medical roles, and to enable industry to weld magnesium and other metals used in airplane construction. At the time Germany invaded Poland in September 1939 the only operating helium plant in the world was that at Amarillo, Tex., with a rated capacity of 24 million cubic feet per year. However, as only five wells had been drilled in the Government's Cliffside gas field to supply the helium-bearing natural gas to the plant, the helium that could be produced without damaging the wells by overdraft was about 20 million cubic feet a year. As the war in Europe progressed, our defense requirements mounted rapidly, and measures to provide additional capacity were taken. From April 1941 to October 1942 the Congress appropriated $16,775,000 to establish an over-all helium-production capacity of 240 million cubic feet a year, 12 times the prewar available capacity. From the sums appropriated the Amarillo plant was enlarged, additional wells were drilled in the Cliffside field, four new complete helium-extraction plants were constructed, and the Government's reserves of helium-bearing natural gas were increased. About $1,800,000 remained for return to the United States Treasury.

The rapid construction and successful operation of these added facilities were possible only because the Bureau of Mines had a well-developed operating plant to provide a basis for the construction of the new plants and maintained a small but highly trained group of employees around whom, as a nucleus, the staffs and crews for these new plants could be assembled. No operations of the armed services were curtailed for lack of helium production at any time during the

[1] The latest report in this series covered the fiscal year ended June 30, 1941. For security reasons, no reports on the production, distribution, or use of helium were published during the war. This report covers the period from July 1, 1941, to June 30, 1947, with some data extended to December 31, 1947.

war. The value of helium in the war is indicated in part by the following quotation:[2]

In all, blimps escorted 89,000 surface craft in World War II without a single loss to enemy submarines. Of these, 50,000 were in areas where U-boats were known to be present at the time.

PRODUCTION

During World War I the Bureau of Mines directed the building and operation of three small experimental helium units in Texas. These units were operated by cooperating commercial concerns and produced 200,000 cubic feet of helium before the end of that war. After the war the experimental plants were dismantled and the Navy directed the commercial installation and operation of a helium production plant at Fort Worth, Tex., which began operation in April 1921. On July 1, 1925, the Government's entire helium program was placed under the Bureau of Mines. The Fort Worth plant produced helium until January 10, 1929, shortly before the present Amarillo plant began operations. The Amarillo plant was the sole Government producing unit from 1929 to March 1943, when the Exell plant began production. The accompanying table indicates the total production of helium at the Fort Worth plant, the cumulative production of the Amarillo plant to January 1, 1942, and the annual production of helium by all plants for calendar years 1942 through 1947.

Helium production in the United States, 1921–47

Calendar year	Plant	Cubic feet
1921—January 1929	Fort Worth plant	46,088,787
1929 (April)–1941	Amarillo plant	131,887,380
1942	do	33,252,582
1943	All plants	116,307,437
1944	do	126,933,130
1945	do	94,733,744
1946	do	58,236,385
1947	do	70,297,700
Total 1921–47		[1] 677,737,145

[1] Includes 69,200,090 cubic feet injected back into the gas reservoir in calendar years 1945–47.

FIELDS AND PLANTS

Amarillo Helium Plant.—In June 1941 Congress authorized money for expanding the Amarillo, Tex., plant from a capacity of 24 million to 36 million cubic feet of helium a year, drilling more gas wells, and adding new gas-purification equipment at the plant. The new helium-production unit began operation in August 1942. In July 1943 the plant produced a record volume of 4,617,920 cubic feet, almost 54 percent above rated capacity. The plant produced helium during 47 of the 49 months from July 1941 to August 1945 and then was shut down at the end of the war to conserve helium. It operated for a short time from June to September 1946 while the Exell plant was shut down for test, inspection, and maintenance work. The Amarillo plant now is in stand-by status but can begin helium production al-

[2] Rosendahl, Rear Adm. C. E.: They Were Dependable—Airship Operation in World War II: Naval Air Station, Lakehurst, N. J., 1946, 56 pp.

most immediately when occasion demands its operation. To date, since it was built in 1929, the Amarillo plant has produced more than 252 million cubic feet of helium.

The following table lists yearly receipts from the sale of residue natural gas as fuel from the plant since the fiscal year 1942.

Receipts from sale of residue natural gas at Amarillo helium plant

Fiscal year:	Receipts
1942	$70, 307. 58
1943	84, 775. 39
1944	83, 240. 62
1945	37, 404. 98
1946	15, 808. 51
1947	20, 166. 67
Total	311, 703. 75

Receipts prior to 1942 were $297,006.07, or a total of $608,709.28 to June 30, 1947.

Cliffside Gas Field.—After more than 30 years of concentrated search, the Cliffside field near Amarillo, Tex., remains the best helium reserve known. During the war 7 additional wells were drilled, and 1 well was abandoned for mechanical reasons, leaving the total number of gas wells in this Government-owned field at 11. Since 1929 the field has produced about 15.7 billion cubic feet of helium-bearing gas, of which 7.8 billion was produced in fiscal years 1942 through 1947. The average helium content of the gas is 1.8 percent by volume.

Exell Plant.—Early in 1941 the Bureau of Mines initiated an expanded intensive survey of gas fields in Texas, Kansas, Wyoming, Colorado, and Utah to determine the best locations for additional helium plants. By December the results indicated that the most favorable location was in the Channing area of the Amarillo (Texas Panhandle) gas field. The gas from this area of 70,000 acres was piped to fuel markets through one pipe line, privately owned; the company owning the pipe line also controlled the gas supply, thus simplifying negotiations and contractual relations; the gas reserve was large; and the helium content of the gas—1 percent—was enough to warrant its extraction. In addition, the new plant could be built within 35 miles of the helium headquarters at Amarillo, thus simplifying administration.

The plant location was selected at Exell, Moore County, Tex., and contracts for its construction were let on April 9, 1942. Originally a capacity of 24 million cubic feet a year was planned, but the contract was supplemented on July 2, 1942, to increase the capacity to 60 million cubic feet a year. Because of the highly specialized character of the gas-liquefaction and helium-separation equipment used, such equipment for this plant and all the later plants was designed and installed by Bureau of Mines personnel.

On March 13, 1943, the Exell plant began producing helium without difficulties. This plant now is operating and supplies all present demands for helium from both Federal and non-Federal users. It has produced helium for 55 of the 58 months from March 1943 to January 1948 and in October 1943 made a record monthly output of 8,200,000 cubic feet of helium. To January 1, 1948, the Exell plant has supplied 277,398,080 cubic feet of helium. This amount represents helium that would never have been utilized if it had not been recovered by the Exell plant, because it was extracted from gas moving to fuel markets.

Otis Helium Plant.—As estimates of helium demand by the armed services, particularly the Navy, increased with progress of the war, contracts for additional plants were made. On January 6, 1943, contracts were let for another plant at Otis, Kans., with a rated capacity of 48 million cubic feet a year. Nine and one-half months later, on October 21, 1943, this plant began producing helium. A total of 4,787,950 cubic feet was produced during December 1943. The plant continued in operation until August 25, 1945, when it was shut down and placed in stand-by status after producing 56,633,755 cubic feet of helium. This helium likewise would have been lost to utilization, as the natural gas from which it was produced went to fuel markets through a gas pipe line.

Navajo Plant.—In the latter part of June 1942 a petroleum company, while drilling for oil, discovered a large gas reserve of high-helium content on the Navajo Indian Reservation near Shiprock, N. Mex. After careful study and upon completion of agreements with all parties concerned, contracts were let on January 20, 1943, for another plant at Shiprock with an annual capacity of 48 million cubic feet. This plant was placed in operation on March 13, 1944, and operated very successfully for a trial period of 18 days. It then was shut down to conserve helium, as the demand was decreasing and the other plants were meeting all needs. It now is in stand-by status. In the 18 days of operation 2,243,414 cubic feet of helium were produced. As the gas field and plant are not near standard-gage rail points, a rail terminal for the plant was constructed at Gallup, N. Mex., about 90 miles from the plant, and a small-diameter, high-pressure helium pipe line was laid from the plant to the terminal.

Rattlesnake Gas Field.—The Continental Oil Co. and the Santa Fe Corp. had produced oil from a shallow formation in the Rattlesnake field, San Juan County, N. Mex., for many years before 1941. This production was on a tract of 4,080 acres leased from the Navajo Tribe and forming a part of the Navajo Indian Reservation. In 1941 the Continental Oil Co. leased an adjoining 3,720-acre tract from the Navajos and on this lease drilled into a high-pressure gas formation at 6,950 feet in late June 1942. The gas was incombustible, and a representative of the Geological Survey, supervising the drilling operations on the Navajo Reservation for the Navajo Tribe, immediately sent a sample of the gas to the Amarillo helium headquarters for analysis. The analysis indicated a 7.5-percent helium content, and the Bureau of Mines arranged with the Continental Oil Co. to have tests made of the gas flow and rate of production, with Bureau personnel at the well location. These tests, made early in July 1942, indicated a large gas reserve at high pressure, and the helium content of 7.5 percent was confirmed. On December 1, 1942, the Continental Oil Co. assigned this 3,720-acre lease to the Government for $1.

From a geologic standpoint and for other considerations the location of another well to confirm the extent and productivity of the gas formation could best be made on the 4,080-acre lease held jointly by the Continental Oil Co. and the Sante Fe Corp. Agreements were concluded with the two concerns to allow drilling of this well and its subsequent production as needed. The well was completed successfully with a very high capacity, and the combined capacity of the two wells is enough to supply the Navajo plant.

After long and complicated negotiations and study, Congress passed an act in June 1947 authorizing the U. S. Department of the Interior to conclude agreements with the Navajo Tribe and the two oil companies by which the Government obtained full rights in and control of this valuable helium reserve. Payments amounting to $147,799 in cash were made to the Navajos as advance royalty and rental payments, and other payments were made to the oil companies for their rights in the gas formation. This valuable helium reserve, estimated to contain 12 billion cubic feet of gas, from which 788 million cubic feet of helium can be extracted, is available to the Government in time of need.

Dismantled Plants.—During the war another plant was constructed near Cunningham, Kans., beginning operations on January 17, 1944. The plant produced 43,049,000 cubic feet of helium during continuous operation from January 17, 1944, to July 9, 1945. At the time construction was begun it was known that the reserves were small and the life of the plant would be limited, but better locations were not known and the plant served the wartime requirements well. After the war, the plant was dismantled, and equipment not needed at the other plants was disposed of as surplus.

In 1938 the Government purchased two small, privately owned helium plants from the Girdler Corp., at Thatcher, Colo., and Dexter, Kans. The Thatcher plant had produced only about 3 million cubic feet of helium during its operation by the Girdler Corp. from September 1929 to June 1930, and the capacity of the plant under the most favorable conditions would have been very limited and helium production very costly. For these reasons the Secretary of the Interior approved disposal of the plant in July 1944, and all surplus equipment was sold. An exhaustive study of the Dexter, Kans., plant and its possible gas supply indicated that operation could not be justified, so it too was dismantled and all surplus equipment sold.

Conservation of Helium.—Immediately after the close of the war period, demands for helium dropped sharply, so that only one plant was necessary to supply all demands. The 60-million-cubic-foot annual capacity of the Exell plant was more than enough to supply the demand, and in January 1945 the Bureau of Mines began a conservation program by injecting the excess helium from the Exell plant into the Government-owned Cliffside field. As there is little difference in the cost of operating a helium plant below capacity rates as compared with full capacity rates, substantial conservation of helium has been effected at low cost by storing the excess production of the Exell plant in the Cliffside field. In the last 6 months of the fiscal year 1945—from January to June 1945, inclusive—20,629,400 cubic feet of helium were so conserved by injection into the Cliffside field. In fiscal year 1946, 28,930,020 cubic feet were saved, and in the fiscal year 1947 the total was 5,933,250 cubic feet. From July 1947 to December 31, 1947, the volume injected was 13,707,420 cubic feet, or a total of 69,200,090 cubic feet in the 3-calendar-year period.

SHIPMENTS AND USES

Shipments.—The Navy continues to use more helium than any other agency of the Government, principally for inflation of lighter-than-air craft, for welding, for aerological studies, and in diving operations. The accompanying table indicates shipments of helium to the various Federal agencies during the past 7 fiscal years.

Shipments of helium in the United States, 1941–47 (fiscal years), in cubic feet

Fiscal year	Shipments to Federal Government				Sales for private use			Total shipments
	Navy	Weather Bureau	Army and other Federal agencies	Total	Scientific and commercial	Medical	Total	
1941	6,903,830	3,716,135	3,066,845	13,686,810	766,856	480,084	1,246,940	14,933,750
1942	16,173,670	5,062,400	6,470,305	27,706,375	573,880	405,125	979,005	28,685,380
1943	52,105,780	5,214,280	3,084,180	60,404,240	631,994	427,661	1,059,655	61,463,895
1944	120,785,059	6,377,815	1,432,730	128,595,604	1,588,900	598,905	2,187,805	130,783,409
1945	91,893,654	7,234,320	7,502,250	106,630,224	2,850,023	527,077	3,377,100	110,007,324
1946	12,027,705	9,409,155	9,886,040	31,322,900	3,645,246	603,879	4,249,125	35,572,025
1947	28,871,800	7,752,620	7,161,915	43,786,335	11,462,978	1,863,757	13,326,735	57,113,070

The table also shows the volume of helium sold to non-Government purchasers. To date, the Bureau of Mines has executed more than 500 contracts with private concerns for the delivery of helium. Many large gas-distributing companies maintain stocks of helium for resale in practically all large cities in the United States and in many of the smaller ones.

Uses of Helium.—Helium is used both by Federal agencies and commercial concerns for inflating airships; for meteorology; for welding magnesium, aluminum, stainless steel, and other metals and alloys; in medicine in connection with the administration of anesthetics and in admixture with oxygen for the relief of severe cases of asthma; and as a tracer for following the movement of gas in underground petroleum reservoirs. Scientifically, liquid helium is being used to produce the lowest temperatures ever attained, and fundamental studies of great significance in physics and thermodynamics are in progress with the aid of the liquefied helium.

PRICES

Public sale of helium by the Bureau of Mines was authorized by an amendatory Helium Act approved September 1, 1937. Regulations provided that the price to be paid by commercial users for helium would be based on actual costs during each fiscal year. Amended regulations were put into effect on February 16, 1947, and these regulations provided the following prices to be paid by public users: Helium sold for medical use and delivered in tank cars, trailers, or multiple-cylinder units—$11 per thousand cubic feet; helium sold for medical use and delivered in standard cylinders containing about 200 cubic feet each—$13 per thousand cubic feet; helium sold for scientific and commercial use and delivered in tank cars, trailers, and multiple-cylinder units—$13 per thousand cubic feet; and helium sold in standard cylinders for scientific and commercial use—$15 per thousand cubic feet. These prices are for deliverv at the plant.

Iron Ore

By NORWOOD B. MELCHER

GENERAL SUMMARY

THE iron-ore industry, operating under conditions relatively free of strikes in 1947, attained a production 31 percent greater than during 1946. In spite of this and a favorable Great Lakes shipping season, output was less than in the peak war years 1942–44. All active districts in the United States increased production in 1947, and imports of foreign material nearly doubled those in 1946. Canada and Chile continued to be the two most important sources of foreign iron ore in 1947; but Sweden, which normally ships relatively small quantities to the United States, shipped well over 1 million tons to furnaces on the eastern seaboard. A trend showing the Lake Superior district becoming relatively less important as a source of iron ore continued in 1947. That district, which supplied 85 percent of domestic production in 1945, furnished 83 percent in 1946 and 82 percent in 1947. This trend is magnified when the increasing reliance on imported ore is considered. Accordingly, the Lake Superior district furnished 83 percent of the total supply in 1945, 80 percent in 1946, and only 78 percent in 1947. This trend is expected to continue as an inevitable result of several factors: (1) The expansion of steel facilities in domestic areas that do not depend upon Lake Superior iron ores, particularly western and east coastal areas, (2) a depletion of high-grade, direct-shipping iron-ore reserves in the Lake Superior region, resulting in shipment of less ore from that area, and (3) the rapid development of high-grade iron-ore deposits in foreign countries, especially Labrador and Venezuela.

The limitations in increasing iron-ore production in the United States loomed as the major obstacle toward increasing steel expansion after 1947. Steel expansion of approximately 2,000,000 tons scheduled at the close of 1947, will add an equal amount to requirements for iron ore, and inasmuch as only small increases in capacity for Great Lakes shipping were under construction, it appeared that this additional requirement for iron ore would be met from foreign sources.

Salient statistics of iron ore in the United States, 1944–47

	1944	1945	1946	1947
Crude iron ore:				
Production by districts:				
Lake Superior gross tons	88,294,284	85,451,692	67,014,550	[1] 88,420,140
Southeastern do	11,469,700	9,616,593	9,278,832	11,031,102
Northeastern do	7,749,541	7,686,338	5,136,313	8,698,983
Western do	3,506,620	3,557,776	2,764,786	5,821,989
	111,020,145	106,312,399	84,194,481	113,972,214
Production by mining methods:				
Open pit do	82,393,899	78,935,218	63,859,082	85,624,658
Underground do	28,626,246	27,377,181	20,335,399	28,347,556
	111,020,145	106,312,399	84,194,481	113,972,214
Production by types of ore:				
Hematite do	96,238,818	92,161,239	74,127,099	96,869,038
Brown ore do	5,265,700	4,397,650	3,598,474	5,579,464
Magnetite do	9,514,555	9,752,711	6,468,184	11,523,620
Carbonate do	1,072	799	724	92
	111,020,145	106,312,399	84,194,481	113,972,214
Shipments do	112,073,286	106,538,936	83,985,686	113,918,585
Iron ore (usable; less than 5 percent Mn):				
Production by districts:				
Lake Superior gross tons	79,111,320	74,821,045	59,042,154	[1] 76,531,769
Southeastern do	7,121,676	6,329,987	6,247,096	7,527,321
Northeastern do	3,849,396	3,620,147	2,596,349	3,987,195
Western do	3,442,405	3,087,774	2,450,611	4,502,512
Undistributed (byproduct ore) do	592,908	517,440	506,903	542,723
	94,117,705	88,376,393	70,843,113	93,091,520
Production by types of product:				
Direct do	73,260,136	67,768,993	54,014,466	71,121,676
Concentrates do	16,648,364	16,812,961	13,799,046	17,058,162
Sinter do	3,616,297	3,276,999	2,522,698	4,368,959
Byproduct material (pyrites cinder and sinter)) gross tons	592,908	517,440	506,903	542,723
	94,117,705	88,376,393	70,843,113	93,091,520
Production by types of ore:				
Hematite do	86,726,870	81,294,688	65,728,172	84,535,465
Brown ore do	1,218,509	942,910	686,402	1,201,408
Magnetite do	5,578,807	5,620,810	3,920,986	6,811,876
Carbonate do	611	545	650	48
Byproduct material (pyrites cinder and sinter gross tons	592,908	517,440	506,903	542,723
	94,117,705	88,376,393	70,843,113	93,091,520
Shipments do	95,135,675	88,136,715	70,090,410	93,314,635
Value	$256,885,512	$243,760,986	$215,006,427	$320,864,981
Average value per ton at mine	2.70	2.77	3.07	3.44
Stocks at mines Dec. 31 gross tons	4,136,639	4,431,970	5,339,147	5,220,726
Imports do	463,532	[2] 1,197,925	2,754,216	4,903,484
Value	$2,007,865	[2] $4,113,583	$10,370,675	$22,095,876
Exports gross tons	2,158,447	2,063,125	1,505,854	2,806,894
Value	$7,163,405	$6,688,156	$5,492,549	$10,011,476
Consumption gross tons	99,942,454	[3] 86,158,495	72,174,844	96,115,549
Manganiferous ore (5 to 35 percent Mn):				
Shipments gross tons	1,327,324	1,359,691	1,045,699	1,048,531
Value	$3,855,946	$3,513,666	$3,126,711	$3,447,149

[1] Includes production of 218,833 gross tons of crude ore and 147,787 gross tons of usable ore from Fillmore County, Minn., which is not strictly in the Lake Superior district.
[2] Revised figure.
[3] Corrected figure.

PRODUCTION AND SHIPMENTS

Domestic iron-ore mines produced crude ore totaling 113,972,214 gross tons and shipped 113,918,585 tons in 1947—increases of 35 and 36 percent, respectively, over 1946. Of the 1947 shipments, 37 percent was sent to beneficiating plants, and 63 percent went direct to consumers, as compared with 36 and 64 percent, respectively, in 1946. From the crude ore shipped to beneficiating plants, 17,058,162 tons of concentrates and 4,368,959 tons of sinter were produced. In addition, 542,723 tons of byproduct ore in the form of cinder and sinter were produced by the pyrites industry during the year. In all, 93,091,520 gross tons of usable ore were produced at mines and mills in 1947. Of this quantity, 71,121,676 tons were suitable for consumption as mined without requiring further concentrating. The output in 1947 came from 217 mines, of which 35 mined over 1,000,000 tons of crude ore each. In addition to the mines, one plant treating tailings produced in previous years contributed toward the total output of usable ore. Minnesota, with 62,492,916 tons, supplied 67 percent of the usable ore, compared with 49,290,807 tons or 70 percent in 1946; and Michigan, with 12,577,462 tons, or 13 percent, was the second largest producer. These two States and Wisconsin, with 1,461,391 tons or 2 percent, constitute the Lake Superior region, which supplied 82 percent of the domestic output. About three-fourths of the iron ore mined in both 1946 and 1947 came from open-pit mines.

Shipments of usable ore from mines totaled 93,314,635 gross tons in 1947; of this quantity, 71,233,371 tons (76 percent) were direct-shipping ore for use in iron and steel furnaces. Total shipments also include 35,512 tons of ore for cement manufacture, 10,122 tons for paint, and 12,260 tons for miscellaneous purposes. Shipments of byproduct ore for use in iron and steel included in the total shipments amounted to 644,447 tons in 1947, valued at $3,236,170.

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Crude iron ore mined in the United States, by States and varieties, 1946–47, in gross tons

[Exclusive of ore containing 5 percent or more managnese]

State	1946					1947				
	Number of mines	Hematite	Brown ore	Magnetite	Total	Number of mines	Hematite	Brown ore	Magnetite	Total
Alabama	[1] 20	5,782,894	2,183,829		7,966,723	[1] 24	6,973,550	2,604,922		9,578,472
California	2	325,491		15,000	340,491	3	530,434			530,434
Colorado	1	340			340					
Georgia	[1] 8		1,303,395		1,303,395	[1] 7		1,444,520		1,444,520
Michigan	40	8,756,802			8,756,802	37	12,657,407			12,657,407
Minnesota	94	57,195,005			57,195,005	116	74,082,509	218,833		74,301,342
Missouri	2	380,536	536		381,072	2	504,903	265		505,168
Nevada	1			3,299	3,299	1			5,452	5,452
New Jersey	4			831,522	831,522	4			938,404	938,404
New York	7	2,880		4,301,187	[2] 4,313,505	7	4,576		7,755,911	[3] 7,760,579
Pennsylvania	2		8,714			2				
Virginia	1					1		8,110		8,110
Texas	2	1,091	102,000		103,091	4	529	1,302,814		1,303,343
Utah	4			1,317,176	1,317,176	5			2,823,853	2,823,853
Washington						1	2,268			2,268
Wisconsin	2	1,062,743			1,062,743	2	1,461,391			1,461,391
Wyoming	1	619,317			619,317	1	651,471			651,471
Total	[1] 191	74,127,099	3,598,474	6,468,184	[2] 84,194,481	[1] 217	96,869,038	5,579,464	11,523,620	[3] 113,972,214

[1] Excludes an undetermined number of small pits. Output of these pits included in tonnage given.
[2] Includes 724 tons of carbonate ore.
[3] Includes 92 tons of carbonate ore.

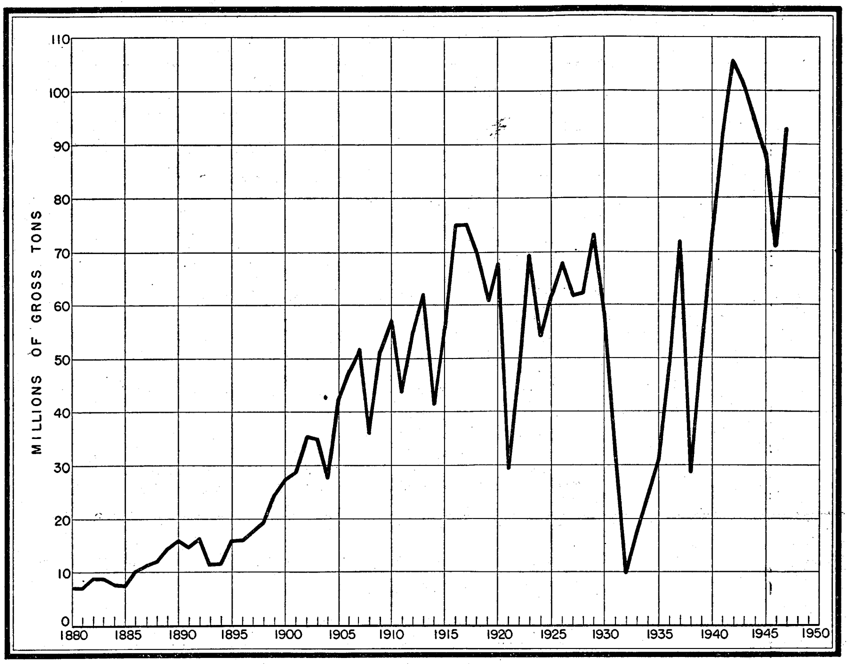

FIGURE 1.—Trends in production of iron ore in the United States, 1880–1947.

Crude iron ore mined in the United States, by States and mining methods, 1946–47, in gross tons

State	1946			1947		
	Open pit	Underground	Total	Open pit	Underground	Total
Alabama	2,258,405	5,708,318	7,966,723	2,820,800	6,757,672	9,578,472
California	340,491		340,491	530,434		530,434
Colorado	340		340			
Georgia	1,303,395		1,303,395	1,444,520		1,444,520
Michigan	811,628	7,945,174	8,756,802	1,191,118	11,466,289	12,657,407
Minnesota	54,907,909	2,287,096	57,195,005	71,110,817	3,190,525	74,301,342
Missouri	381,072		381,072	503,562	1,606	505,168
Nevada	3,299		3,299	5,452		5,452
New Jersey		831,522	831,522		938,404	938,404
New York				3,880,381	3,880,198	7,760,579
Pennsylvania	2,432,276	1,881,229	4,313,505			
Virginia				8,110		8,110
Texas	103,091		103,091	1,303,343		1,303,343
Utah	1,317,176		1,317,176	2,823,853		2,823,853
Washington				2,268		2,268
Wisconsin		1,062,743	1,062,743		1,461,391	1,461,391
Wyoming		619,317	619,317		651,471	651,471
	63,859,082	20,335,399	84,194,481	85,624,658	28,347,556	113,972,214

Crude iron ore shipped from mines in the United States, by States and disposition, 1946–47, in gross tons

State	1946			1947		
	Direct to consumers	To benefici-ation plants	Total	Direct to consumers	To benefici-ation plants	Total
Alabama	4,461,553	3,514,475	7,976,028	5,443,097	4,127,889	9,570,986
California	219,141	15,000	234,141	373,574		373,574
Colorado	340		340			
Georgia		1,303,395	1,303,395		1,444,520	1,444,520
Michigan	8,449,102	99,552	8,548,654	12,921,707	123,720	13,045,427
Minnesota	37,537,956	19,808,661	57,346,617	47,168,713	26,841,902	74,010,615
Missouri	536	380,536	381,072	265	504,903	505,168
Nevada	3,299		3,299	5,452		5,452
New Jersey	134,394	656,843	791,237	138,446	788,243	926,689
New York	62,936	} 4,196,904	4,259,840	} 192,380		
Pennsylvania					7,516,194	7,708,574
Virginia					9,651	9,651
Texas	941	102,000	102,941	663	1,299,135	1,299,798
Utah	1,321,334		1,321,334	2,821,293		2,821,293
Washington				2,268		2,268
Wisconsin	1,097,471		1,097,471	1,543,099		1,543,099
Wyoming	619,317		619,317	651,471		651,471
	53,908,320	30,077,366	83,985,686	71,262,428	42,656,157	113,918,585

Iron ore mined in the United States, by mining districts and varieties, 1946–47, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

Variety of ore	Lake Superior district	Birming-ham	Chatta-nooga	Adiron-dack and Cornwall	New Jersey and Southeast New York	Other	Total
1946							
Crude ore:							
Hematite	67,014,550	5,782,894				1,329,655	74,127,099
Brown ore		263,000	1,247,900			2,087,574	3,598,474
Magnetite				4,301,187	831,522	1,335,475	6,468,184
Carbonate						724	724
	67,014,550	6,045,894	1,247,900	4,301,187	831,522	4,753,428	84,194,481
Iron ore:							
Hematite	59,042,154	5,581,747				1,104,271	65,728,172
Brown ore		52,991	267,880			365,531	686,402
Magnetite				2,175,290	417,529	1,328,167	3,920,986
Carbonate						650	650
	59,042,154	5,634,738	267,880	2,175,290	417,529	2,798,619	70,336,210
1947							
Crude ore:							
Hematite	88,201,307	6,971,251	2,299			1,694,181	96,869,038
Brown ore		464,000	1,527,620			3,587,844	5,579,464
Magnetite				7,755,911	938,404	2,829,305	11,523,620
Carbonate						92	92
	88,201,307	7,435,251	1,529,919	7,755,911	938,404	8,111,422	113,972,214
Iron ore:							
Hematite	76,383,982	6,788,815	2,299			1,360,369	84,535,465
Brown ore		92,877	312,749			795,782	1,201,408
Magnetite				3,514,588	467,983	2,829,305	6,811,876
Carbonate						48	48
	76,383,982	6,881,692	315,048	3,514,588	467,983	4,985,504	92,548,797

Iron ore produced in the United States, by States and types of product, 1946–47, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1946					1947				
	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	4,452,860	1,102,243	400,095	5,955,198	35.79	5,449,758	1,330,010	445,127	7,224,895	35.97
California	325,491		7,692	333,183	50.78	530,434			530,434	54.10
Colorado	340			340	56.18					
Georgia			284,614	284,614	45.00			295,992	295,992	43.88
Michigan	8,657,250		31,354	8,688,604	51.82	12,533,687		43,775	12,577,462	51.21
Minnesota	37,386,434	96,350	11,808,023	49,290,807	51.48	47,336,142	295,045	14,861,729	62,492,916	50.99
Missouri	536		155,152	155,688	54.13	265		171,091	171,356	53.55
Nevada	3,299			3,299	65.17	5,452			5,452	65.00
New Jersey	134,111		283,418	417,529	63.67	138,154		329,829	467,983	63.36
New York	53,818				62.19	188,272				62.65
Pennsylvania		1,324,105	808,181	2,186,104	56.15		2,743,904	587,036	3,519,212	58.68
Virginia					31.49			6,434	6,434	35.00
Texas	1,091		20,517	21,608	50.73	529		317,149	317,678	40.87
Utah	1,317,176			1,317,176	53.73	2,823,853			2,823,853	53.34
Washington						2,268			2,268	56.48
Wisconsin	1,062,743			1,062,743	54.09	1,461,391			1,461,391	52.74
Wyoming	619,317			619,317	52.40	651,471			651,471	49.20
	54,014,466	2,522,698	13,799,046	70,336,210	50.59	71,121,676	4,368,959	17,058,162	92,548,797	50.36
Byproduct ore: [2]										
Delaware					63.06					63.04
Tennessee		506,903		506,903	68.40		542,723		542,723	68.80
Virginia					57.00					57.00
		506,903		506,903	65.80		542,723		542,723	65.91
Total	54,014,466	3,029,601	13,799,046	70,843,113	50.70	71,121,676	4,911,682	17,058,162	93,091,520	50.44

[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, by States and varieties, 1946–47, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1946				1947			
	Hematite	Brown ore	Magnetite	Total	Hematite	Brown ore	Magnetite	Total
Alabama	5,581,747	373,451		5,955,198	6,791,114	433,781		7,224,895
California	325,491		7,692	333,183	530,434			530,434
Colorado	340			340				
Georgia		284,614		284,614		295,992		295,992
Michigan	8,688,604			8,688,604	12,577,462			12,577,462
Minnesota	49,290,807			49,290,807	62,345,129	147,787		62,492,916
Missouri	155,152	536		155,688	171,091	265		171,356
Nevada			3,299	3,299			5,452	5,452
New Jersey			417,529	417,529			467,983	467,983
New York	2,880						3,514,588	[2] 3,519,212
Pennsylvania, Virginia		7,284	2,175,290	[1] 2,186,104	4,576			
Virginia						6,434		6,434
Texas	1,091	20,517		21,608	529	317,149		317,678
Utah			1,317,176	1,317,176			2,823,853	2,823,853
Washington					2,268			2,268
Wisconsin	1,062,743			1,062,743	1,461,391			1,461,391
Wyoming	619,317			619,317	651,471			651,471
	65,728,172	686,402	3,920,986	[1] 70,336,210	84,535,465	1,201,408	6,811,876	[2] 92,548,79
Byproduct ore:[3] Delaware, Tennessee, Virginia				506,903				542,723
Grand total	65,728,172	686,402	3,920,986	70,843,113	84,535,465	1,201,408	6,811,876	93,091,520

[1] Includes 650 tons of carbonate ore. [2] Includes 48 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, by States and uses, in 1947, 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	5,443,097	1,330,496	433,963				7,207,556	$23,436,620
California	353,839			19,735			373,574	(2)
Georgia			295,992				295,992	693,485
Michigan	12,921,707		43,775				12,965,482	46,782,975
Minnesota	47,168,713	295,045	14,972,344				62,436,102	203,614,336
Missouri	212		171,091			53	171,356	(2)
Nevada	5,452						5,452	(2)
New Jersey	138,446		314,227	9,535		6,687	468,895	3,689,832
New York, Pennsylvania	187,804	2,746,448	487,041	1,549	4,710	4,041	3,431,593	26,208,379
Texas	663		288,501			109	289,273	(2)
Utah	2,818,868			2,425			2,821,293	2,860,739
Virginia					5,412	1,370	6,782	(2)
Washington				2,268			2,268	(2)
Wisconsin	1,543,099						1,543,099	(2)
Wyoming	651,471						651,471	(2)
Undistributed								[2] 10,342,445
	71,233,371	4,371,989	17,006,934	35,512	10,122	12,260	92,670,188	317,628,811
Byproduct ore:[3] Delaware, Tennessee, Virginia		644,447					644,447	3,236,170
Grand total	71,233,371	5,016,436	17,006,934	35,512	10,122	12,260	93,314,635	320,864,981

[1] Exclusive of sinter produced at consuming plants.
[2] Values that may not be shown separately are combined as "Undistributed."
[3] 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 that require concentration will be comparable in size to those producing similar quantities of direct-shipping ore. Thirty-five mines, each yielding more than 1,000,000 gross tons of crude ore, produced 59 percent of the United States output in 1947. Of these producers, 24 were in Minnesota, 4 in Alabama, 4 in New York, 1 in Pennsylvania, 1 in Utah, and 1 in Wisconsin; 24 were open-pit operations, 7 underground, and 4 combination mines. Except for 6 mines that produced magnetite, all the million-ton mines produced hematite in 1947. In 1946, 19 mines, producing more than 1,000,000 tons of ore each, furnished 48 percent of the United States output.

There were 37 mines in 1947 that produced 500,000 to 1,000,000 tons of crude ore each. These mines produced about one-fifth of the United States total of crude ore, and four-fifths was obtained from mines with production of over half a million tons of crude ore. These mines are listed in detail in the following table.

Iron-ore mines in the United States in 1947, 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-Burton-Sellers	Minnesota	Hibbing	Mesabi	Open pit	9,480,279	9,298,330
Rouchleau	do	Virginia	do	do	4,957,550	4,957,550
Mountain Iron	do	do	do	do	2,829,120	2,749,354
Shaw (Stockpile)	do	Franklin	do	do	2,749,445	2,749,445
Hill Annex	do	Calumet	do	do	2,707,273	1,645,851
Mahoning	do	Hibbing	do	do	2,392,138	2,392,138
Monroe-Tener	do	Chisholm	do	do	2,363,938	2,363,938
Fraser	do	Fraser City	do	do	2,053,520	2,053,520
Benson	New York	Star Lake	Adirondack	do	1,879,682	652,977
Iron Mountain	Utah	Cedar City	Iron Mountain	do	1,860,123	1,860,123
Spruce	Minnesota	Eveleth	Mesabi	Combined	1,819,273	1,819,273
Gross Marble	do	Marble	do	Open pit	1,803,777	1,082,368
Hill-Trumbull	do	do	do	do	1,757,169	700,840
Muscoda	Alabama	Bessemer	Birmingham	Underground	1,629,654	[1] 4,598,071
Wenonah	do	do	do	do	1,610,096	(2)
Morrison	Minnesota	Coleraine	Mesabi	Open pit	1,605,969	1,037,635
Canisteo	do	do	do	do	1,586,228	854,638
Olson	do	Cooley	do	do	1,551,040	517,357
Cornwall	Pennsylvania	Lebanon	Cornwall	Combined	2,773,642	1,724,604
New Bed-Harmony and Old Bed	New York	Mineville	Adirondack	Underground		
Ishkooda	Alabama	Bessemer	Birmingham	do	1,419,999	(2)
Susquehanna	Minnesota	Hibbing	Mesabi	Open pit	1,273,366	1,108,520
Embarrass	do	Biwabik	do	do	1,253,148	1,253,148
Chateaugay	New York	Lyon Mountain	Adirondack	Underground	1,244,485	375,046
MacIntyre	do	Tahawus	do	Open pit	1,236,380	475,163
Pyne	Alabama	Bessemer	Birmingham	Underground	1,208,175	1,208,175
Holman-Brown	Minnesota	Taconite	Mesabi	Open pit	1,205,565	768,192
Montreal	Wisconsin	Montreal	Gogebic	Underground	1,153,196	1,153,196
Portsmouth Group	Minnesota	Crosby	Cuyuna	Open pit	1,113,786	823,311
Galbraith	do	Nashwauk	Mesabi	do	1,085,184	505,542
Fayal	do	Eveleth	do	Combined	1,059,903	1,059,903
Hawkins	do	Nashwauk	do	Open pit	1,049,024	615,306
Mississippi	do	Keewatin	do	do	1,026,503	779,684
Pillsbury	do	Balkan	do	Combined	1,017,987	1,017,987

See footnotes at end of table.

Iron-ore mines in the United States in 1947, by size of crude output—Continued

Name of mine	State	Nearest town	Range or district	Mining method	Production (gross tons)	
					Crude ore	Usable ore
Scranton	Minnesota	Hibbing	Mesabi	Open pit	1,011,904	1,011,904
Buckeye	do	Grand Rapids	do	do	991,854	676,445
Argonne	do	Nashwauk	do	do	948,506	496,972
Hodge Mining Co.	Georgia	Taylorsville	Chattanooga	do	939,000	187,771
South Rust	Minnesota	Hibbing	Mesabi	do	934,583	934,583
Danube	do	Bovey	do	do	911,265	605,867
Hartley	do	Fraser City	do	do	860,864	860,864
Webb	do	Hibbing	do	Combined	794,090	766,963
Missabe Mountain	do	Virginia	do	Open pit	734,004	734,004
Mather	Michigan	Ishpeming	Marquette	Underground.	729,669	729,669
Maas	do	Negaunee	do	Open pit	724,539	724,539
North Harrison	Minnesota	Cooley	Mesabi	do	721,694	228,369
Columbia	do	Virginia	do	do	712,835	682,211
Bennett	do	Keewatin	do	do	690,842	629,691
Kevin	do	Cooley	do	do	659,726	247,892
Sunrise	Wyoming	Sunrise	Hartville	Underground.	651,471	651,471
Longyear	Minnesota	Hibbing	Mesabi	Open pit	631,677	628,935
Buck-Zimmerman	Michigan	Iron River	Menominee	Underground.	630,619	630,619
Wabigon	Minnesota	Buhl	Mesabi	Open pit	622,318	598,594
Godfrey	do	Chisholm	do	Underground.	612,430	612,430
Plymouth	Michigan	Wakefield	Gogebic	Open pit	605,801	605,801
Pioneer	Minnesota	Ely	Vermilion	Underground.	600,731	600,731
Davis-Geneva and West Davis.	Michigan	Ironwood	Gogebic	do	587,352	587,352
Hiawatha Nos. 1 and 2.	do	Iron River	Menominee	do	564,625	564,625
Cambria-Jackson	do	Negaunee	Marquette	do	556,666	556,666
Penokee	do	Ironwood	Gogebic	do	548,954	548,954
Cliffs Shaft	do	Ishpeming	Marquette	do	546,796	546,796
Newport	do	Ironwood	Gogebic	do	546,229	546,229
Sunday Lake	do	Wakefield	do	do	530,378	530,378
Negaunee	do	Negaunee	Marquette	do	518,387	518,387
Sloss	Alabama	Bessemer	Birmingham	do	514,763	514,763
Eureka	Michigan	Ramsay	Gogebic	do	508,973	508,973
Russellville No. 14	Alabama	Russellville	Russellville	Open pit	508,448	82,142
Athens	Michigan	Negaunee	Marquette	Underground.	508,100	508,100
Douglas	Minnesota	Chisholm	Mesabi	Open pit	507,699	405,345
Iron Mountain	Missouri	Iron Mountain.	Iron Mountain.	Combined	504,903	171,091
Mount Haven	Texas	Jacksonville	Eastern Texas	Open pit	1,100,283	313,084
Scrub Oaks	New Jersey	Dover	Northern N. J.	Underground.		
Output of 72 mines producing more than 500,000 tons crude ore each					91,029,595	74,950,395
Output of 12 mines producing 400,000 to 500,000 tons crude ore each					5,320,621	3,928,778
Output of 18 mines producing 300,000 to 400,000 tons crude ore each					6,400,367	4,613,142
Output of 24 mines producing 200,000 to 300,000 tons crude ore each					5,816,726	4,412,814
Output of 23 mines producing 100,000 to 200,000 tons crude ore each					3,486,874	2,896,387
Output of 14 mines producing 50,000 to 100,000 tons crude ore each					1,023,197	990,353
Output of 54 mines producing under 50,000 tons crude ore each					[3] 894,834	[3] 756,928
Grand total United States (217 mines)					113,972,214	92,548,797

[1] Includes Ishkooda and Wenonah.
[2] Included with Muscoda.
[3] Includes output from 1 plant treating tailings.

SINTER

Domestic sintering plants in 1947 used 12,529,497 gross tons of iron ore, 4,693,840 tons of flue dust, 625,463 tons of pyrites cinder, 17,262 tons of manganiferous ore, and 237,974 tons of mill cinder and roll scale to produce 16,188,522 tons of sinter—a conversion yield of 89 percent.

Sinter production in 1947 came from plants at mines, blast-furnace plants, and custom mills. Of the sinter produced in the United States in 1947, 27 percent was made at mine plants in 4 States, and 73 percent was produced at blast-furnace plants and custom mills in 13 States.

Production and consumption of sinter in the United States, by States, in 1947, in gross tons

State	Sinter produced	Sinter consumed	
		In blast furnaces	In steel furnaces
Alabama	1,698,152	1,833,937	89,341
California, Colorado, Utah	979,899	977,114	----------
Delaware	113,438	----------	----------
Illinois	678,136	682,667	13
Indiana	952,959	892,555	56,956
Maryland	----------		
Kentucky, Tennessee, West Virginia	428,291		
Maryland, Kentucky, Tennessee, West Virginia		365,406	64,069
Michigan	347,504	275,461	63,808
Minnesota	295,045	----------	----------
New York	3,153,876	1,114,481	115,361
Ohio	3,641,645	3,978,265	363,219
Pennsylvania	3,899,577	3,839,900	260,217
	16,188,522	13,959,786	1,012,984

REVIEW OF LAKE SUPERIOR DISTRICT

Production and Shipments.—Although supplying proportionately slightly less iron ore in 1947 than in former years, the Lake Superior district was by far the major source of domestic ore, and output from the region increased 29 percent over 1946. The Mesabi, largest of the six producing ranges, supplied 77 percent of the district total and 63 percent of the United States total compared with 79 and 66 percent, respectively, in 1946. A total of 76,383,982 tons of iron ore was reported shipped from the six ranges in the Lake Superior district during 1947. In addition to this, 147,787 gross tons were produced and shipped from Fillmore County in southern Minnesota, which is not considered part of the true Lake Superior region, and 926,405 tons of ore containing (natural) over 5 percent manganese (all from Minnesota) were produced, making a total output of 77,458,174 tons of all grades. Shipments from the district consisted of 933,001 tons of manganiferous ore, 147,787 tons of iron ore from Fillmore County, and 76,924,212 tons from the six ranges, or a total shipment from mines of 78,005,000 tons.

Production and shipments from Canadian mines in the Lake Superior district are not included in these statistics. Shipments from those mines in 1947 totaled 1,805,927 gross tons. Of this quantity, 599,679 tons came from the Helen mine in the Michipicoten district, and 1,206,248 tons were shipped from the Steep Rock mine in the Steep Rock district.

The Lake Superior Iron Ore Association reported 76,258,079 tons of iron and manganiferous ores shipped to upper lake ports from

United States mines in 1947, an increase of 28 percent over 1946. All-rail shipments totaled 1,722,739 tons in 1947 compared with 1,491,856 tons in 1946. The 1947 shipping season was of about average duration, opening on April 13 and closing December 6.

Iron mining in the Spring Valley area in Fillmore County, southeastern Minnesota, was resumed in 1947 after being inactive since 1943. This ore differs from the Lake Superior iron ore in that it is limonite or brown ore and is of different origin, being of the bog type. The ore is washed before using and moves all-rail to Granite City, Ill.

Iron ore produced in the Lake Superior district, by ranges, 1854–1947, in gross tons

[Exclusive after 1905 of ore containing 5 percent or more manganese]

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Total
1854–1942	219, 372, 935	196, 081, 245	231, 601, 023	72, 455, 525	1, 248, 701, 856	29, 642, 750	1, 997, 855, 334
1943	5, 680, 727	5, 366, 595	5, 877, 215	1, 782, 237	65, 334, 939	1, 747, 304	85, 789, 017
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
1946	3, 455, 961	2, 662, 308	3, 633, 078	1, 232, 008	46, 678, 679	1, 380, 120	59, 042, 154
1947	5, 070, 631	3, 741, 217	5, 227, 005	1, 471, 879	58, 772, 404	2, 100, 846	76, 383, 982
Total	242, 965, 323	216, 280, 434	255, 958, 116	79, 889, 472	1, 539, 837, 221	38, 072, 286	2, 373, 002, 852

Analyses.—The following table shows the average analyses of all ore shipped from the Lake Superior district for the past 5 years. The remarkable consistency in the analysis from year to year is noteworthy, although an increasing percentage of concentrating-grade ores is produced in the district.

Average analyses of total tonnages (bill-of-lading weights) of all grades of iron ore from all ranges of Lake Superior district, 1943–47

[Lake Superior Iron Ore Association]

Year	Gross tons	Iron (natural, percent)	Phosphorus (percent)	Silica (percent)	Manganese (percent)	Moisture (percent)
1943	85, 116, 347	51. 58	0. 091	8. 32	0. 82	11. 06
1944	81, 039, 404	51. 72	. 088	8. 42	. 74	11. 02
1945	75, 206, 781	51. 69	. 089	8. 52	. 72	10. 96
1946	58, 975, 188	51. 32	. 087	8. 83	. 74	11. 22
1947	77, 210, 278	50. 91	. 093	9. 09	. 75	11. 28

Reserves.—The accompanying tables show reserves of iron ore in Michigan and Minnesota. It should be borne in mind that these data represent only taxable and State-owned reserves and do not represent the total that may be expected to become available. Additional tonnages are added to the reserve figures each year, and undoubtedly ultimate production in the Lake Superior district will greatly exceed that indicated by present reserve tonnages.

The Wisconsin Department of Taxation estimated reserves of iron ore in Wisconsin to be 6,000,000 tons on January 1, 1948.

Technologic Developments.—Improvements in mining efficiency in the Lake Superior district in recent years have been effected largely through advances in equipment and methods, as well as the addition of new equipment for more efficient handling of ore and overburden from mines to cars. Truck haulage has become more important in

Iron-ore reserves in Michigan, January 1, 1944–48, in gross tons

[Michigan Department of Conservation]

Range	1944	1945	1946	1947	1948
Gogebic	32, 791, 848	32, 686, 550	31, 828, 392	31, 331, 775	31, 937, 142
Marquette	49, 652, 024	51, 357, 761	51, 648, 430	62, 228, 925	66, 636, 928
Menominee	53, 902, 631	50, 376, 403	48, 260, 784	49, 298, 678	51, 462, 819
Total Michigan	136, 346, 503	134, 420, 714	131, 737, 606	142, 859, 378	150, 036, 889

Unmined iron-ore reserves in Minnesota, May 1, 1943–47, in gross tons

[Minnesota Department of Taxation]

	1943	1944	1945	1946	1947
Mesabi	1, 043, 804, 391	1, 020, 138, 504	962, 290, 748	924, 903, 098	922, 401, 348
Vermilion	13, 449, 980	12, 636, 820	12, 349, 903	11, 523, 341	10, 699, 576
Cuyuna	63, 559, 455	62, 059, 815	59, 659, 027	59, 061, 587	55, 756, 200
Total Lake Superior district (taxable)	1, 120, 813, 826	1, 094, 835, 139	1, 034, 299, 678	995, 488, 026	988, 857, 124
Fillmore County	259, 859	231, 393			186, 700
State ore (not taxable)	16, 672, 818	13, 000, 996	19, 865, 715	19, 950, 255	11, 600, 524
Total Minnesota	1, 137, 746, 503	1, 108, 067, 528	1, 054, 165, 393	1, 015, 438, 281	1, 000, 644, 348

the pits, and Diesel locomotives have been replacing steam for large pits using rail haulage. Trucks as large as 35 gross tons capacity are in service at some of the mines. Larger units are being used for stripping, and drag-line excavators have become important. The latest means of transporting ore from the pits to railroad cars is through the use of long conveyors. At the end of 1947, 13 operations employed belt conveyors for this purpose. One beneficiating plant under construction will use pumps to transport the ore in suspension pipes to the concentrating plants.

It is evident that underground mining will become relatively more important in the Lake Superior district, and companies are giving more emphasis to the importance of reducing mining costs in underground mines to meet other competition. This is true also in concentrating plants, as the concentrating-grade ores will be used in greater tonnages in the future. The possibility of using flotation as a concentrating medium is not being overlooked, but this appears to depend upon developing cheaper reagents and improved processes for sintering the fine concentrates. Research on these problems was centered largely at laboratories of the Battelle Memorial Institute in Columbus, Ohio; ore-dressing laboratories at the M. A. Hanna Co. at Hibbing, Minn.; and the Jones & Laughlin laboratory at Negaunee, Mich. The inevitable trend toward using taconite concentrates utilizing the low-grade magnetic ores in the eastern Mesabi range resulted in the decision to construct a small commercial concentrating plant at Aurora, Minn., to yield 200,000 tons of product annually. This plant was scheduled to go into production in 1948. Plans were also being made for constructing large commercial plants to utilize these materials.

Average costs, per gross ton, of mining iron ore at underground mines and at siliceous open pits in Michigan in 1947 [1]

Item	Underground				Siliceous open pits
	Gogebic	Marquette	Menominee	Average	
Cost of mining:					
Labor	$1.7502	$1.9747	$1.3634	$1.7181	$0.3435
Supplies	.7283	.7377	.6380	.7034	.2814
Deferred costs	.1846	.0585	.2092	.1416	.0388
Taxes	.2566	.2120	.1380	.2012	.0615
General overhead	.2174	.1595	.1929	.1862	.1138
Transportation	2.1174	1.7670	1.8588	1.9091	1.7626
Marketing	.0645	.0185	.0863	.0516	.0468
Total ore cost	5.3190	4.9279	4.4866	4.9112	2.6484
Lake Erie value per ton	5.9579	5.8607	5.4364	5.7559	3.2777
Gross ore profit [2]	.6389	.9328	.9498	.8447	.6293
Other costs:					
Royalty	.3946	.2210	.2459	.2754	.0988
Interest on borrowed money	------	.0142	.0066	.0078	.0020
Federal income and excess profits	.2178	.1866	.3174	.2345	.1119

[1] Pardee, F. G., Kennedy, Bruce E., General Statistics Covering Costs and Production of Michigan Iron Mines: Michigan Dept. of Conservation, Geol. Survey Div., 1947, 9 pp.
[2] This figure does not represent true profit, as much ore is sold below the Lake Erie price.

MINING BY STATES

Alabama.—Production of crude iron ore in Alabama, the third largest producing State, increased 20 percent over 1946, considerably less than the 35-percent gain in the United States as a whole. The rise in Alabama output was the result of increases of 21 percent and 19 percent in red ore and brown ore, respectively. The Tennessee Coal, Iron & Railroad Co. was again by far the largest shipper of red hematite from Alabama during 1947. It shipped ore from its Red Mountain mines, comprising the Muscoda, Ishkooda, and Wenonah groups. Most of this ore is shipped direct after crushing and blending, but approximately one-fourth of the ore, consisting of fines, was sintered before use. The Republic Steel Corp. shipped mostly sinter from its Spaulding operation and direct-shipping hematite from the Edwards mine in Jefferson County. The Sloss-Sheffield Steel & Iron Co., Woodward Iron Co., and Hooper Construction Co. all shipped red ore from mines in Jefferson County. The hematite shipped from Alabama during 1947 averaged (natural) 35.96 percent Fe, 0.15 percent Mn, 0.28 percent P, 16.14 percent SiO_2, 14.84 percent CaO, and 2.44 percent H_2O.

Brown ore was shipped from one mine in Tuscaloosa County in the Birmingham district, five mines in Franklin County, and one mine in Colbert County—both in the Russellville district—and one mine in Calhoun County, three in Cherokee County, and two in Cleburne County, all in the Chattanooga district in northeastern Alabama. The brown ore shipped in 1947 from Alabama averaged (natural) 46.0 percent Fe, 0.60 percent Mn, 0.50 percent P, 11.4 percent SiO_2, and 8.0 percent moisture.

In 1947 the iron-ore supplies of Alabama were supplemented by shipments of hematite from Missouri and pyrites cinder from Tennessee and Virginia. The material from Virginia is sintered with Alabama ores before being used, but this tonnage is not included with iron-ore production of Alabama.

Iron ore mined in the United States in 1947, 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:			
Calhoun	1	1,000	246
Cherokee	3	73,800	14,822
Colbert	2	8,300	1,689
Franklin [1]	1	414,729	48,972
Jefferson	1	2,299	2,299
St. Clair	7	1,643,093	275,175
Shelby	8	6,971,251	6,788,815
Tuscaloosa	1	464,000	92,877
	24	9,578,472	7,224,895
California:			
Riverside	1	27,029	27,029
San Bernardino	2	503,405	503,405
	3	530,434	530,434
Georgia:			
Bartow [1]	3	956,350	191,260
Polk	3	488,000	104,698
Walker	1	170	34
	7	1,444,520	295,992
Michigan:			
Dickinson	2	77,576	77,576
Gogebic	7	3,765,614	3,765,614
Iron	13	3,743,586	3,663,641
Marquette	15	5,070,631	5,070,631
	37	12,657,407	12,577,462
Minnesota:			
Crow Wing	9	2,559,285	2,100,846
Fillmore	1	218,833	147,787
Itasca	30	21,602,923	12,024,306
St. Louis	76	49,920,301	48,219,977
	116	74,301,342	62,492,916
Missouri:			
Howell	1	265	265
St. Francois	1	504,903	171,091
	2	505,168	171,356
Nevada: Pershing	1	5,452	5,452
New Jersey:			
Morris	3	891,470	444,279
Passaic	1	46,934	23,704
	4	938,404	467,983
New York:			
Clinton	1		
Essex	3		
Oneida	1	7,760,487	3,519,164
St. Lawrence	2		
Pennsylvania:			
Lebanon	1		
Carbon	1	92	48
	9	7,760,579	3,519,212
Texas:			
Cass	1	289,833	70,691
Cherokee	1	593,598	144,780
Llano	1	529	529
Morris	1	419,383	101,678
	4	1,303,343	317,678
Utah: Iron	5	2,823,853	2,823,853
Virginia: Pulaski	1	8,110	6,434
Washington: Stevens	1	2,268	2,268
Wisconsin: Iron	2	1,461,391	1,461,391
Wyoming: Platte	1	651,471	651,471
	217	113,972,214	92,548,797

[1] Includes output of 1 plant reprocessing tailings.

California.—Most of the California iron-ore production in 1947 came from the Vulcan mine in San Bernardino County, which was shipped to Fontana, Calif., for consumption. The Kaiser Co., Inc., operator of the Fontana plant, was busy developing the Eagle Mountain deposits in Riverside County for its future supplies of iron ore. A trial run was made in 1947 of this ore averaging (natural) 56.9 percent iron, 0.05 percent Mn, 0.027 percent phosphorus, 7.03 percent silicon, 1.16 percent CaO, and 1.00 percent moisture. Hematite for the manufacture of cement was produced and shipped from the Cave Canyon mine in San Bernardino County during the year.

Georgia.—All of the ore shipped from Georgia in 1947 was brown ore and came from Bartow and Polk Counties, except for a small tonnage from Walker County. All of this ore is washed before shipping and is used in blast furnaces in the Birmingham area.

Michigan and Minnesota.—See Review of Lake Superior District.

Missouri.—Most of the iron ore produced in Missouri in 1947 was hematite from the Iron Mountain mine in St. Francois County. This ore was crushed and concentrated by jigging and averaged (natural) 53.6 percent Fe. A relatively small quantity of brown ore was shipped from the Kingsbury mine in Howell County by Doane & Ives.

Nevada.—Segerstrom & Heizer shipped magnetite from Pershing County, Nev., for use in steel furnaces during 1947. The ore averaged about 65 percent Fe.

New Jersey.—Magnetite was produced from the Mount Hope, Richard, and Scrub Oaks mines in Morris County and the Peters mine in Passaic County during 1947. The latter mine was purchased from the War Assets Administration by the Ringwood Mines, Inc., and went into operation on June 23, 1947; it had not operated since 1931 but was reconditioned and placed in standby condition during World War II by the Defense Plant Corporation.

New York.—Sinter, magnetite, and a little concentrate were shipped from the Fisher Hill mine in Essex County, N. Y., by the Republic Steel Corp. in 1947. Concentrate, sinter, and Old-Bed lump ore were shipped from the New Bed—Harmony and Old-Bed mines in the same district during the year. Republic also shipped high-grade sinter from the Chateaugay mine to its blast furnace at Troy, N. Y. The latter ore is among the highest-grade in the country, averaging 65.9 percent iron in 1947. The National Lead Co. shipped magnetite concentrates and sinter from its MacIntyre development near Tahawus, Essex County; this ore is produced as a byproduct of the company titanium operations. The Jones & Laughlin Ore Co. shipped both concentrates and sinter from the Benson mine near Star Lake in St. Lawrence County. The Hanna Coal & Ore Corp. shipped sintered concentrates from the Clifton mine near Degrasse, St. Lawrence County.

A small quantity of Clinton hematite was shipped from Oneida County by the Clinton Metallic Paint Co. to be used in the manufacture of paint.

Pennsylvania.—All metallurgical iron ore shipped from Pennsylvania during 1947 came from the combination underground open-pit mines at Cornwall in Lebanon County. This ore was shipped to the Lebanon, Pa., concentrator, where it was concentrated magnetically; most of the product was sintered before shipping to consuming plants. The Cornwall mines are operated by the Bethlehem Steel Co.

The Prince Manufacturing Co., Bowmanstown, Pa., is the only producer of carbonate ore in the United States. This ore is mined at the Hazard and Little Gap mines near Palmerton, Carbon County, and is used as a pigment in the manufacture of paint.

Texas.—Iron-ore production increased greatly in 1947 over the previous year owing to resumption of blast-furnace operations at Houston and Daingerfield. The mine supplying the Daingerfield furnace is in Morris County and resumed production on July 1, 1947. It was operated by the Lone Star Steel Co. Two mines operating in Texas supply ore to the Houston blast furnace—the North Basin mine near Linden in Cass County and the Mount Haven mine near Jacksonville in Cherokee County. All the above three mines produced brown ore, and washing was required before the ore was suitable for use. Approximately 4 tons of crude ore are required to produce 1 ton of concentrate. The Sheffield Steel Co., operating the North Basin and Mount Haven mines, acquired these properties from the Reconstruction Finance Corporation May 1, 1947.

Tillie B. Moss continued to ship high-grade hematite from the Iron Mountain mine in Llano County, Tex., for use in steel furnaces.

Utah.—The Columbia Iron Mining Co. continued to be the largest producer and shipper of iron ore in Utah in 1947. This ore came from the Iron Mountain mine in Iron County and was used in the Columbia Steel Co. furnaces at Ironton and Geneva, Utah. The Utah Construction Co. shipped from the Excelsior mine, also in Iron County. Most of this ore went to Fontana, Calif., for consumption, but a relatively small part was shipped for use in cement manufacture. The Colorado Fuel & Iron Corp. shipped ore from the Blowout and Duncan mines, Iron County, to its blast furnaces at Pueblo, Colo. Helene E. Beatty shipped lump ore from the Great Western mine to steel furnaces on the west coast. All of the ore shipped from Utah in 1947 was semialtered magnetite.

Virginia.—The American Pigment Corp. shipped brown ore from its mine in Pulaski County for use in the manufacture of paint and linoleum.

Washington.—Hematite for use in the manufacture of cement was shipped by the Spokane Portland Cement Co. from the Napoleon mine in Stevens County.

Wisconsin.—See Review of Lake Superior District.

Wyoming.—The Sunrise mine in Platte County, operated by the Colorado Fuel & Iron Corp., produced hematite for shipment to blast furnaces at Pueblo, Colo., during 1947.

CONSUMPTION

A total of 96,115,549 gross tons of iron ore was reported consumed during 1947. Of this, 82 percent was consumed directly in iron blast furnaces, and 13 percent was used in sintering plants, 4 percent in steel furnaces, and 1 percent in ferro-alloy furnaces and miscellaneous uses. In addition to this iron ore used direct, blast furnaces consumed 13,959,786 tons of sintered ore and steel furnaces used 1,012,984 gross tons of sinter.

Consumption of iron ore in the United States, by States and uses, in 1947, 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	All other [1]	
Alabama	5,385,039	12,279	1,336,602	---	53,897	---	---	6,787,817
California					35,112	(2)	---	
Colorado	2,516,417	245,076	1,067,580	---	2,613	---	---	3,871,097
Utah					1,181	---	---	
Illinois	8,691,390	256,897	352,133	---	(2)	(2)	---	9,323,221
Indiana	9,900,548	540,985	501,455	9,725	4,450	---	---	10,957,163
Kentucky					---	---	---	
Maryland	4,448,673	373,352	---	---	(2)	(2)	---	4,823,255
Massachusetts					---	---	---	
Michigan	2,074,246	81,208	146,408	---	---	(2)	---	2,308,555
Tennessee		---	---	---	6,501	---	---	
Minnesota	944,527	67,754	390,876	---	---	---	---	1,403,157
Missouri	---	---	---	---	2,583	---	53	2,636
New Jersey	---	---	---	---	---	(2)	(2)	17,018
New York	4,793,988	301,313	3,077,577	162,126	4,737	(2)	(2)	8,345,614
Ohio	15,002,401	713,431	2,865,808	151,791	(2)	(2)	---	18,742,491
Pennsylvania	22,933,758	1,506,417	2,791,058	4,936	16,232	46,444	---	27,298,845
Texas	235,498	---	---	---	16,268	---	109	251,875
Virginia	---	---	---	---	2,581	(2)	(2)	12,553
Washington	---	---	---	---	1,587	---	---	1,587
West Virginia	1,937,468	12,964	---	---	714	---	---	1,951,146
Other States	---	---	---	---	[3] 12,463	[4] 5,056	---	17,519
Total	78,863,953	4,111,676	12,529,497	328,578	166,579	103,006	12,260	96,115,549

[1] Shipments from domestic mines.
[2] Not at liberty to show separately; included in total.
[3] Arkansas, Florida, Kansas, Louisiana, Maine, Montana, Nebraska, Oklahoma, and Oregon.
[4] Georgia, North Dakota, and Wisconsin.

STOCKS

Stocks of usable iron ore at mines on December 31, 1947, decreased only very slightly from the previous year. Of the quantity in stock piles, 33 percent was at mines in Minnesota, 31 percent in Michigan, and 26 percent in New York and Pennsylvania. Including 1 percent at mines in Wisconsin, the Lake Superior district held 65 percent of the total stocks at the end of the year, compared with 71 percent on December 31, 1946. Stocks of crude ore at mines totaled 3,001,384 gross tons on December 31, 1947, compared with 3,096,426 tons in 1946.

Stocks of usable iron ore at mines, by States, December 31, 1946–47, in gross tons

State	1946	1947
Alabama	20,542	37,881
California	219,800	344,659
Michigan	1,985,715	1,597,695
Minnesota	1,656,275	1,748,207
Missouri	---	---
Nevada	---	---
New Jersey	2,247	1,335
New York	1,278,380	
Pennsylvania	5,803	1,371,323
Virginia		---
Texas	150	28,539
Utah	15,093	17,653
Wisconsin	155,142	73,434
Total	5,339,147	5,220,726

Stocks of iron ore at consuming plants totaled 32,817,529 gross tons on December 31, 1947, compared with 33,661,856 tons at the end of 1946.

Stocks at Lake Erie Ports.—On December 1, 1947, just before navigation stopped, the Lake Superior Iron Ore Association reported 4,815,635 gross tons of iron ore at Lake Erie ports, compared with 4,856,537 tons in 1946. At the opening of the 1948 season (May 1, 1948), 1,953,179 tons of ore were in stock at these ports, compared with 1,816,400 tons on May 1, 1947. Thus, withdrawals from stocks during the 5-month period 1947–48 were about the same as during the previous year.

PRICES

The average value per gross ton of iron ore at mines was $3.44 in 1947, compared with $3.07 in 1946 and $2.77 in 1945.

The accompanying table gives the average value at mines of the different classes of iron ore in 1947 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 has not been given to publish the value. These data are taken directly from the 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 that is not sold on the open market.

Average value per gross ton of iron ore at mines in the United States, 1946–47

[Exclusive of ore containing 5 percent or more manganese]

State	1946							1947						
	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	$2.70	-----	-----	(1)	$2.85	-----	(1)	$3.04	-----	-----	(1)	$2.88	-----	(1)
Georgia	-----	-----	-----	-----	2.16	-----	-----	-----	-----	-----	-----	2.34	-----	-----
Michigan	3.34	-----	-----	(1)	-----	-----	-----	3.61	-----	-----	(1)	-----	-----	-----
Minnesota	2.82	-----	-----	$3.15	-----	-----	(1)	3.17	-----	-----	$3.54	-----	-----	(1)
New Jersey	-----	-----	(1)	-----	-----	$7.34	-----	-----	-----	(1)	-----	-----	$7.76	-----
New York, Pennsylvania	(1)	-----	-----	-----	-----	5.76	$7.54	(1)	-----	-----	-----	-----	6.39	$7.94
Utah	-----	-----	$1.04	-----	-----	-----	-----	-----	-----	$1.01	-----	-----	-----	-----
Other States [2]	2.71	$3.46	5.61	4.84	16.72	7.00	-----	3.17	$2.80	5.71	5.27	4.27	-----	-----
Average, all States	2.89	3.46	1.79	3.17	3.38	6.40	5.66	3.24	2.80	1.67	3.54	3.43	6.95	6.55
Byproduct ore: [3]														
Delaware, Tennessee, Virginia	-----	-----	-----	-----	-----	-----	4.67	-----	-----	-----	-----	-----	-----	5.02

[1] Included with average for all States.

[2] Includes California, Colorado (1946 only), Missouri, Nevada, Texas, Virginia, Washington (1947 only), Wisconsin, and Wyoming.

Lake Superior Ore.—Prices for Lake Superior iron ores are quoted at Lake Erie ports and are based on ores containing (natural) 51.50 percent Fe and, in the case of Bessemer ores, 0.045 percent phosphorus (dry). Prices for all grades were 50 cents per gross ton higher in 1947 than during the 1946 season. The new prices per gross ton in 1947 were as follows: Old Range Bessemer $5.95, Old Range non-Bessemer $5.80, Mesabi Bessemer $5.70, Mesabi non-Bessemer $5.55, and High-Phosphorus $5.55 In the case of Bessemer iron ore there are premiums for ores containing less than 0.045 percent P, and ores containing more than 0.180 percent are considered high-phosphorus.

FOREIGN TRADE [1]

Imports of iron ore in 1947 established a new record high. Exports totaled 2,806,894 gross tons valued at $10,011,476. Of the iron ore exported in 1947, Canada received 2,804,492 tons valued at $9,995,889, Belgium received 2,361 tons valued at $13,409, and the Canal Zone, Argentina, Netherlands, and France very small quantities. Swedish imports, resumed in 1946, increased fivefold during 1947; and Brazil, which shipped virtually none to the United States in 1946, exported more than 85,000 tons in 1947. Canada and Chile also increased substantially their exports to the United States.

Iron ore imported for consumption in the United States, by countries, 1945–47, in gross tons

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Algeria	[1] 224,445	[1] $940,064	83,381	$291,873	30,733	$164,659
Argentina			18	136		
Belgium and Luxembourg			1,200	3,600	21	498
Brazil			3	24	85,534	421,621
British West Africa					22,970	191,718
Canada [2]	[1] 708,582	[1] 2,631,248	1,102,852	5,085,888	1,553,245	7,587,385
Chile	214,670	386,406	1,095,627	2,459,704	1,670,073	4,746,560
Cuba	145	1,053	158,268	749,654	153,050	773,722
Denmark			24,458	150,001		
France [2]			3,969	10,999	702	755
Greece			2,000	6,000		
Iran					1,500	42,000
Italy			500	1,000	16	50
Mexico	[1] 37,782	[1] 81,158	789	1,070	54,966	102,633
Morocco, French	1,200	6,000	5,550	17,600		
Newfoundland and Labrador			15,500	62,000		
Norway					28,246	165,258
Peru	13	60				
Spain			4	20		
Sweden			232,887	1,384,993	1,286,896	7,756,413
Tunisia	10,382	37,120	26,873	121,233	6,000	50,100
Union of South Africa			2	100	8,932	49,455
United Kingdom	706	30,474	335	24,780	600	43,049
	[1] 1,197,925	[1] 4,113,583	2,754,216	10,370,675	4,903,484	22,095,876

[1] Revised figure.
[2] Includes pyrites cinder.

[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.

BENEFICIATION

Iron ore as mined may be classified broadly as direct-shipping and concentrating-grade ore. The direct-shipping ore is high-grade enough and otherwise suitable for smelting without further treatment. The concentrating-grade ore is usually low grade, contains undesirable impurities, and must be treated before being used. Such ore is concentrated by washing, jigging, tabling, magnetic concentration, and high-density separation to remove impurities, thereby improving its grade. Fine ores often are agglomerated or sintered into a lumpy form, which is desirable in blast and steel furnaces because of its improved structure and grade. Sintering likewise has a beneficial effect by reducing the sulfur and moisture content of the ore. At some mines, ore is crushed and screened to improve its physical characteristics, but ore known to be so improved is not included in the statistics as beneficiated ore because it is not enriched in chemical composition. Of the direct-shipping ore, some is sintered later at consuming plants; this material is not considered beneficiated and is discussed in the Sinter section of this chapter.

Iron ore shipped from mines in the United States, 1925–29 (average), and 1943–47, in gross tons, and percentage of beneficiated ore compared to total shipped

[Exclusive of ore containing 5 percent or more manganese]

Year	Beneficiated	Total	Proportion of beneficiated to total (percent)	Year	Beneficiated	Total	Proportion of beneficiated to total (percent)
1925–29 (ave.)	8,653,590	66,697,126	13.0	1945	19,586,782	87,580,942	22.4
1943	20,117,685	98,817,470	20.4	1946	15,588,763	69,494,052	22.4
1944	20,303,422	94,544,635	21.5	1947	21,407,760	92,670,188	23.1

In 1947, 21,427,121 gross tons of beneficiated ore were produced at mine plants from 42,656,157 gross tons of crude ore. Beneficiation of iron ore was reported at 93 mines in 10 States in 1947, compared with 91 mines in 11 States in 1946. Beneficiated ore shipped from domestic mine plants in 1947 increased 37 percent over 1946 and totaled 21,407,760 tons. Concentrates comprised 18 percent and sinter 5 percent of total usable ore shipments, compared with 19 and 4 percent, respectively, in 1946.

The ratio of crude ore used to beneficiated ore produced was 1.991:1 in 1947 compared to 1.843:1 in 1946.

EMPLOYMENT

In 1947, a total of 29,821 men working 64,820,276 man-hours produced 93,472,545 gross tons of iron and manganiferous ores, an average of 1.442 tons per man-hour. Details for 1946 are given in the following table; similar data for 1947 are not yet available. The above data and the table that follows include, in the Lake Superior district, manganiferous ore, 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 1946, by districts and States [1]

District and State	Employment					Crude ore (gross tons)	Production								
	Average number of men employed	Time employed					Usable ore			Average per man (gross tons)					
		Average number of days	Total man-shifts	Man-hours			Gross tons	Iron contained		Crude ore		Usable ore			
				Average per shift	Total			Gross tons	Percent natural	Per shift	Per hour	Per shift	Per hour	Iron contained	
														Per shift	Per hour
Lake Superior:[1]															
Michigan	7,425	211	1,563,051	8.0	12,506,833	8,758,545	8,690,347	4,503,268	51.82	6.283	0.785	6.240	0.780	3.249	0.406
Wisconsin						1,062,743	1,062,743	574,884	54.09						
Minnesota	11,452	213	2,444,878	8.0	19,590,762	58,151,039	50,246,784	25,733,083	51.21	23.785	2.968	20.552	2.565	10.525	1.314
	18,877	212	4,007,929	8.0	32,097,595	67,972,327	59,999,874	30,811,235	51.35	16.959	2.118	14.970	1.869	7.688	.960
Southeastern States:															
Alabama	5,197	264	1,369,960	8.1	11,039,110	7,966,723	5,955,198	2,131,128	35.79	5.815	.722	4.347	.539	1.556	.193
Georgia	67	276	18,518	10.3	190,863	1,312,109	291,898	130,368	45.00	70.856	6.875	15.763	1.529	7.040	.683
Virginia									31.49						
	5,264	264	1,388,478	8.1	11,229,973	9,278,832	6,247,096	2,261,496	36.20	6.683	.826	4.499	.556	1.629	.201
Northeastern States:															
New Jersey	683	236	161,239	8.5	1,365,437	831,522	417,529	265,847	63.67	5.157	.609	2.590	.306	1.649	.195
New York	2,645	203	537,819	8.1	4,369,118	4,304,791	2,178,820	1,303,629	62.19	8.004	.985	4.051	.499	2.424	.298
Pennsylvania									56.15						
	3,328	210	699,058	8.2	5,734,555	5,136,313	2,596,349	1,569,476	60.45	7.347	.896	3.714	.453	2.245	.274
Western States:															
California	65	223	14,514	9.8	142,593	340,491	333,183	169,178	50.78	23.459	2.388	22.956	2.337	11.656	1.186
Colorado	13	169	2,202	8.0	17,613	340	340	191	56.18	46.971	5.872	9.967	1.246	5.065	.633
Texas						103,091	21,608	10,962	50.73						
Missouri	324	252	81,547	8.0	652,376	381,072	155,688	84,274	54.13	12.308	1.539	9.544	1.193	5.039	.630
Nevada						3,299	3,299	2,150	65.17						
Wyoming						619,317	619,317	324,522	52.40						
Utah	138	245	33,749	8.0	269,990	1,317,176	1,317,176	707,762	53.73	39.029	4.879	39.029	4.879	20.971	2.621
	540	244	132,012	8.2	1,082,572	2,764,786	2,450,611	1,299,039	53.01	20.943	2.554	18.564	2.264	9.840	1.200
Total 1946	28,009	222	6,227,477	8.1	50,144,695	85,152,258	71,293,930	35,941,246	50.41	13.674	1.698	11.448	1.422	5.771	.717

[1] Includes manganese-bearing ore from the Lake Superior district; in 1946, all was from Minnesota.

WORLD REVIEW

The following table shows world production of iron ore, by countries, in recent years.

World production of iron ore, 1941–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1941	1942	1943	1944	1945	1946	1947
North America:							
Canada	468,138	494,691	581,769	501,899	1,030,052	1,405,696	1,834,897
Cuba	192,851	132,847	47,113	28,370	----------	----------	63,276
Mexico	152,600	160,286	252,437	301,550	282,524	275,445	332,446
Newfoundland	983,259	1,212,016	551,515	471,824	1,000,449	1,264,141	1,466,577
United States	93,892,753	107,219,890	102,872,863	95,628,294	89,794,834	71,980,145	94,585,639
South America:							
Argentina	3,750	890	150	1,921	43,353	55,400	60,500
Brazil	754,750	641,900	792,217	782,000	716,000	517,765	926,625
Chile [2]	1,702,692	408,587	299,411	674,529	944,863	1,352,886	1,607,929
Europe:							
Austria	2,895,025	2,996,912	3,188,459	3,014,909	323,488	462,016	884,856
Belgium	131,790	113,300	127,890	(3)	29,800	38,764	58,209
Bulgaria	[4] 30,000	(3)	(3)	(3)	(3)	(3)	(3)
Czechoslovakia	[5] 1,687,000	[5] 1,575,000	[6] 498,093	[6] 483,974	271,373	1,116,074	1,363,491
France	10,570,450	12,757,620	16,879,160	9,371,755	7,694,000	16,214,000	18,550,571
Germany [7]	15,455,698	13,223,456	10,763,000	(3)	(3)	3,556,391	[8] 4,192,000
Hungary	788,900	837,680	837,640	[9] [10] 427,660	[9] [11] 35,580	132,970	243,940
Italy	1,340,410	1,084,841	[10] 502,000	(3)	49,256	131,617	225,936
Luxembourg	6,829,584	5,110,050	5,253,025	2,912,500	1,405,877	2,246,908	1,992,167
Norway	566,513	284,498	219,000	264,426	78,538	59,972	[4] 100,000
Poland	906,317	808,776	717,331	680,754	93,600	423,723	544,113
Rumania	171,254	220,365	252,058	243,418	140,797	111,502	120,870
Spain	1,718,979	1,606,161	1,587,817	1,508,610	1,171,377	1,596,212	1,498,320
Sweden	10,527,889	9,727,250	10,819,997	7,253,359	3,929,662	6,867,208	(3)
Switzerland	314,230	304,673	276,959	214,499	17,436	18,000	45,000
U. S. S. R.[12]	22,742,110	(3)	(3)	(3)	[4] 18,000,000	[4] 21,000,000	(3)
United Kingdom:							
Great Britain [13]	19,278,736	20,225,085	18,790,524	15,720,021	14,402,407	12,368,173	11,268,909
Northern Ireland	(3)	4,825	6,660	579	(3)	----------	----------
Yugoslavia	[4] [14] 523,000	[10] [14] 256,000	(3)	(3)	(3)	(3)	(3)
Asia:							
China	11,028,035	17,633,149	[15] 6,929,461	[15] 8,128,400	1,441,325	15,310	100,000
India	3,245,749	3,269,070	2,697,813	2,401,576	2,300,454	2,409,443	(3)
Indochina, French	52,250	63,000	82,000	29,700	7,920	----------	(3)
Japan [16] [17]	1,614,011	2,532,108	3,057,177	4,367,879	1,356,260	566,468	498,084
Korea	1,691,000	2,278,000	2,359,000	3,387,000	832,953	[4] 75,000	[4] 93,000
Malaya, Federation of	1,167,418	92,233	49,137	10,621	13,590	205	1,668
Philippines, Republic of	[18] 849,006	(3)	(3)	(3)	(3)	----------	----------
Turkey	60,793	19,044	86,393	90,430	125,261	121,548	145,620
U. S. S. R.	(12)	(3)	(3)	(3)	(12)	(12)	(3)
Africa:							
Algeria	328,700	329,000	183,572	783,900	1,202,648	1,671,244	1,555,722
Belgian Congo	13,000	9,000	23,964	----------	----------	----------	----------
Morocco:							
French	3,714	3,329	10,670	6,600	98	124,530	153,650
Spanish	554,776	547,432	547,625	690,880	764,816	787,340	904,820
Rhodesia:							
Northern	271	394	624	212	76	162	1,528
Southern	315	182	182	----------	----------	----------	286
Sierra Leone	[19] 1,046,501	[19] 633,375	517,727	641,165	840,611	741,105	[4] [18] 650,000
Tunisia	912	30,994	29,703	88,863	132,450	183,705	403,691
Union of South Africa	802,868	717,738	738,128	768,392	775,470	946,828	1,162,127

See footnotes at end of table.

World production of iron ore, 1941–47, by countries, in metric tons[1]—Continued

Country[1]	1941	1942	1943	1944	1945	1946	1947
Oceania:							
Australia:							
New South Wales	64,115	185,041	205,691	154,326	43,358	(3)	(3)
Queensland	2,349	3,815	3,095	2,375	1,743	1,681	1,364
South Australia	2,276,345	2,156,111	2,217,865	2,061,810	1,543,983	1,847,398	2,179,965
Tasmania	2,215		7			5	(3)
Western Australia		152	86				
New Caledonia	99,181		36,280	60,406		(3)	(3)
New Zealand	1,569	2,472	5,068	6,133	6,164	7,525	6,326
Total (estimate)	219,540,000	222,000,000	217,000,000	193,000,000	160,000,000	153,000,000	182,000,000

1 In addition to the countries listed Burma, Egypt, Eritrea, French West Africa, Greece, Madagascar, Portugal, and South-West Africa report production of iron ore, but quantity produced is believed insufficient to affect estimate of world total.
2 Production of Tofo mines.
3 Data not available; estimate by author of the chapter included in total.
4 Estimate.
5 Bohemia, Moravia, and Slovakia.
6 Bohemia and Moravia only.
7 Exclusive of manganiferous iron ore carrying 12 to 30 percent manganese.
8 Excluding Soviet zone.
9 Data represents Trianon Hungary subsequent to October 1944.
10 January to June, inclusive.
11 June to December, inclusive.
12 U. S. S. R. in Asia included with U. S. S. R. in Europe.
13 Exclusive of bog ore, which is used mainly for purification of gas.
14 Croatia only.
15 Manchuria only.
16 Preliminary data for fiscal year ended March 31 of year following that stated.
17 Includes iron sand production as follows: 1941–42, 233,000 tons; 1942–43, 368,000 tons: 1943–44, 427,000 tons; 1944–45, 858,782 tons; 1945–46, 235,094 tons; 1946, 10,470 tons; 1947, 1,648 tons.
18 January to October, inclusive.
19 Exports.

Brazil.—Production of iron ore in Brazil in 1947 increased 79 percent from the previous year and totaled nearly a million tons. However, only 9 percent of the output was exported to the United States. The high cost of transporting Brazilian ore in 1947 limited shipments to high-grade lump ore for use in steel furnaces; none was reported used in the manufacture of pig iron during 1947 in the United States. All of the iron-ore production in Brazil during 1947 came from the State of Minas Geraes, where iron ore is produced in three important districts. The Itabira district, with Caue Peak as the most important producing mine, is the source of most of the export material. This ore is shipped via the Vitoria e Minas Railroad, 350 miles north of Vitoria, for export mainly to the United States and the United Kingdom. Iron ore for the Volta Redondo plant in Brazil was obtained from the Casa do Pedra mine near Congonhas do Campo, the second most important Brazilian district. At Bello Horizonte, iron ore is produced mainly from the Sabara mine for other Brazilian iron and steel plants.

Cuba.—All of the iron ore produced in Cuba in 1947 came from Oriente Province. Brown ore was shipped from the Mayari mine for experimental purposes and hematite was shipped from the Daiquiri and Estancia mines for use in making pig iron at Sparrows Point, Md. The Estancia mine was abandoned in 1947, and the Daiquiri mine was exhausted of known reserves.

Iron ore shipped from mines in the Province of Oriente, Cuba, 1884–1947, in gross tons

	Juragua, Daiquiri, and Estancia (hematite and magnetite)	Sigua (hematite)	Mayari (brown ore)	Guama (hematite)	El Cuero (hematite)	Total
1884–1945	22,503,074	20,438	3,989,092	41,241	903,103	27,456,948
1946	148,480		848			149,328
1947	88,727		55,193			143,920
	22,740,281	20,438	4,045,133	41,241	903,103	27,750,196

Canada.—There were only two active iron-ore mines in Canada during the 1947 season—the Helen mine in the Michipicoten range and the Steep Rock mine in the Atikokan or Steep Rock district. Some of the sinter produced at the Helen mine came from ore mined in 1946 from the Josephine mine. The latter mine did not operate in 1947, having closed late in the previous year after a cave-in. The largest producing mine in 1947 (1,206,248 gross tons) was the Steep Rock, where all of the production (open-pit) came from the B ore body. Plans of the operating company are to develop the ore body for underground mining before the open-pit mine is exhausted, so that the present annual production rate of approximately 1,000,000 tons can be maintained during the life of the ore body. Drilling was in progress during 1947 in the A ore body 1½ miles north of B. The remaining lake water covering the ore body was pumped out in 1947, and it is expected that 2 years will be required for removing the cover of silt and clay. Plans contemplate an ultimate production from the A ore body to exceed that of the present mine.

Drilling of siderite deposits, such as occur at the Helen mine, continued in 1947. Operators of the Helen mine were drilling the Bartlett deposits 9 miles northeast of the Helen in 1947. Several other deposits of siderite, undeveloped or partly developed, are known to exist. Algoma has a deposit smaller than the Bartlett on the Johnson location east of the Helen mine. The Goulais magnetite deposits of Algoma, 60 miles northeast of Sault St. Marie, contain an estimated 100,000,000 tons of concentrating ore averaging 30 percent iron. Two other siderite deposits, the Ruth and the Lucy, between the Helen and the Bartlett mines, held by the Frobisher, Ltd., and Sherritt Gordon Mines, Ltd., are now under option by the Jones & Laughlin Steel Corp.; the Lucy deposit was drilled during 1947, and the Ruth had been drilled earlier.[2]

The Hollinger-North Shore Exploration Co., Ltd., and the Labrador Mining & Exploration Co., Ltd., continued drilling in the Labrador-Quebec iron-ore area in 1947. At the close of the season, 98,692,000 gross tons of ore were measured on the Quebec (Ungava) side of the border, and 41,126,000 gross tons were blocked out in Labrador. In

[2] Goodwin, W. M., Iron Ores in 1947, Canadian Bureau of Mines, Ottawa, January 1948. 12 pp.

addition to the drilling, two adits were driven—one in the Fairman No. 3 deposit, a distance of 165 feet, at which point the face was approximately 100 feet below the surface, and at Ruth Lake No. 3, 225 feet into the ore body and a winze sunk near the face of the adit to a depth of 40 feet below the adit floor. The bottom of this winze was 140 feet below the surface of outcrop. Both of these were terminated in high-grade ore. An air strip and approximately 50 miles of secondary roads were constructed during the 1947 season. Two DC–3 transport planes were purchased to be placed in service during the 1948 season. A smaller plane, equipped with skis or floats, was purchased for inland transportation at the development. Burnt Creek Camp was established as a central operating base and buildings were constructed to handle the needs of 150 men. Plans were made for expanding the drilling program during the 1948 season, with the goal of developing 300,000,000 tons of ore the minimum necessary to justify constructing the necessary railroad 360 miles from the port of Seven Islands on the Gulf of the St. Lawrence River. Two new servicing companies were formed in 1947 to assist general development of the Labrador-Quebec fields. The Quebec, North Shore & Labrador Railroad Co. was formed to construct and operate the proposed railroad and the Ungava Power Co. to develop and distribute hydroelectric power for the operations. These, as well as the development companies, are controlled by the Hollinger Consolidated Gold Mines, Ltd., of Toronto, and the M. A. Hanna Co. of Cleveland.

Venezuela.—Several large iron-ore deposits in Venezuela are being developed by two United States companies. The El Pao deposits, 30 miles south of San Felix, a town at the junction of the Caroni and Orinoco Rivers, in the State of Bolivar, have been under development since 1939 by the Iron Mines Co. of Venezuela, a subsidiary of Bethlehem Steel Corp. The company has nearly completed the necessary railroad from the mine to Pulua, the port of shipment, 1 mile from San Felix. As the Orinoco River is too shallow in some locations to permit ocean-going vessels to reach Pulua, it will be necessary to ship the ore by barge to a port under construction at Puerto Hierro for transshipment to ocean-going vessels. The Oliver Iron Mining Co., a subsidiary of the United States Steel Corp., acquired five new concessions in 1947 covering 25,000 hectares in the Imataca region, south and southwest of the El Pao deposits. Field parties conducted exploration and drilling throughout 1947, and surveys were under way to determine the most practical outlet for transporting ore.

Iron and Steel

By NORWOOD B. MELCHER

GENERAL SUMMARY

STEEL production in the United States rose 27 percent in 1947 over 1946 but was still restricted by raw-material shortages and work stoppages. The industry operated at 93 percent of capacity in 1947—the highest rate since 1944 but far below the record high of 98 percent realized in 1943. However, a higher ratio of finished steel to steel ingots than ever before was attained in 1947, and shipments of steel products from producing plants reached 63,057,150 net tons—an increase of 29 percent over 1946 and only 2 percent less than in the record year 1944.

The supply-demand picture for 1947 was characterized by increased tightening in the supply of most steel products. The automotive industry, the largest single user of steel products, was forced to hold output to a level considerably below its potential capacity. Production of passenger cars during the year totaled 3,558,178 units as compared to a peak (1929) production of 4,587,400 units. The demand for automobiles continued strong throughout 1947, with little indication of any lessening during 1948. Some increases in automobile production during 1948 were believed by the industry to be possible through increases in cold-rolled sheet capacity scheduled to go into operation during 1948. Also, the acquisition of some rolling capacity by the automotive industry will make additional steel available during 1948.

The construction industry was the second-largest user of steel during 1947, receiving 6.3 million tons of steel products—approximately one-third more than during the previous year. The value of private construction also increased one-third and totaled 10.9 billion dollars. The bulk of the expansion was in residential construction where, after a period of relatively weak demand during the first half of the year, demand increased so much during the latter half of the year that construction progressed in spite of high prices. Nevertheless, residential construction was proportionately smaller than might be expected on the basis of past experience of comparable prosperity and housing shortages; increases were slight in other types of construction. More steel was used in containers in 1947 than in any previous year, and it was evident, at the close of the year, that this trend was still on the increase. According to Iron Age, the tin-can industry used 2¾ million net tons of tin plate in 1946 and substantially more in 1947. It was planned that the use of tinplate would be between 3¼ and 3¾ million net tons in 1948. Beer cans alone will require about 400,000 net tons. Increased production costs in the container industry made competition strong from glass and other containers, but the use of these products may be expected to increase. Railroads were the fourth-largest users of steel in 1947, receiving 4,879,879 tons of steel products during the year. Rails, by far the greatest part of the tonnage, constituted nearly one-third of the total. Production of freight cars during 1947 totaled 80,711 units.

Salient statistics of iron and steel in the United States, 1943–47, in net tons

	1943	1944	1945	1946	1947
Pig iron:					
Production	60,765,195	61,003,759	53,224,213	44,842,025	58,327,231
Shipments	60,787,159	60,995,977	53,265,353	45,075,890	58,367,510
Imports	1,445	5,778	[1] 21,150	14,091	32,624
Exports	144,269	162,478	[1] 90,833	95,698	40,202
Steel: [2]					
Production of ingots and castings:					
Open-hearth:					
Basic	77,207,870	79,168,294	71,069,876	60,112,300	76,209,268
Acid	1,413,934	1,195,659	869,726	599,663	664,525
Bessemer	5,625,492	5,039,923	4,305,318	3,327,737	4,232,543
Crucible	146	25	24	2,563,024	18
Electric	4,589,070	4,237,699	3,456,704		3,787,717
	88,836,512	89,641,600	79,701,648	66,602,724	84,894,071
Capacity, annual	90,636,490	93,564,560	95,505,280	91,890,560	91,241,250
Percent of capacity	98.0	95.8	83.5	72.5	93.0
Production of alloy steel:					
Stainless	457,448	477,498	542,904	550,097	519,933
Other than stainless	12,692,370	10,155,588	8,104,807	5,527,098	6,908,298
	13,149,818	10,633,086	8,647,711	6,077,195	7,428,231
Shipments of steel products:					
For domestic consumption	54,288,793	59,267,961	53,448,897	[1] 45,763,761	58,850,458
For export	5,616,853	4,925,198	3,793,343	[1] 3,011,771	4,206,692
	59,905,646	64,193,159	57,242,240	48,775,532	63,057,150

[1] Revised figure.
[2] American Iron and Steel Institute. Capacity figures Dec. 31 from A. I. S. I. Form 7.

Premium payments on pig iron used for housing were extended through December 31, 1947. The premium-payment plan was instituted in September 1946 and was originally scheduled to end June 30, 1947. These payments continued to be $8 a ton on over-quota shipments made for operating plants and $12 a ton for idle furnaces put into operation for this purpose. These payments were made only if the producer complied with the housing expediter's notification regarding shipments to specific manufacturers of housing-type items.

There was considerable controversy during 1947 regarding the adequacy of the present United States steel capacity to meet current and future demands. Members of the iron and steel industry testifying before the Senate Small Business Committee during June and July were generally of the opinion that present and planned capacity would be adequate to meet any foreseeable demand. Some members of industry and Government believed that steel capacity is far from adequate and should be expanded promptly.

The increasing gravity of the steel shortages was accompanied by rises in steel prices during the year. The composite price as published by the Iron Age, which was approximately 2.86 cents per pound in January, advanced slightly to about 2.88 cents per pound in June but increased to 3.20 cents per pound after September and continued unchanged during the balance of the year.

Exports of steel (manufacturers and semimanufacturers) during 1947 exceeded those of any year since 1943; 6,763,677 tons were exported during 1947. Steel bars constituted the largest tonnage, with tinplate the second-largest tonnage. Exports were widely distributed. The largest recipients, in order of importance, were Canada, Argentina, France, Brazil, and Mexico. These countries received 45 percent of the total.

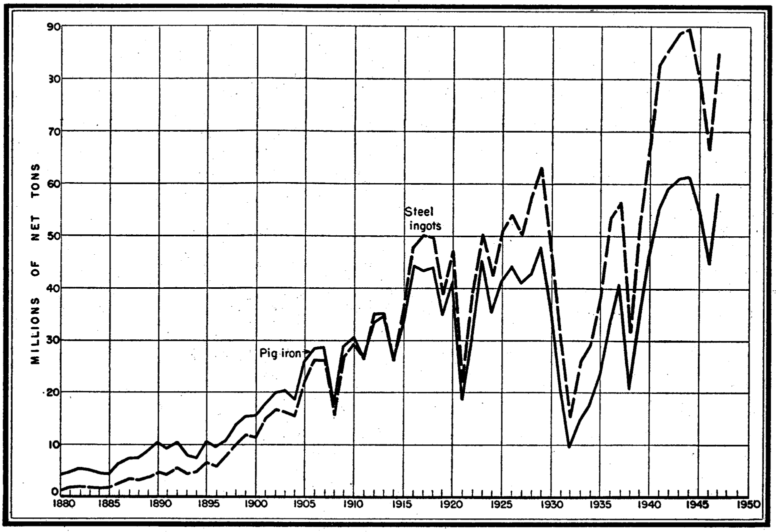

FIGURE 1.—Trends in production of pig iron and steel ingots in the United States, 1880–1947.

PRODUCTION AND SHIPMENTS OF PIG IRON

Domestic production of pig iron, exclusive of ferro-alloys, increased 30 percent over 1946 and totaled 58,327,231 net tons, all of which was produced using coke as a fuel. Pennsylvania was the largest producer of pig iron in 1947, with 30 percent of the total, as in 1946, and Ohio was also unchanged at 21 percent. Of the pig iron manufactured in 1947, it is calculated that 1,680,000 tons valued at $50,971,000 were made from 3,275,703 tons of foreign ore largely from Africa, Canada, Chile, Cuba, Mexico, Newfoundland, and Sweden. Domestic ore (86,092,406 tons) and sinter (15,622,529 tons) and 8,729,983 tons of miscellaneous materials were reported used in the manufacture of 56,647,231 tons of pig iron. In addition, 1,397,426 tons of home scrap and 116,352 tons of flue dust were consumed in making pig iron in 1947.

Shipments of pig iron increased 29 percent in quantity and 60 percent in value over 1946. The values given in the accompanying table represent the approximate amounts received for the iron f. o. b. furnaces and do not include freight cost, selling commissions, and other items normally included in market prices for pig iron as published by trade journals.

Pig iron produced and shipped in the United States, 1946–47, by States

State	Produced		Shipped from furnaces			
	1946 (Net tons)	1947 (Net tons)	1946		1947	
			Net tons	Value	Net tons	Value
Alabama	3,135,387	3,928,785	3,145,303	$66,517,978	3,928,007	$110,436,827
California	323,925	459,148	344,024		453,376	
Colorado						
Utah	1,055,991	1,911,264	1,095,238	30,578,847	1,915,386	72,511,626
Texas						
Illinois	4,357,310	5,600,154	4,359,719	109,717,853	5,607,680	173,679,369
Indiana	4,828,528	6,400,254	4,823,257	122,786,881	6,385,503	195,211,140
Kentucky	624,174	661,925	624,174	(1)	661,925	(1)
Maryland	1,945,006	2,408,260	1,945,852	(1)	2,408,230	(1)
Massachusetts	8,730	205,234	9,878	(1)	203,844	(1)
Michigan	1,345,575	1,378,829	1,363,950	37,081,447	1,388,402	44,782,690
Minnesota	531,356	546,299	540,057	(1)	546,432	(1)
New York	2,771,006	3,663,581	2,801,828	63,937,403	3,675,217	101,204,575
Ohio	9,628,101	12,316,561	9,647,981	240,218,956	12,322,330	380,383,106
Pennsylvania	13,251,337	17,563,146	13,330,186	329,194,957	17,587,252	531,716,815
Tennessee	32,132		32,688			
West Virginia	1,003,467	1,283,791	1,011,753	(1)	1,283,926	(1)
Virginia			2			
Undistributed [1]				103,894,664		160,732,515
Total	44,842,025	58,327,231	45,075,890	1,103,928,986	58,367,510	1,770,658,663

[1] Data that may not be shown separately are combined as "Undistributed."

Metalliferous Materials Used.—The production of pig iron in 1947 required 104,990,638 tons of iron ore, sinter, and manganiferous iron ore, 3,196,215 tons of mill cinder and roll scale, 4,213,940 tons of open-hearth and Bessemer slag, 1,277,231 tons of purchased scrap, and 42,597 tons of miscellaneous materials—an average of 1.950 tons of metalliferous materials (exclusive of home scrap and flue dust) per ton of pig iron made.

Alabama furnaces used red hematite from Jefferson County, Ala., and brown ore from Alabama, Georgia, and Texas. Manganese-bearing ores of domestic and foreign (Africa, Cuba, and Mexico) origin and pyrite cinder from Virginia also were used. Because of the preponderance of relatively low-grade ore used in the Alabama furnaces, the consumption of ore per ton of pig iron is higher than in any other State.

Pig iron shipped from blast furnaces in the United States, 1946–47, by grades

Grade	1946			1947		
	Net tons	Value		Net tons	Value	
		Total	Average		Total	Average
Charcoal	32,688	(1)	(1)			
Foundry	2,615,223	$61,025,123	$23.33	3,156,157	$95,147,407	$30.15
Basic	34,131,539	827,680,207	24.25	44,947,995	1,356,926,056	30.19
Bessemer	5,682,079	147,753,446	26.00	6,850,065	209,790,374	30.63
Low-phosphorus	182,139	5,133,543	28.18	361,806	12,607,016	34.84
Malleable	2,226,843	56,210,006	25.24	2,787,901	88,359,352	31.69
All other (not ferro-alloys)	205,379	6,126,661	25.74	263,586	7,828,458	29.70
	45,075,890	1,103,928,986	24.49	58,367,510	1,770,658,663	30.34

[1] Value included with "All other."

The iron ore used at the Fontana, Calif., furnace came from the Vulcan mine in San Bernardino County, Calif., the Eagle Mountain mine in Riverside County, Calif., and the Walker Iron Mining Co. (Excelsior) mine in Iron County, Utah. Some of the iron ore was sintered at Fontana before using. Manganese ore from Lower California, Mexico, was also used.

The blast furnaces at Pueblo, Colo., used hematite from the Sunrise mine in Platte County, Wyo., and the Duncan and Blowout mines in Iron County, Utah. The manganiferous ore used came from the Boston Hill mine, Grant County, N. Mex.

Blast furnaces (including ferro-alloy blast furnaces) in the United States, 1946–47

[American Iron and Steel Institute]

State	Dec. 31, 1946			Dec. 31, 1947		
	In blast	Out of blast	Total	In blast	Out of blast	Total
Alabama	19	1	20	19	1	20
California	1		1	1		1
Colorado	4		4	4		4
Illinois	20	1	21	20	1	21
Indiana	18	2	20	20	2	22
Kentucky	3		3	3		3
Maryland	7		7	7	1	8
Massachusetts	1		1	1		1
Michigan	5		5	5		5
Minnesota	3		3	3		3
New York	13	3	16	15	1	16
Ohio	44	2	46	46	1	47
Pennsylvania	70	2	72	72	2	74
Tennessee	2	1	3	2	1	3
Texas		2	2	2		2
Utah	3	1	4	4		4
Virginia	1		1	1		1
West Virginia	4		4	4		4
	218	15	233	229	10	239

The blast furnaces at Sparrows Point, Md., used Lake Superior ore and foreign ore from Chile, Cuba, and Sweden. Domestic manganiferous ore from the Lake Superior district and foreign ore from Africa also were used.

Blast furnaces in Illinois and Kentucky used Lake Superior iron ore and manganiferous iron ore exclusively; Indiana used these and iron ore from Sweden. Furnaces in Michigan, Minnesota, and West Virginia used mostly Lake Superior ore, but a considerable tonnage from Canada also was used.

In New York, the furnaces in the Buffalo district used hematite from the Lake Superior district and Canada and magnetite from New York. The furnace at Troy consumed magnetite from the Chateaugay mine at Lyon Mountain, N. Y., and manganese ore from South Africa.

Ohio blast furnaces consumed magnetite sinter from New York and domestic and Canadian hematite from the Lake Superior district.

Virtually all of the ore consumed in western Pennsylvania furnaces came from the Lake Superior district. Furnaces in the eastern part of the State used some Lake ore, some magnetite ore from New Jersey, New York, and Pennsylvania, iron ore from Africa and Chile, and manganese-bearing ores from Africa and Australia.

Texas furnaces used brown iron ore from eastern Texas and iron and manganese ores from Mexico.

Iron ore and other metallic materials consumed and pig iron produced, 1946–47, by States, in net tons

<table>
<tr><th rowspan="3">State</th><th colspan="5">Metalliferous materials consumed</th><th rowspan="3">Pig iron produced</th><th colspan="4">Materials consumed per ton of pig iron made</th></tr>
<tr><th colspan="2">Iron and manganiferous iron ores</th><th rowspan="2">Sinter</th><th rowspan="2">Miscellaneous [1]</th><th rowspan="2">Total</th><th rowspan="2">Ores</th><th rowspan="2">Sinter</th><th rowspan="2">Miscellaneous</th><th rowspan="2">Total</th></tr>
<tr><th>Domestic</th><th>Foreign</th></tr>
<tr><td>1946</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Alabama</td><td>5,897,958</td><td>3,338</td><td>1,609,262</td><td>139,658</td><td>7,650,216</td><td>3,135,387</td><td>1.882</td><td>0.513</td><td>0.045</td><td>2.440</td></tr>
<tr><td>California</td><td>343,091</td><td>4,182</td><td>209,942</td><td>53,772</td><td>610,987</td><td>323,925</td><td>1.072</td><td>.648</td><td>.166</td><td>1.886</td></tr>
<tr><td>Colorado
Utah</td><td>1,456,261</td><td>---------</td><td>446,652</td><td>41,688</td><td>1,944,601</td><td>1,055,991</td><td>1.379</td><td>.423</td><td>.039</td><td>1.841</td></tr>
<tr><td>Illinois</td><td>7,446,579</td><td>---------</td><td>603,459</td><td>633,815</td><td>8,683,853</td><td>4,357,310</td><td>1.709</td><td>.139</td><td>.145</td><td>1.993</td></tr>
<tr><td>Indiana</td><td>8,315,584</td><td>---------</td><td>710,575</td><td>655,153</td><td>9,681,312</td><td>4,828,528</td><td>1.722</td><td>.147</td><td>.136</td><td>2.005</td></tr>
<tr><td>Kentucky</td><td>1,042,405</td><td>---------</td><td>22,954</td><td>150,477</td><td>1,215,836</td><td>624,174</td><td>1.670</td><td>.037</td><td>.241</td><td>1.948</td></tr>
<tr><td>Maryland</td><td>1,398,458</td><td>1,299,412</td><td>360,936</td><td>464,934</td><td>3,523,740</td><td>1,945,006</td><td>1.387</td><td>.186</td><td>.239</td><td>1.812</td></tr>
<tr><td>Massachusetts</td><td>12,278</td><td>3,606</td><td>---------</td><td>694</td><td>16,578</td><td>8,730</td><td>1.819</td><td>------</td><td>.080</td><td>1.899</td></tr>
<tr><td>Michigan</td><td>2,074,248</td><td>95,350</td><td>264,955</td><td>137,115</td><td>2,571,668</td><td>1,345,575</td><td>1.612</td><td>.197</td><td>.102</td><td>1.911</td></tr>
<tr><td>Minnesota</td><td>993,606</td><td>61</td><td>---------</td><td>58,854</td><td>1,052,521</td><td>531,356</td><td>1.870</td><td>------</td><td>.111</td><td>1.981</td></tr>
<tr><td>New York</td><td>4,227,001</td><td>40,721</td><td>776,435</td><td>370,681</td><td>5,414,838</td><td>2,771,006</td><td>1.540</td><td>.280</td><td>.134</td><td>1.954</td></tr>
<tr><td>Ohio</td><td>12,830,219</td><td>229,316</td><td>3,340,723</td><td>1,559,737</td><td>17,959,995</td><td>9,628,101</td><td>1.356</td><td>.347</td><td>.162</td><td>1.865</td></tr>
<tr><td>Pennsylvania</td><td>19,131,826</td><td>38,024</td><td>3,379,014</td><td>2,425,410</td><td>24,974,274</td><td>13,251,337</td><td>1.447</td><td>.255</td><td>.183</td><td>1.885</td></tr>
<tr><td>Tennessee</td><td rowspan="2">1,591,529</td><td>---------</td><td rowspan="2">112,599</td><td>---------</td><td rowspan="2">1,928,700</td><td>32,132</td><td rowspan="2">1.642</td><td rowspan="2">.109</td><td>-----</td><td rowspan="2">1.862</td></tr>
<tr><td>West Virginia</td><td>108,828</td><td>115,744</td><td>1,003,467</td><td>.115</td></tr>
<tr><td></td><td>66,761,043</td><td>1,822,838</td><td>11,837,506</td><td>6,807,732</td><td>87,229,119</td><td>44,842,025</td><td>1.529</td><td>.264</td><td>.152</td><td>1.945</td></tr>
<tr><td>1947</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Alabama</td><td>6,038,647</td><td>3,104</td><td>2,054,009</td><td>172,653</td><td>8,268,413</td><td>3,928,785</td><td>1.538</td><td>.523</td><td>.044</td><td>2.105</td></tr>
<tr><td>California</td><td>379,279</td><td>4,529</td><td>354,833</td><td>66,844</td><td>805,485</td><td>459,148</td><td>.836</td><td>.773</td><td>.145</td><td>1.754</td></tr>
<tr><td>Colorado
Texas
Utah</td><td>2,788,568</td><td>43,766</td><td>739,534</td><td>84,168</td><td>3,656,036</td><td>1,911,264</td><td>1.482</td><td>.387</td><td>.044</td><td>1.913</td></tr>
<tr><td>Illinois</td><td>9,857,650</td><td>---------</td><td>764,587</td><td>674,610</td><td>11,296,847</td><td>5,600,154</td><td>1.760</td><td>.137</td><td>.120</td><td>2.017</td></tr>
<tr><td>Indiana</td><td>11,101,185</td><td>12,957</td><td>999,662</td><td>893,016</td><td>13,006,820</td><td>6,400,254</td><td>1.736</td><td>.156</td><td>.140</td><td>2.032</td></tr>
<tr><td>Kentucky</td><td>1,141,929</td><td>---------</td><td>21,330</td><td>138,886</td><td>1,302,145</td><td>661,925</td><td>1.725</td><td>.032</td><td>.210</td><td>1.967</td></tr>
<tr><td>Maryland</td><td>1,224,559</td><td>2,345,283</td><td>278,243</td><td>534,528</td><td>4,382,613</td><td>2,408,260</td><td>1.482</td><td>.116</td><td>.222</td><td>1.820</td></tr>
<tr><td>Massachusetts</td><td>289,253</td><td>77,529</td><td>---------</td><td>7,198</td><td>373,980</td><td>205,234</td><td>1.787</td><td>------</td><td>.035</td><td>1.822</td></tr>
<tr><td>Michigan</td><td>2,246,278</td><td>75,997</td><td>308,516</td><td>110,368</td><td>2,741,159</td><td>1,378,829</td><td>1.684</td><td>.224</td><td>.080</td><td>1.988</td></tr>
<tr><td>Minnesota</td><td>1,059,782</td><td>4,723</td><td>---------</td><td>72,114</td><td>1,136,619</td><td>546,299</td><td>1.949</td><td>------</td><td>.132</td><td>2.081</td></tr>
<tr><td>New York</td><td>5,464,864</td><td>21,814</td><td>1,235,788</td><td>484,041</td><td>7,206,507</td><td>3,663,581</td><td>1.498</td><td>.337</td><td>.132</td><td>1.967</td></tr>
<tr><td>Ohio</td><td>16,698,607</td><td>455,774</td><td>4,455,657</td><td>1,962,008</td><td>23,572,046</td><td>12,316,561</td><td>1.393</td><td>.362</td><td>.159</td><td>1.914</td></tr>
<tr><td>Pennsylvania</td><td>25,824,167</td><td>35,561</td><td>4,300,688</td><td>3,390,721</td><td>33,551,137</td><td>17,563,146</td><td>1.472</td><td>.245</td><td>.193</td><td>1.910</td></tr>
<tr><td>Tennessee</td><td rowspan="2">1,977,638</td><td rowspan="2">194,666</td><td rowspan="2">109,682</td><td>---------</td><td rowspan="2">2,420,814</td><td rowspan="2">1,283,791</td><td rowspan="2">1.692</td><td rowspan="2">.086</td><td rowspan="2">.108</td><td rowspan="2">1.886</td></tr>
<tr><td>West Virginia</td><td>138,828</td></tr>
<tr><td></td><td>86,092,406</td><td>3,275,703</td><td>15,622,529</td><td>8,729,983</td><td>113,720,621</td><td>58,327,231</td><td>1.532</td><td>.268</td><td>.150</td><td>1.950</td></tr>
</table>

[1] Excludes recycled materials.

Utah furnaces used semialtered magnetite from the Iron Mountain mine near Cedar City, Utah, and manganese-bearing ores from Nevada and Utah. The sinter used was produced at Geneva and Provo from Iron Mountain fine ore.

The blast furnace at Everett, Mass., used hematite from the Lake Superior district, magnetite from New Jersey, and foreign iron ore from Algeria, Newfoundland, and Sweden.

Foreign iron and manganiferous iron ore consumed in the manufacture of pig iron in the United States, 1946–47, by sources of ore, in net tons

Source	1946	1947	Source	1946	1947
Africa	139,369	88,045	Newfoundland	3,158	14,141
Australia		1,558	Sweden	91,041	323,016
Canada	472,628	765,620	Unclassified		10,392
Chile	1,033,492	1,898,732			
Cuba	75,630	125,412			
Mexico	7,520	48,787	Total	1,822,838	3,275,703

PRODUCTION OF STEEL

Steel production increased 27 percent over 1946, while capacity decreased 1 percent. Capacity at the end of 1947 totaled 91,241,250 short tons, compared with the record high of 95,505,280 tons at the end of 1945. Production of steel ingots and castings in the United States in 1947 was 84,894,071 tons. Of this total, 90.6 percent was made in open-hearth furnaces, 5 percent in Bessemer converters, and 4.4 in electric furnaces. Included in the last figure is a small production of steel in crucible furnaces, which amounted to only 18 tons in 1947. In 1947, 90.3 percent of domestic steel output was made in furnaces in the Northeastern district, 4.6 percent in the Southern district, and 5.1 percent in the Western district, compared with 90.9 4.6, and 4.5 percent, respectively, in 1946.

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.

Steel capacity, production, and percent of operations, 1943–47, in net tons [1]

[American Iron and Steel Institute]

Year	Annual capacity [2] as of Dec. 31	Production					
		Open hearth	Bessemer	Crucible	Electric and all other	Total	Percent of capacity
1943	90,636,490	78,621,804	5,625,492	146	4,589,070	88,836,512	98.0
1944	93,564,560	80,363,953	5,039,923	25	4,237,699	89,641,600	95.8
1945	95,505,280	71,939,602	4,305,318	24	3,456,704	79,701,648	83.5
1946	91,890,560	60,711,963	3,327,737	(3)	2,563,024	66,602,724	72.5
1947	91,241,250	76,873,793	4,232,543	18	3,787,717	84,894,071	93.0

1 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.
2 Capacity figures from A. I. S. I. Form 7.
3 Included with "Electric and all other."

Open-hearth steel ingots and castings manufactured in the United States, 1943–47, by States, in net tons [1]

[American Iron and Steel Institute]

State	1943	1944	1945	1946	1947
New England States	487,773	444,101	432,601	367,868	428,651
New York and New Jersey	4,488,951	4,365,108	3,813,333	3,242,138	4,213,369
Pennsylvania	24,548,335	24,677,513	21,194,721	17,495,219	22,911,984
Ohio	14,834,574	15,011,818	13,402,084	11,446,783	14,026,978
Indiana	10,679,645	10,925,049	10,237,621	8,359,305	10,128,496
Illinois	6,350,309	6,496,338	5,812,286	4,851,975	6,206,370
Other States	17,232,217	18,444,026	17,046,956	14,948,675	18,957,945
	78,621,804	80,363,953	71,939,602	60,711,963	76,873,793

[1] Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots.

Bessemer-steel ingots and castings manufactured in the United States, 1943–47, by States, in net tons [1]

[American Iron and Steel Institute]

State	1943	1944	1945	1946	1947
Ohio	2,365,326	2,207,176	1,930,956	1,447,825	1,981,428
Pennsylvania	1,926,316	1,645,247	1,388,284	1,143,388	1,345,412
Other States	1,333,850	1,187,500	986,078	736,524	905,703
	5,625,492	5,039,923	4,305,318	3,327,737	4,232,543

[1] Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots.

Steel electrically manufactured in the United States, 1943–47, in net tons [1]

[American Iron and Steel Institute]

Year	Ingots	Castings	Total	Year	Ingots	Castings	Total
1943	4,473,377	115,693	4,589,070	1946	2,479,064	83,960	[2] 2,563,024
1944	4,131,703	105,996	4,237,699	1947	3,680,500	107,217	3,787,717
1945	3,381,678	75,026	3,456,704				

[1] Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots.
[2] Includes crucible steel.

Alloy Steels.—The steel output for 1947 includes 7,428,231 net tons of alloy-steel ingots and castings, which represent 9 percent of the total, as in 1946. 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; or steels containing aluminum, boron, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, and other alloying elements when added to steel to obtain desired alloying effects. The output of alloy steels in 1947 increased 22 percent over 1946, whereas total steel increased 27 percent. Of the alloy steel produced in 1947, 74 percent came from basic open-hearth, 2 percent from acid open-hearth, and 24 percent from electric furnaces and crucibles; none was produced in Bessemer converters.

Electric furnaces produced proportionately less alloy steel in 1947 than in 1946; only 47 percent of steel made in electric furnaces was alloy in 1947. Typically, steels with higher alloy content are made in electric furnaces and steel with lower content by the open-hearth process.

Alloy-steel ingots and castings manufactured in the United States, 1943–47, by processes, in net tons [1]

[American Iron and Steel Institute]

Process	1943	1944	1945	1946	1947
Open hearth:					
Basic	8,539,523	6,494,627	5,572,353	4,325,657	5,520,540
Acid	677,416	515,662	274,889	115,711	128,754
Crucible	136	23	18	} 1,635,827	1,778,937
Electric	3,932,743	3,622,774	2,800,451		
	13,149,818	10,633,086	8,647,711	6,077,195	7,428,231

[1] Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots.

Metalliferous Materials Used.—During 1947, steel furnaces used 3,795,886 net tons of domestic iron ore and 809,191 tons of foreign ore, most of which came from Brazil, Chile, and Sweden, smaller quantities originating in Africa and Canada. In addition, open-hearth furnaces consumed 1,134,542 tons of sinter made from both foreign and domestic materials.

Both charge ore and feed ore are used in the basic open-hearth process. Charge ore is used to add oxygen to the charge before it is melted. This ore should be low in combined and uncombined moisture, silica, and fines. Ore with a high silica content requires large additions of limestone and consequently produces large volumes of slag, which reduce furnace efficiency. Iron-ore sinter has been found to be a good charge ore in open-hearth practice.

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 it is undesirable, as in charge ore, because of the larger quantity of slag resulting. Lump ore, which is preferred as feed ore, is high-priced, and the supply is limited.

Metalliferous materials consumed in steel furnaces in the United States, 1943–47, in net tons

Year	Iron ore		Sinter	Manganese ore		Pig iron	Ferro-alloys	Iron and steel scrap	
	Domestic	Foreign		Domestic	Foreign			Home	Purchased
1943	4,574,277	46,939	1,490,361	6,064	27,985	53,759,354	1,828,000	29,088,371	18,420,700
1944	4,629,102	12,562	1,586,654	2,177	9,321	54,104,677	1,648,000	29,422,868	18,193,639
1945	3,793,562	24,465	1,291,929	1,915	7,245	46,596,855	1,388,000	25,236,910	17,919,602
1946	3,117,774	446,611	769,640	2,364	2,110	38,443,934	1,044,000	19,868,551	16,513,487
1947	3,795,886	809,191	1,134,542	2,680	3,512	50,177,381	1,300,000	23,993,919	20,791,449

CONSUMPTION OF PIG IRON

Consumption of pig iron in 1947 increased 29 percent over 1946. Pig iron, a product of the blast furnace, is a semiraw material and, except for a small quantity used in direct castings, moves to steel- or iron-melting furnaces for further refining, alone or mixed with other ingredients. In 1947, 86 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 10 percent was consumed in iron-making furnaces, of which the cupola is the most important. Gray-iron foundries used 18 percent more pig iron in 1947 than in 1946. Cupolas used 9 percent of total pig iron in 1947, compared with 10 percent in 1946.

Consumption of pig iron in the United States, 1944–47, by type of furnace

Type of furnace or equipment	1944		1945		1946		1947	
	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total
Open-hearth	48,281,168	79.2	41,682,581	78.4	34,608,053	76.8	45,338,462	77.8
Bessemer	5,583,027	9.2	4,750,817	8.9	3,722,756	8.3	4,711,581	8.1
Electric	240,482	.4	163,457	.3	113,125	.3	127,338	.2
Cupola [1]	3,941,159	6.5	4,084,091	7.7	4,612,704	10.2	5,438,727	9.3
Air; Brackelsberg	499,457	.8	433,953	.8	356,436	.8	413,900	.7
Crucible	863	(2)	552	(2)	985	(2)	1,312	(2)
Puddling	28,166	(2)	22,725	(2)	14,506	(2)	16,573	(2)
Direct castings [1]	2,377,299	3.9	2,049,001	3.9	1,641,874	3.6	2,241,789	3.9
Miscellaneous					1,191	(2)	1,073	(2)
	60,951,621	100.0	53,187,177	100.0	45,071,630	100.0	58,290,755	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 1947 were located in all 48 States and in 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 together, in 1947, used 95 percent of the pig iron, Pennsylvania (the leading consumer) taking 30 percent of the total and Ohio (the second-largest consumer) 20 percent.

Consumption of pig iron in the United States, 1944–47, by States and districts

State and district	1944		1945		1946		1947	
	Consumers	Net tons	Consumers	Net tons	Consumers	Net tons	Consumers	Net tons
Connecticut	57	101,816	61	104,676	55	88,307	58	92,114
Maine	15	6,543	16	6,692	16	10,267	15	14,111
Massachusetts	104	192,870	103	184,432	94	154,654	98	199,258
New Hampshire	16	6,785	16	8,908	15	5,992	16	5,771
Rhode Island	12	39,858	12	38,670	10	28,339	12	31,036
Vermont	13	12,057	12	11,133	12	9,411	14	10,007
Total New England	217	359,929	220	354,511	202	296,970	213	352,297

Consumption of pig iron in the United States, 1944–47, by States and districts—Continued

State and district	1944 Consumers	1944 Net tons	1945 Consumers	1945 Net tons	1946 Consumers	1946 Net tons	1947 Consumers	1947 Net tons
Delaware	7	355,486	8	331,639	7	292,498	7	312,845
New Jersey [1]	74		81		77		76	
New York	194	2,958,342	197	2,598,306	179	2,201,586	172	2,966,882
Pennsylvania [1]	380	19,095,662	434	16,047,518	354	13,120,922	349	17,287,166
Total Middle Atlantic	655	22,409,490	720	18,977,463	617	15,615,006	604	20,566,893
Alabama	67	3,263,647	69	2,884,295	66	2,568,276	69	3,356,612
District of Columbia	1	3,185,611	3	2,848,408	1	2,629,314	1	3,150,317
Kentucky [1]	24		24		24		24	
Maryland [1]	22		26		21		19	
West Virginia	25	1,671,046	25	1,433,478	25	1,115,785	25	1,379,112
Florida	19	89,835	18	88,111	17	63,613	14	37,525
Georgia	49		52		52		49	
Mississippi	6	903	6	1,023	8	2,256	8	2,596
North Carolina	46	18,062	48	22,886	50	28,423	47	27,466
South Carolina	17	4,779	17	5,355	17	7,348	16	9,169
Tennessee	54	162,913	55	176,736	52	197,055	53	254,202
Virginia	49		53		53		54	
Total Southeastern	379	8,396,796	396	7,460,292	386	6,612,070	379	8,216,999
Arkansas	5	6,826	5	7,944	4	5,620	4	5,766
Oklahoma	13		12		10		9	
Louisiana	12		13		12		11	
Texas	45	152,058	42	174,497	37	54,138	37	120,091
Total South Central	75	158,884	72	182,441	63	59,758	61	125,857
Illinois [1]	209	5,158,045	225	4,426,898	208	3,716,293	208	4,782,722
Indiana	131	7,453,187	142	6,543,439	126	5,356,288	128	6,810,122
Iowa	55	103,055	56	83,412	58	104,744	54	98,116
Minnesota	58	443,943	63	426,666	61	443,861	59	445,584
Missouri	59	130,537	56	106,734	52	93,298	51	80,926
Kansas	21	10,381	24	13,532	24	16,901	22	14,041
Nebraska	12		13		11		11	
Michigan	178	2,332,201	189	2,228,616	173	2,275,887	167	2,737,764
Wisconsin	110		122		115		116	
North Dakota	1	412	1	578	1	316	1	225
South Dakota	1		1		1		1	
Ohio [1]	335	12,271,656	339	10,803,564	297	9,162,118	299	11,674,075
Total North Central	1,170	27,903,417	1,231	24,633,439	1,127	21,169,706	1,117	26,643,575
Arizona	3	91	4	133	5	1,022	4	1,215
Nevada								
New Mexico								
Colorado	20	1,082,544	28	1,067,032	26	761,468	26	1,511,704
Utah								
Idaho	3	367	4	495	4	1,547	5	3,041
Wyoming								
Montana								
Total Rocky Mountain	26	1,083,002	36	1,067,660	35	764,037	35	1,515,960
Oregon	33	39,614	31	34,834	32	33,795	26	17,812
Washington	37		40		31		31	
California [1]	128	600,489	137	476,537	123	520,288	116	635,164
Total Pacific Coast	198	640,103	208	511,371	186	554,083	173	652,976
Undistributed [1]	------	------	------	------	------	------	7	216,198
Total United States	2,720	60,951,621	2,883	53,187,177	2,616	45,071,630	2,589	58,290,755

[1] In 1947, some pig iron consumed in California, Illinois, Kentucky, Maryland, New Jersey, Ohio, and Pennsylvania—not separable—is included with "Undistributed."

PRICES

The average value of all grades of pig iron given in the accompanying table is compiled from reports of producers to the Bureau of Mines. The figures represent f. o. b. blast furnaces and do not include the value of ferro-alloys. The general average value for all grades of pig iron at furnaces was $30.34 a net ton in 1947, compared with $24.49 in 1946.

Average value per net ton of pig iron at blast furnaces in the United States, 1943–47, by States

State	1943	1944	1945	1946	1947
Alabama	$17.35	$17.34	$18.39	$21.15	$28.12
California, Colorado, and Utah	18.59	19.04	19.49	21.25	30.50
Illinois	21.43	20.92	22.98	25.17	30.97
Indiana	22.39	22.41	23.11	25.46	30.57
Michigan	16.60	17.21	17.60	27.19	32.25
New York	20.20	19.96	22.83	22.82	27.54
Ohio	21.78	21.96	22.99	24.90	30.87
Pennsylvania	21.49	21.48	22.37	24.70	30.23
Other States [1]	19.48	20.10	20.48	24.95	31.52
Average for United States	20.95	20.97	22.01	24.49	30.34

[1] Comprises Kentucky, Maryland, Massachusetts, Minnesota, Tennessee, Texas, Virginia, and West Virginia.

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, 1946–47

[Metal Statistics, 1948]

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	
	1946	1947	1946	1947	1946	1947	1946	1947
January	$19.76	$24.00	$22.99	$27.23	$23.44	$27.68	$22.54	$26.79
February	19.76	24.00	22.99	27.23	23.44	27.68	22.54	26.79
March	20.12	26.06	23.35	29.91	23.79	30.36	22.90	29.46
April	20.43	26.68	23.66	29.91	24.11	30.36	23.21	29.46
May	20.56	26.68	23.79	29.91	24.24	30.36	23.35	29.46
June	22.21	26.68	25.45	29.91	25.89	30.36	25.00	29.46
July	22.21	27.88	25.45	31.36	25.89	31.80	25.00	30.91
August	22.21	29.80	25.45	32.59	25.89	33.04	25.00	32.14
September	22.21	29.80	25.45	32.59	25.89	33.04	25.00	32.14
October	22.21	29.80	25.45	32.59	25.89	33.04	25.00	32.14
November	22.21	29.80	25.45	32.59	25.89	33.04	25.00	32.14
December	23.50	29.80	26.59	32.59	27.04	33.04	26.14	32.14
Average	21.45	27.58	24.67	30.70	25.12	31.14	24.22	30.20

Composite prices of finished steel in the United States, 1938–47, by months, in cents per pound [1]

[Iron Age]

Month	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
January	2.58414	2.35367	2.30467	2.30467	2.28249	2.29176	2.27235	2.38444	2.54490	2.86410
February	2.58084	2.35367	2.30467	2.30467	2.28249	2.29176	2.27235	2.38444	2.54490	2.87118
March	2.57754	2.35367	2.30467	2.30467	2.28249	2.29176	2.27235	2.38444	2.54490	2.87118
April	2.57754	2.35367	2.26015	2.30467	2.28249	2.29176	2.30329	2.42471	2.73011	2.88239
May	2.56939	2.30807	2.30467	2.30467	2.28249	2.29176	2.30329	2.42471	2.73011	2.88239
June	2.51300	2.28297	2.30467	2.30467	2.28249	2.29176	2.30329	2.42471	2.73011	2.88239
July	2.35944	2.28297	2.30467	2.30467	2.28249	2.29176	2.30837	2.44076	2.70711	2.90953
August	2.35944	2.28297	2.30467	2.30467	2.28249	2.29176	2.30837	2.44076	2.70711	3.18676
September	2.35655	2.28297	2.30467	2.30467	2.28249	2.29176	2.30837	2.44076	2.70711	3.18925
October	2.31964	2.28297	2.30467	2.30467	2.28249	2.29176	2.21188	2.44104	2.70379	3.19541
November	2.35367	2.28837	2.30467	2.30467	2.28249	2.29176	2.21188	2.44104	2.70379	3.19541
December	2.35367	2.30467	2.30467	2.30467	2.28249	2.29176	2.21188	2.44104	2.73347	3.19541
Average	2.45874	2.31088	2.30096	2.30467	2.28249	2.29176	2.27298	2.42277	2.67395	3.01013

[1] Weighted average of Iron Age quotations on following steel items: Hot-rolled and cold-rolled strip, sheets, bars, plates, shapes, wire rods, rails, and pipe. The composite was revised in 1941 to obtain greater sensitivity in reflecting price changes. (For details of revisions see Iron Age, Aug. 28, 1941, p. 92.) Prior to 1941, this index was computed on the basis of finished steel shipments in the 10-year period 1929–39. The 3 years, 1941, 1942, and 1943, are based on annual shipments for the year. Since 1944, the index has been based on quarterly shipments.

FOREIGN TRADE [1]

Imports of pig iron for consumption in 1947 increased 132 percent quantitatively from 1946, but the value of imports increased 253 percent. Norway, Poland, and the United Kingdom supplied 78 percent of United States receipts during the year.

Pig iron imported for consumption in the United States, 1943–47, by countries, in net tons

[U. S. Department of Commerce]

Country	1943	1944	1945	1946	1947
North America:					
Canada	49	5,778	21,150	1,287	1,747
Mexico				11,248	1,004
Europe:					
Austria					281
Netherlands					2,711
Norway					9,482
Poland and Danzig					7,466
Sweden				28	
U. S. S. R.					1,357
United Kingdom	560			1,528	8,576
Asia: India	500				
Oceania: Australia	336				
Total: Net tons	1,445	5,778	21,150	14,091	32,624
Value	$41,408	$116,408	$432,621	$492,519	$1,738,812

Exports of pig iron from the United States decreased 58 percent in quantity and 62 percent in value from 1946. Shipments went to only 14 countries in 1947 compared with at least 28 in 1946. The Belgium—Luxembourg customs district was the main recipient in 1947, taking 73 percent of the total.

[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.

Pig iron exported from the United States, 1946–47, by countries, in net tons [1]

[U. S. Department of Commerce]

Country	1946	1947	Country	1946	1947
North America:			Europe—Continued		
Canada	11,789	9,523	Denmark	1,120	----------
Canal Zone	104	278	France	14,000	----------
Cuba	122	47	Greece	695	3
Dominican Republic	214	----------	Italy	16,856	----------
El Salvador	62	34	Portugal	2,316	----------
Other North America	29	19	Sweden	24,082	----------
South America:			Other Europe	112	----------
Argentina	4,772	140	Asia:		
Bolivia	144	6	China	12,155	----------
Chile	904	500	Palestine and Trans-Jordan	112	----------
Colombia	756	----------	Philippines, Republic of	60	133
Paraguay	28	----------	Africa:		
Peru	854	224	Algeria	56	----------
Uruguay	3,366	3	Egypt	143	30
Venezuela	497	----------	Other Africa	111	----------
Other South America	239	----------			
Europe:			Total: Net tons	95,698	40,202
Belgium and Luxembourg	----------	29,262	Value	$2,670,369	$1,011,502

[1] Changes in table in Minerals Yearbook, 1946, p. 639, are as follows: 1945: U. S. S. R., 241. Total: Net tons 90,833; value $2,393,129.

Imports and exports of iron and steel products are given in detail in the following table.

Iron and steel imported for consumption in the United States, 1945–47, by commodities

[U. S. Department of Commerce]

Commodity	1945		1946		1947	
	Net tons	Value	Net tons	Value	Net tons	Value
Semimanufactures:						
Steel bars:						
Concrete reinforcement bars	--------	----------	(1)	$23	2	$191
Solid or hollow, n. e. s	1,592	$183,420	863	183,311	687	161,230
Hollow and hollow drill steel	37	7,436	101	19,773	37	7,515
Bar iron	24	3,461	404	62,932	250	46,526
Wire rods, nail rods, and flat rods up to 6 inches in width	2,199	263,152	6,051	795,104	6,018	906,483
Boiler and other plate iron and steel, n. e. s	72	47,443	2,048	124,846	663	52,652
Steel ingots, blooms, and slabs	1,655	115,774	589	44,968	1,513	68,353
Billets, solid or hollow	6,456	477,032	603	43,124	4	798
Die blocks or blanks; shafting, etc	360	70,577	273	69,083	240	79,054
Circular saw plates	--------	----------	(1)	397	2	1,632
Sheets of iron or steel, common or black, and boiler or other plate iron or steel	91	8,330	113	11,568	750	58,819
Sheets and plates and steel, n. s. p. f	2,487	225,472	91	20,092	431	48,941
Tin plate, terneplate, and taggers' tin	164	41,792	334	90,143	655	192,853
Total semimanufactures	15,137	1,443,889	11,470	1,465,364	11,252	1,625,047
Manufactures:						
Structural iron and steel	2,682	162,755	875	106,447	1,730	257,073
Rails for railways	27,766	573,773	5,771	113,678	8,859	211,223
Rail braces, bars, fishplates or splice bars, and tie plates	4,708	163,805	2,226	81,089	1,408	57,188
Pipes and tubes:						
Cast-iron pipe and fittings	8	2,229	215	42,959	59	10,155
Other pipes and tubes	910	139,473	203	26,045	6,228	1,519,443
Wire:						
Barbed	(1)	19	--------	----------	(1)	32
Round wire, n. e. s	21	4,588	207	40,341	97	25,423
Telegraph, telephone, etc., except copper, covered with cotton jute, etc	63	49,299	6	3,941	122	28,949
Flat wire and iron or steel strips	1,958	1,309,525	2,947	2,095,054	2,634	1,885,742
Rope and strand	2,415	949,064	294	89,483	312	92,438
Galvanized fencing wire and wire fencing	--------	----------	9	129	3	308
Hoop, band and strips, or scroll iron or steel, n. s. p. f	98	112,432	50	65,944	35	48,058
Nails	27	14,774	183	53,222	116	51,357
Castings and forgings, n. e. s	20,064	2,816,502	1,047	217,289	1,216	303,499
Total manufactures	60,720	6,298,238	14,033	2,935,621	22,819	4,490,888
Grand total	75,857	7,742,127	25,503	4,400,985	34,071	6,115,935

[1] Less than 1 ton.

Iron and steel exported from the United States, 1945–47, by commodities

[U. S. Department of Commerce]

Commodity	1945 Net tons	1945 Value	1946 Net tons	1946 Value	1947 Net tons	1947 Value
Semimanufactures:						
Steel ingots, blooms, billets, slabs, and sheet bars	203,746	$10,664,091	452,534	$21,316,011	491,215	$32,490,308
Iron and steel bars and rods:						
Iron bars	3,166	300,395	25,572	2,059,874	34,752	3,948,426
Concrete reinforcement bars	267,080	15,017,384	199,651	12,624,758	248,373	23,191,211
Other steel bars	332,456	35,240,227	478,637	37,727,642	850,026	91,406,772
Wire rods	109,334	5,493,116	62,355	3,838,543	71,237	7,116,964
Iron and steel plates, sheets, skelp, and strips:						
Boiler plates	25,485	1,512,117	61,703	3,766,241	32,558	2,762,273
Other plates, not fabricated	188,478	11,886,100	470,904	29,655,835	529,922	45,086,679
Skelp iron or steel	146,535	6,380,416	56,563	2,609,715	67,403	3,451,166
Iron and steel sheets, galvanized	174,746	15,158,621	77,747	7,556,987	74,440	10,511,185
Steel sheets, black, ungalvanized	742,303	53,249,618	482,783	46,077,869	568,760	85,165,592
Iron sheets, black	12,835	943,910	31,177	2,477,937	30,215	3,753,982
Strip band, and scroll iron or steel:						
Cold-rolled	57,717	7,821,216	64,626	9,323,516	89,618	17,474,960
Hot-rolled	84,669	6,505,636	84,376	6,323,882	107,149	10,963,981
Tin plate, terneplate, and taggers' tin	527,610	55,457,364	398,490	43,568,821	620,198	86,917,802
Total semimanufactures	2,876,160	225,630,211	2,947,118	228,927,631	3,815,866	424,241,301
Manufactures—steel-mill products:						
Structural iron and steel:						
Water, oil, gas, and other storage tanks complete and knocked-down material	32,977	4,346,698	49,331	5,872,907	98,234	15,178,585
Structural shapes:						
Not fabricated	286,412	14,428,679	319,103	18,074,652	463,375	32,519,487
Fabricated	57,032	8,493,407	99,477	14,890,198	244,934	38,741,120
Plates, fabricated, punched, or shaped	197,929	21,760,743	34,856	2,629,060	36,898	4,171,032
Metal lath	1,891	330,868	3,538	679,016	5,717	1,216,971
Frames, sashes, and sheet piling	22,620	1,431,836	27,356	2,092,382	37,709	4,388,473
Railway-track material:						
Rails for railways	327,884	14,429,681	385,583	18,520,263	500,582	31,732,249
Rail joints, splice bars, fishplates, and tie plates	69,245	4,313,944	53,072	4,164,363	119,411	9,897,099
Switches, frogs, and crossings	37,999	4,933,999	6,763	1,216,754	7,249	1,651,127
Railroad spikes	15,907	1,327,191	12,045	1,214,087	23,459	2,684,325
Railroad bolts, nuts, washers, and nut locks	6,419	1,078,990	8,470	1,372,811	7,759	1,603,871
Tubular products:						
Boiler tubes	52,724	8,140,464	44,565	6,688,123	69,951	13,314,243
Casing and oil-line pipe	256,749	24,520,446	179,781	18,912,327	332,877	39,665,391
Seamless black pipe, other than casing and oil line	21,576	2,355,272	14,870	1,838,380	18,717	2,856,028
Welded black pipe	64,326	6,206,191	85,280	8,174,177	90,995	10,847,857
Welded galvanized pipe	57,261	6,184,518	61,062	7,100,025	70,219	11,577,836
Malleable-iron screwed pipe fittings	3,681	1,534,075	4,431	1,924,231	5,164	2,887,552
Cast-iron screwed pipe fittings	938	278,819	1,030	302,017	2,946	1,249,402
Cast-iron pressure pipe and fittings	65,496	4,375,463	43,724	3,154,665	41,040	3,575,451
Cast-iron soil pipe and fittings	7,346	663,091	2,727	286,013	5,602	849,972
Riveted-steel or iron pipe and fittings	61,626	18,180,458	72,985	17,617,034	101,850	30,914,371
Wire and manufactures:						
Barbed	29,251	3,340,550	52,509	5,613,481	84,346	12,093,216
Galvanized wire	61,929	6,840,616	65,218	10,019,634	101,026	19,428,575
Iron and steel wire, uncoated	59,620	6,482,572	46,800	4,862,386	78,862	12,322,992
Wire rope and strand	31,607	12,300,784	34,710	11,594,081	30,829	10,319,192
Woven-wire fencing and screen cloth	9,646	3,027,289	13,258	3,815,838	18,356	7,481,477
All other	36,336	8,308,768	35,564	10,116,336	67,443	18,513,762
Nails and bolts (except railroad):						
Wire nails	31,264	2,870,862	19,102	2,046,774	25,754	3,915,832
Horseshoe nails	1,529	472,875	2,080	676,421	1,025	368,679
All other nails, including tacks and staples	9,528	1,817,263	9,570	2,013,472	14,970	3,714,788
Bolts, nuts, rivets, and washers (except aircraft and railroad)	41,805	10,638,205	31,622	9,216,175	48,323	15,487,672
Castings and forgings:						
Horseshoes, mule shoes, and calks	1,681	260,174	1,859	274,969	897	178,977
Iron and steel, including car wheels, tires, and axles	169,678	21,158,448	121,396	15,202,594	191,292	24,307,976
Total manufactures	2,131,912	226,833,239	1,943,737	212,175,646	2,947,811	389,655,580

Iron and steel exported from the United States, 1945–47, by commodities—Con.

Commodity	1945		1946		1947	
	Net tons	Value	Net tons	Value	Net tons	Value
Advanced manufactures:						
House-heating boilers and radiators		$351,992		$527,680		$1,898,479
Oil burners and parts		2,299,341		5,541,272		15,905,896
Tools:						
Axes		684,018		826,970		1,379,579
Shovels, spades, scoops, and drainage tools		1,028,657		844,529		1,404,422
Hammers and hatchets		1,124,035		1,033,422		1,665,521
Saws, wood and metal cutting		5,774,538		5,260,775		7,441,018
All other tools		36,907,814		34,383,214		57,877,807
Total advanced manufactures		48,170,395		48,417,862		87,572,722

WORLD REVIEW

The United States Steel Export Co. has estimated that, of the 1947 world steel production of 150,000,000 tons, approximately 12,500,000 tons entered world trade.[2] Although the total 1947 production was 4,500,000 tons over the prewar year 1937, the world trade was 8,500,000 tons less. The high 1947 production rate was largely due to the high level of United States production, as Germany, which produced 19,000,000 tons in 1937, approximated 3,000,000 tons in 1947. Similarly, Japan, which formerly produced about 6,000,000 tons annually, attained a rate of only slightly more than 1,000,000 tons in 1947.

The following tables show pig-iron production from records of the Bureau of Mines and production of steel by the important producing nations, compiled by the American Iron and Steel Institute.

World production of pig iron (including ferro-alloys), 1941–47, by countries, in metric tons [1]

[Compiled by B. B. Mitchell]

Country [1]	1941	1942	1943	1944	1945	1946	1947
Australia [2]	1,499,392	1,582,641	1,421,765	1,326,308	1,135,648	920,829	1,161,479
Austria	652,300	783,481	965,000	926,178	101,549	54,430	278,505
Belgium	1,422,090	1,269,450	1,630,570	718,490	734,580	2,160,830	2,816,780
Brazil	208,795	213,619	247,680	292,169	259,909	369,254	480,929
Canada	1,566,171	1,981,309	1,773,866	1,836,088	1,774,497	1,379,605	1,922,930
Chile	6,607	4,376	9,256	5,948	172,242	365,345	480,638
China [3]	1,960,311	4,743,251	[4] 1,867,507	[4] 2,121,574	493,575	31,000	35,733
Czechoslovakia	1,572,000	1,596,000	1,704,000	1,584,000	576,000	961,000	1,422,466
Finland	22,170	28,886	43,277	100,303	36,798	77,088	70,637
France	3,350,933	3,837,621	4,920,730	2,892,694	1,197,142	3,494,258	4,943,000
Germany	15,433,000	15,441,000	15,972,000	13,370,000	[5, 6] 1,123,000	[6] 2,083,400	[6] 2,261,200
Hungary	444,720	420,470	420,620	[7] 396,260	[7] 43,700	160,180	299,400
India	2,042,123	1,859,108	1,776,941	1,453,713	1,417,309	1,466,542	1,463,112
Indochina, French	(8)	1,146	2,922	1,926			(8)
Italy	1,109,914	974,262	689,012	279,057	71,355	199,600	[9] 318,005
Japan	[10] 4,366,158	[10] 4,362,249	[10] 4,103,813	[10] 2,114,177	[10] 1,165,855	[9] 218,000	[9] 397,000
Korea	300,256	398,428	543,492	567,856	166,900	[11] 10,000	[11] 20,000
Luxembourg	1,343,017	1,689,121	2,289,740	1,348,096	316,477	1,364,400	1,818,160
Mexico [9]	96,638	123,761	123,325	135,157	218,322	282,243	235,620
Netherlands	(8)	(8)	(8)	(8)	(8)	[10] 222,129	[10] 322,585
Norway	123,294	110,838	144,855	123,745	50,995	135,410	165,232
Poland	731,600	741,700	741,700	690,900	228,249	725,736	867,121
Rumania	118,799	161,014	172,806	140,736	53,862	65,867	89,924

See footnotes at end of table.

[2] American Metal Market, vol. 55, No. 2, Jan. 3, 1948, p. 1.

World production of pig iron (including ferro-alloys), 1941–47, by countries, in metric tons [1]—Continued

Country [1]	1941	1942	1943	1944	1945	1946	1947
Saar	2,153,000	2,161,000	2,302,000	1,629,000	(8)	234,562	654,430
Spain	545,148	549,030	697,318	564,294	488,414	509,441	517,180
Sweden	749,470	771,190	831,769	888,219	785,359	719,336	724,569
Switzerland	9,500	12,400	15,400	29,400	2,770	11,500	5,000
Turkey	86,057	67,350	55,259	69,795	69,524	78,886	99,027
Union of South Africa	360,000	362,800	486,800	471,520	555,700	560,000	630,000
U. S. S. R. [11]	11,450,000	4,280,000	5,500,000	7,210,000	8,730,000	9,780,000	11,200,000
United Kingdom	7,510,600	7,726,000	7,302,250	6,844,621	7,221,474	7,885,564	7,909,543
United States	51,456,627	55,316,075	56,969,248	57,059,457	49,855,561	42,023,299	54,558,725
Yugoslavia	[12] 50,561	(8)	(8)	(8)	(8)	(8)	163,000
Total (estimate)	112,900,000	113,800,000	115,900,000	107,300,000	79,300,000	79,000,000	99,000,000

1 Pig iron is also produced in Belgian Congo, New Zealand, and Republic of the Philippines, but quantity produced is believed insufficient to affect estimate of world total.
2 Data for fiscal year ended June 30 of year stated.
3 Data represent area designated as Free China during the period of Japanese occupation. Figures for production in 1941–42 and 1945–47 are not available and not included with China, but estimates are included in total.
4 Includes Manchuria.
5 January, February, September-December, inclusive only.
6 Excludes Russian Zone.
7 Data represent Trianon Hungary subsequent to October 1944.
8 Data not available; estimate by author of chapter included in total.
9 Excluding ferro-alloy production, for which data are not yet available.
10 Data for fiscal year ended March 31 of year following that stated.
11 Estimate.
12 Croatia only.

World production of steel, 1943–47 by countries, in net tons

[American Iron and Steel Institute]

Country	1943	1944	1945	1946	1947
Austria	----------	----------	189,155	206,681	394,293
Belgium	1,838,636	701,063	812,395	2,517,653	3,186,749
Canada	2,872,489	2,930,174	2,803,097	2,293,005	2,901,670
Czechoslovakia	2,830,706	2,777,796	1,044,980	1,843,046	2,519,858
France	5,651,492	3,408,311	1,822,077	4,858,938	6,338,225
Germany	22,011,800	20,191,930	[1] 321,872	[1] 2,962,982	[1] 3,290,366
Hungary	855,826	765,878	141,535	388,891	657,853
Italy	1,904,774	1,137,574	436,511	1,269,850	1,874,000
Japan [2]	9,675,989	7,031,572	1,177,256	608,470	1,040,571
Luxembourg	2,367,740	1,388,898	291,007	1,426,376	1,888,240
Poland	869,700	755,000	545,670	1,343,704	1,730.611
Russia	13,300,000	15,400,000	19,800,000	20,000,000	22,600,000
Saar	2,635,600	1,974,220	----------	320,769	776,019
Spain	720,561	545,935	617,308	655,868	581,132
Sweden	1,338,189	1,319,936	1,326,560	1,334,885	1,310,635
United Kingdom	14,594,944	13,599,264	13,243,328	14,219,520	14,246,400
United States	88,836,512	89,641,600	79,701,648	66,602,724	84,894,071
Total above	172,304,958	163,569,151	124,274,399	122,853,362	150,230,693

1 American, British, and French zones.
2 Includes Korea and Manchuria in 1943–44.

REVIEW BY COUNTRIES

Argentina.—The Argentine Government has indicated an interest in developing an Argentine steel industry and opened an experimental blast furnace in 1945 in the Province of Jujuy. Negotiations were under way in 1947 between Government and industry with a view toward organizing an integrated steel industry in Argentina.

Austria.—Before its dissolution, the Austro-Hungarian empire had an annual capacity for producing 3.5 million tons of steel and 2.5 million tons of pig iron. After 1919 Austria was left with a capacity of only 500,000 tons of pig iron and 700,000 tons of steel. Recovery of the Austrian steel industry was very slow, but after the Anschluss the Germans constructed a large steel works at Linz, with the result that Austria's present capacities for pig-iron and steel are respectively, three times and twice the former rate. If enough coal became available, it is believed that Austria could furnish its own steel requirements and have a substantial surplus for export.[3]

Belgium.—An agreement was concluded in March 1947 between Belgium and Great Britain whereby Belgium-Luxembourg would supply British industry with 23,000 tons of steel products per quarter during the year beginning April 1, 1947. Under the agreement, the quarterly deliveries were to consist of 20,000 tons of semifinished steel and 3,000 tons of fabricated products. Specifications and prices were to be established in advance of each quarter.[4]

Brazil.—A new 12-ton electric furnace was placed in operation early in 1947 in Usina Santo Olympia in São Paulo—the third electric furnace at this mill; scrap is used exclusively in making low-carbon steel for the company rolling mills. In 1946 Santo Olympia produced 15,000 metric tons of ingots and 14,500 tons of rolled steel.[5]

The Brazilian steel industry and its ore resources were described by Vaill.[6]

Chile.—An American company has contracted with Compania de Acero del Pacifico of Chile to supervise construction, engineering, and management of the first integrated steel plant to be built in Chile. The new plant will be built at Concepcion on San Vicinte Bay at a cost of more than $50,000,000. The plant will be financed jointly by Chilean capital and by the Export-Import Bank. The plant, planned for completion in 1949, will have a capacity of 250,000 tons of finished-steel products per year, and it is expected that Chilean raw materials will be used.[7]

China.—The Anshan Iron and Steel Works is reported to be producing 3,500 metric tons of steel products per month with plans to increase production quickly to 6,000 tons. A second open-hearth furnace was scheduled to be put into operation in December 1947.[8]

Czechoslovakia.—The Czechoslovakian steel industry produced 157,377 tons of iron and steel castings and 803,628 tons rolled steel products during the first 6 months of 1947.[9]

France.—Pig-iron and steel were both of short supply in France during 1947—a condition that was aggravated by industrial strikes late in the year. The following table compares the production of iron and steel in March, April, and May with the prewar rates.

[3] Lynch, Edward C., Austrian Iron and Steel Industry: U. S. Legation, Vienna, Austria, Rept. 50, Apr. 28, 1947, 8 pp.
[4] Miller, R. C., British-Belgo-Luxembourg Steel Agreement: U. S. Embassy, Brussels, Belgium, Rept. 371, Mar. 20, 1947, 1 page.
[5] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 1, July 1947, p. 13.
[6] Vaill, Ralph, Brazilian Ore Resources and the Volta Redondo Plant: Blast Furnace and Steel Plant, November 1947, p. 1365.
[7] Steel, Chile Plans New Steel Plant: Vol. 121, No. 23, Dec. 8, 1947, p. 73.
[8] American Consul General, Shanghai, No. A-716, Oct. 3, 1947.
[9] Metal Bulletin (London), No. 3210, July 25, 1947, p. 15.

Production of pig iron and steel in France, 1938–39, and March–May 1947 [1]

[Thousands of metric tons]

	Monthly averages		March 1947	April 1947	May 1947	
	1938	1939			Quantity	Percent of 1938
Pig iron	501	615	408	416	426	85
Steel ingots and castings	518	662	490	498	496	[2] 96
Basic Bessemer	311	391	260	273	278	89
Open-hearth	173	219	184	179	172	99
Electric	30	48	44	46	45	150
Rolled finished products	343	408	367	355	331	[2] 97

[1] Iron and Coal Trades Review (London), vol. 155, No. 4138, July 4, 1947, p. 35.
[2] Corrected figure.

Germany.—Anglo-American conferences in September 1947 resulted in an agreement to permit increases in German steel capacity to 10,700,000 tons annually compared with a previous restriction of 7,500,000 tons. This agreement limited capacity, and production was still to be controlled according to availability of fuel and other factors.[10]

Italy.—The steel industry of Italy in 1947 was restricted by shortages, especially in coal.

Norway.—It is reported that Norsk Jernverk, the company organized for the purpose of developing a new steel plant at Mo i Rana in Northern Norway, informed the Ministry of Commerce that it will require 133 million kroner to carry out its construction plans. Of this sum, 55 million kroner were included in the 1946–47 budget. Norsk Jernverk has been subjected to criticism in Norway as to the location of the plant, some critics being of the opinion that electric pig iron proposed for production at the new plant will be too expensive and that better sources of raw materials would be available at other locations. The company is reported to have contracted for three electric furnaces with an annual capacity of 240,000 tons of pig iron.[11]

Poland.—At the end of March 1947, 13 blast furnaces, 47 open-hearth furnaces, and 15 electric furnaces were operating in Poland. Production of ferrous products in metric tons during the first quarter 1947 were as follows: Pig iron, 170,942 tons; steel ingots, 326,374 tons; rolled products, 244,240 tons, pipes (other than rolled), 3,350 tons; forgings, 18,694 tons; iron ingots, 7,747 tons; and steel castings, 5,888 tons.[12]

The Polish iron and steel industry was described during 1947.[13]

Sweden.—Production of steel ingots in Sweden during the first quarter of 1947 totaled 310,000 tons compared with 350,000 tons in the same period of 1946. To augment the supply, an agreement was reached with Austria to obtain 7,400 tons of iron and steel products during the second and third quarters of 1947. An agreement between Sweden and Russia was reported whereby Sweden would receive

[10] Steel, Boost in German Steel Capacity to be Allowed: Vol. 121, No. 10, Sept. 8, 1947, p. 58.
[11] Baldwin, Charles F., Developments in Connection with New Norwegian Steel Project: American Embassy, Oslo, Norway, Rept. 117, Mar. 31, 1947.
[12] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 1, July 1947, p. 14.
[13] Mining Journal (London), vol. 229, No. 5839, July 19, 1947, p. 442.

fabricated products other than iron and steel in exchange for finished iron and steel products.[14]

United Kingdom.—Steel production was retarded in the United Kingdom during much of 1947, resulting largely from an acute shortage of ferrous scrap. Consequently, efforts were made to obtain more pig iron by improving the supply of iron ore and coke. In September 1947 steel production had exceeded the target rate for 1947 and was not far below the 1948 goal. The average weekly production for September was 298,000 short tons of steel ingots and castings, an annual rate of 15,500,000 tons. The cumulative production through September, however, was less than 75 percent of the original 1947 quota. The revised goal for 1947 was 14,000,000 tons and for 1948 is 14,000,000 tons. The highest rate of production ever attained in Great Britain was 15,700,000 tons in May 1940. The weekly pig-iron production of 160,000 tons and 165,000 tons in July and August was approximately 10 percent above the 1938 average but slightly less than the level of production obtained in 1946. Production of iron ore in the United Kingdom, which provided about two-thirds of the total supply in 1946, averaged 235,000 and 232,000 tons weekly in July and August. Metallurgical coke production in July and August averaged 298,000 tons weekly, a level slightly less than that of 1946.[15]

Announcement was made in August 1947 by the Iron and Steel Board authorizing expansion of steel making, blast furnace, and rolling mill capacity. These projects are to cost $500,000,000 and some will replace obsolete facilities. Plans for new steel furnaces permitting a capacity increase of 4,148,000 tons has been submitted for approval.[16]

A study of future British steel needs was made during the year.[17]

U. S. S. R.—In a Foreign Ministers' Conference in London late in 1947 the Soviet Delegation presented information regarding the damage done to Russian industries during the war with Germany. It was claimed that the German invaders damaged 37 iron and steel works which employed 168,000 workers and had annually produced 11,000,000 tons of pig iron, 10,000,000 tons of steel, and 8,000,000 tons of rolled steel.[18]

According to statements made in Russia regarding the fourth Five-Year Plan, pig-iron production in 1946 was 112 percent of the 1945 output, steel ingots 109 percent, and rolled products 113 percent. Fifty-one percent of the Russian iron and steel industry was said to be located east of the Urals.[19]

The iron and steel industry of Russia was recently described.[20]

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[14] Steel, Steel-Ingot Production in Sweden Drops During First Quarter of 1947: Vol. 121, No. 3, July 21, 1947, p. 81.

[15] Weaver, Findley, U. S. Embassy, London, England, Rept. 1840, Oct. 27, 1947.

[16] Steel, Substantial Portion of British Steel Expansion Plans Approved: Vol. 121, No. 6, Aug. 11, 1947, pp. 62–63.

[17] Iron Age, Official Discloses Statistics on Future British Steel Needs: Vol. 159, No. 25, June 19, 1947, p. 164.

[18] Metal Bulletin (London), No. 3252, Dec. 23, 1947, p. 10.

[19] Steel, vol. 120, No. 24, June 16, 1947, p. 71.

[20] Alexandrovsky, Ing. J., The Iron and Steel Industry in Russia: Engineering (London), vol. 165, No. 4280, Feb. 6, 1948, pp. 141–143.

Iron and Steel Scrap

By NORWOOD B. MELCHER AND JAMES E. LARKIN

GENERAL SUMMARY

A LARGER output of steel ingots and castings in 1947 as compared with the previous year resulted in a 26-percent increase in the use of ferrous materials; the quantity used—119,155,116 short tons—was the largest since 1944. In spite of the greater demand, stocks of purchased scrap totaled 3,030,221 short tons on December 31, 1947, 40 percent more than at the beginning of the year and equivalent to a 38-day supply at the 1947 average daily consumption rate of 80,234 short tons. Consumption of purchased scrap in 1947 totaled 29,285,419 short tons—an all-time record; home-scrap (representing 26 percent of the total melt) consumption amounted to 31,578,942 short tons and was the highest since 1944. Pig-iron consumption during the year totaled 58,290,755 short tons,

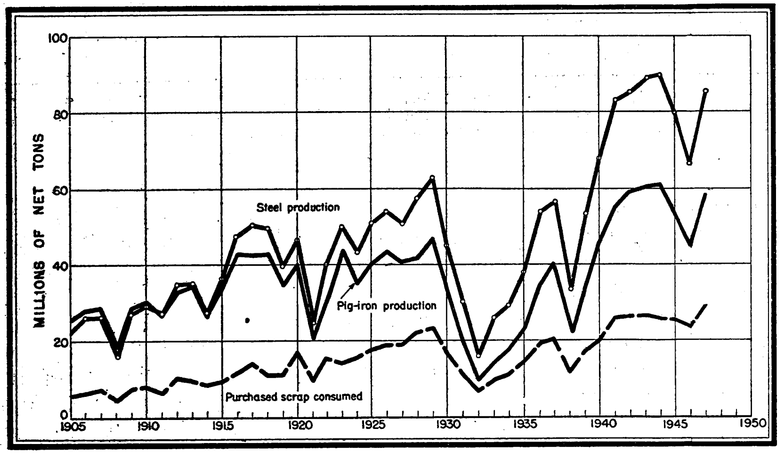

FIGURE 1.—Consumption of purchased scrap and output of pig iron and steel in the United States, 1905–47. Figures on consumption of purchased scrap for 1905–32 are from State of Minnesota vs. Oliver Iron Mining Co., et al., Exhibits, vol. 5, 1935, p. 328; those for 1933–34 are estimated by authors; and those for 1935–47 are based on Bureau of Mines reports. Data on output of steel are as given by the American Iron and Steel Institute.

Salient statistics of ferrous scrap and pig iron in the United States, 1946–47

	1946 (short tons)	1947 (short tons)	Percent of change from 1946
Stocks, December 31:			
Ferrous scrap and pig iron at consumers' plants:			
Home scrap	1,230,276	1,400,719	+14
Purchased scrap	2,167,145	3,030,221	+40
Pig iron	915,168	988,435	+8
	4,312,589	5,419,375	+26
Consumption:			
Ferrous scrap and pig iron charged to—			
Steel furnaces: [1]			
Home scrap	19,868,551	23,993,919	+21
Purchased scrap	16,513,487	20,791,449	+26
Pig iron	38,443,934	50,177,381	+31
	74,825,972	94,962,749	+27
Iron furnaces: [2]			
Home scrap	6,193,237	7,509,888	+21
Purchased scrap	5,655,283	7,055,910	+25
Pig iron	6,626,505	8,112,301	+22
	18,475,025	22,678,099	+23
Miscellaneous uses [3] and ferro-alloy production:			
Home scrap	72,375	75,135	+4
Purchased scrap	1,181,178	1,438,060	+22
Pig iron	1,191	1,073	−10
	1,254,744	1,514,268	+21
All uses:			
Home scrap	26,134,163	31,578,942	+21
Purchased scrap	23,349,948	29,285,419	+25
Total ferrous scrap	49,484,111	60,864,361	+23
Pig iron	45,071,630	58,290,755	+29
	94,555,741	119,155,116	+26
Imports	57,701	70,683	+22
Exports:			
Iron and steel	136,280	164,276	+21
Tin plate, waste-waste, circles, strips, cobbles, etc	12,826	29,745	+132
Average prices per gross ton:			
Scrap:			
No. 1 Heavy-Melting, Pittsburgh [4]	$21.08	$37.13	+76
No. 1 Cast Cupola, Chicago [4]	$23.40	$47.12	+101
For export	[5] $25.42	$56.57	+123
Pig iron, f. o. b. Valley furnaces: [4]			
Basic	$27.14	$33.85	+25
No. 2 Foundry	$27.64	$34.35	+24

[1] Includes open-hearth, Bessemer, and electric furnaces.
[2] Includes cupola, air, Brackelsberg, puddling; crucible, and blast furnaces: also direct castings.
[3] Includes rerolling, reforging, copper precipitation, nonferrous and chemical uses.
[4] Iron Age.
[5] Revised figure.

a 29-percent increase over 1946. Work stoppages in both the steel and coal-mining industry were not as prevalent as during 1946; as a result, the steel industry operated at 93 percent of capacity compared with 73 percent in 1946.

The ferrous raw materials charged into steel-making furnaces during 1947 comprised 51 percent scrap and 49 percent pig iron compared with the converse in 1946. The charge of scrap and pig iron used in iron foundries (mainly cupola furnaces) remained unchanged from 1946 and 1945 and consisted of 64 and 36 percent, respectively, To increase the supply of scrap, the Secretary of the Interior requested the various mining associations to urge their members to collect and distribute idle scrap into proper channels for shipment to steel mills. The United States Department of Commerce, through its Office of Industrial Cooperation, attempted to expedite the return of battlefield scrap, although virtually none was received in 1947. In March, the War Assets Administration began concerted drives to dispose of all scrap steel in its hands. As a result, all materials in its inventories that could be classed as scrap were cleaned out; these drives had resulted in the disposal of iron and steel scrap and salvage totaling 206,549 gross tons by the end of September.

The following statistics and statements, which indicate War Department efforts in returning scrap to the consuming industries, are taken from statements by Brig. Gen. T. M. Osborne, and Lt. Col. S. M. Pool, General Staff Corps, War Department, at hearings before the Special Committee to Study Problems of American Small Business, United States Senate, Eightieth Congress, July 16–18, 1947. During the period January 1, 1944, through May 31, 1947, the Army sold 2,850,867 gross tons in the United States, including 823,762 tons from overseas; of this, 889,728 tons were sold in 1944, 1,134,553 tons in 1945, 663,281 tons in 1946, and 163,305 tons during the first 5 months of 1947. These data do not include 165,000 gross tons of ferrous scrap located in Austria and Germany, which were sold with the stipulation that it must be returned to the United States. These sales took place during April 1947 and were made on an "as is, where is" basis; at the close of 1947 none of this had been returned. Sales of scrap solely to persons or firms for return to the United States have resulted in a loss of revenue to the Government. The sale of the 165,000 gross tons carried a price of $7.50 per ton for return to the United States. Offers of $20 per ton were received for the material for use in Europe.

In May 1947 overseas commanders were requested to state the quantity of ferrous scrap now on hand, the quantity which would become available in 6 months, and the quantity which would become available in 12 months. The following data—in gross tons—covering ferrous scrap were obtained; European Command, none available at this time, 50,000 tons available in 6 months, and an additional 200,000 tons available in 12 months; Japanese Command, 865 tons then available, 3,865 tons available in 6 months, 4,165 tons additional available in 12 months; Caribbean Command, 1,584 tons available, 5,435 tons available in 6 months, 5,973 tons additional available in 12 months; Mediterranean Command, 5,400 tons available, 20,000 tons available in 6 months, with none additional expected to be available in less than 1 year.

The Army, Navy, Maritime Commission, and War Assets Administration reported to the White House on September 23, 1947, that they had made available for the use of American industry 1,044,000 gross tons of scrap from March through August and estimated that an additional 850,000 tons would be available from September through December. It was believed by those agencies that overseas scrap would not be available until 1948.

CONSUMPTION

The large use of scrap as compared with that of pig iron, as in 1946, was noticeable in the New England, Southwestern, and Pacific Coast districts in 1947. These districts together used 7 percent of the total scrap consumed in the United States but only 2 percent of the pig iron. The average ratio of scrap to pig iron in these three districts was 3.7 : 1, whereas for the United States at large it was 1.0 : 1.

Open-hearth steel furnaces are by far the largest consumers of ferrous scrap and pig iron. The proportions of the total scrap and pig-iron supply used in open-hearth furnaces have remained relatively constant, as the following data show: Open-hearth consumption accounted for 65 percent of the total scrap in 1947, 66 percent in 1946, and 67 percent in both 1945 and 1944; 69 percent of the home scrap in both 1947 and 1946, and 73 percent in both 1945 and 1944; and 60 percent of the purchased scrap in 1947, 61 percent in 1946, and 60 percent in 1945.

Cupola-furnace consumption in 1947 was as follows: Home scrap, 17 percent of the total, the same as in 1946 and compared with 12 percent in 1945 and 10 percent in 1944; purchased scrap, 18 percent, the same as in 1946 and compared with 15 percent in 1945 and 1944; pig iron, 9 percent compared with 10 percent in 1946, 8 percent in 1945 and 6 percent in 1944.

Bessemer converters consumed 8 percent of the pig iron in both 1947 and 1946 compared with 9 percent in 1945 and 1944, and 0.4 percent of the scrap compared with 0.5 percent in 1946 and 0.6 percent in 1945.

Electric furnaces consumed 9 percent of the total scrap compared with 7 percent in 1946 and 9 percent in 1945, and 0.2 percent of the pig iron compared with 0.3 percent in both 1946 and 1945.

Ferrous scrap and pig iron consumed in the United States and percent of total derived from home scrap, purchased scrap, and pig iron, 1946–47, by districts

District	1946					1947				
	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	1,167,414	33.7	40.9	74.6	25.4	1,373,904	33.5	40.9	74.4	25.6
Middle Atlantic [1]	30,549,333	27.2	21.7	48.9	51.1	39,294,390	25.7	22.0	47.7	52.3
Southeastern [1]	12,304,512	25.6	20.7	46.3	53.7	14,915,694	24.4	20.5	44.9	55.1
Southwestern	601,479	23.1	67.0	90.1	9.9	872,660	24.5	61.1	85.6	14.4
North Central [1]	45,739,590	28.5	25.2	53.7	46.3	56,455,556	27.5	25.3	52.8	47.2
Rocky Mountain	1,688,468	29.4	25.4	54.8	45.2	2,778,329	27.5	17.9	45.4	54.6
Pacific Coast [1]	2,504,945	23.5	54.4	77.9	22.1	3,049,266	22.0	56.6	78.6	21.4
Undistributed [1]						415,317	42.0	5.9	47.9	52.1
	94,555,741	27.6	24.7	52.3	47.7	119,155,116	26.5	24.6	51.1	48.9

[1] In 1947, some scrap and pig iron consumed in the Middle Atlantic, Southeastern, North Central, and Pacific Coast districts—not separable—are included with "Undistributed."

In gathering data on the consumption of scrap in 1947, the practice of including figures for the use of scrap in the production of ferroalloys and for various miscellaneous uses was continued. Figures for some States are grouped to avoid disclosing the details of individual operations.

Proportion of home and purchased scrap and pig iron used in furnace charges in the United States, 1946–47, in percent

Type of furnace	1946				1947			
	Scrap			Pig iron	Scrap			Pig iron
	Home	Purchased	Total		Home	Purchased	Total	
Open-hearth	27.1	21.3	48.4	51.6	25.7	20.7	46.4	53.6
Bessemer	4.4	1.7	6.1	93.9	4.3	1.2	5.5	94.5
Electric	40.7	56.3	97.0	3.0	38.4	59.2	97.6	2.4
Cupola	32.9	32.1	65.0	35.0	32.8	33.2	66.0	34.0
Air [1]	50.8	23.1	73.9	26.1	50.3	25.7	76.0	24.0
Crucible	28.4	38.8	67.2	32.8	24.1	39.2	63.3	36.7
Puddling		18.2	18.2	81.8		18.2	18.2	81.8
Blast	51.4	48.6	100.0		52.0	48.0	100.0	

[1] Includes data for 2 Brackelsberg furnaces.

Consumption of ferrous scrap and pig iron in the United States, 1946–47, by type of furnace, in short tons

Type of furnace or equipment	Active plants reporting [1]	Scrap			Pig iron
		Home	Purchased	Total	
1946					
Open-hearth	131	18,145,617	14,295,908	32,441,525	34,608,053
Bessemer	31	173,025	69,550	242,575	3,722,756
Electric	332	1,549,909	2,148,029	3,697,938	113,125
Cupola	2,501	4,329,283	4,229,939	8,559,222	4,612,704
Air	118	694,509	316,595	1,011,104	356,436
Brackelsberg	2				
Crucible	12	855	1,166	2,021	985
Puddling	4		3,235	3,235	14,506
Blast	68	1,168,590	1,104,348	2,272,938	
Direct castings	32				1,641,874
Ferro-alloy	20	17,096	258,754	275,850	
Miscellaneous	130	55,279	922,424	977,703	1,191
	3,381	26,134,163	23,349,948	49,484,111	45,071,630
1947					
Open-hearth	127	21,727,939	17,560,105	39,288,044	45,338,462
Bessemer	30	212,702	60,261	272,963	4,711,581
Electric	320	2,053,278	3,171,083	5,224,361	127,338
Cupola	2,495	5,240,692	5,316,947	10,557,639	5,438,727
Air	122	867,170	442,934	1,310,104	413,900
Brackelsberg	2				
Crucible	15	864	1,401	2,265	1,312
Puddling	3		3,691	3,691	16,573
Blast	71	1,401,162	1,290,937	2,692,099	
Direct castings	33				2,241,789
Ferro-alloy	19	9,058	307,916	316,974	
Miscellaneous	128	66,077	1,130,144	1,196,221	1,073
	3,365	31,578,942	29,285,419	60,864,361	58,290,755

[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 department is counted as 1 plant.

CONSUMPTION BY DISTRICTS AND STATES

During 1947 iron and steel scrap and pig iron were used in all 48 States and the District of Columbia; none was used in Alaska. As in 1946, the largest consuming districts in 1947 were the North Central, Middle Atlantic, and Southeastern. All districts showed an increase over 1946 in total scrap and pig iron consumed. The States having

Consumption of ferrous scrap and pig iron in the United States, 1943–47, by districts

District and year	Active plants reporting [1]	Scrap: Home		Scrap: Purchased		Scrap: Total		Pig iron	
		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:									
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
1946	240	392,656	+9.4	477,788	+5.9	870,444	+7.4	296,970	−16.2
1947	245	460,062	+17.2	561,545	+17.5	1,021,607	+17.4	352,297	+18.6
Middle Atlantic:									
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
1946	818	8,319,887	−20.0	6,614,440	−11.0	14,934,327	−16.3	15,615,006	−17.7
1947 [2]	807	10,100,971	+21.4	8,626,526	+30.4	18,727,497	+25.4	20,566,893	+31.7
Southeastern:									
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
1946	476	3,144,778	−9.5	2,547,664	−6.7	5,692,442	−8.3	6,612,070	−11.4
1947 [2]	469	3,639,590	+15.7	3,059,105	+20.1	6,698,695	+17.7	8,216,999	+24.3
Southwestern:									
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
1946	121	139,038	−32.1	402,683	+6.4	541,721	−7.2	59,758	−67.2
1947	123	214,063	+54.0	532,740	+32.3	746,803	+37.9	125,857	+110.6
North Central:									
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
1946	1,357	13,053,967	−14.3	11,515,917	−6.8	24,569,884	−10.9	21,169,706	−14.1
1947 [2]	1,356	15,553,560	+19.1	14,258,421	+23.8	29,811,981	+21.3	26,643,575	+25.9
Rocky Mountain:									
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
1946	90	496,260	−19.0	428,171	−27.7	924,431	−23.3	764,037	−28.4
1947	88	764,317	+54.0	498,052	+16.3	1,262,369	+36.6	1,515,960	+98.4
Pacific Coast:									
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
1946	279	587,577	−12.4	1,363,285	+5.7	1,950,862	−.5	554,083	+8.4
1947 [2]	270	671,750	+14.3	1,724,540	+26.5	2,396,290	+22.8	652,976	+17.8
Undistributed: [2]									
1947	7	174,629	-------	24,490	-------	199,119	-------	216,198	-------
United States:									
1943	3,680	35,037,088	+5.8	26,613,868	−1.9	61,650,956	+2.3	60,315,159	+2.2
1944	3,612	35,426,349	+1.1	25,922,852	−2.6	61,349,201	−.5	60,951,621	+1.1
1945	3,493	30,960,704	−12.6	25,230,381	−2.7	56,191,085	−8.4	53,187,177	−12.7
1946	3,381	26,134,163	−15.6	23,349,948	−7.5	49,484,111	−11.9	45,071,630	−15.3
1947	3,365	31,578,942	+20.8	29,285,419	+25.4	60,864,361	+23.0	58,290,755	+29.3

[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 department is counted as 1 plant.
[2] In 1947, some scrap and pig iron consumed in the Middle Atlantic, Southeastern, North Central, and Pacific Coast districts—not separable—are included with "Undistributed."

the largest consumption of scrap, together with the percentage consumed, were: Pennsylvania 24, Ohio 18, Illinois 10, Indiana 10, Michigan-Wisconsin 8, New York 5, Alabama 4, Maryland 3, and California 3. The percentage of scrap consumed by the above States was essentially the same in 1947 as in 1946.

Consumption of ferrous scrap and pig iron in the United States in 1947, by States and districts

State and district	Active plants reporting [2]	Scrap						Pig iron	
		Home		Purchased		Total			
		Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Connecticut	66	150, 528	0. 5	172, 963	0. 6	323, 491	0. 5	92, 114	0. 2
Maine	19	15, 370	. 1	17, 798	(1)	33, 168	. 1	14, 111	(1)
Massachusetts	113	236, 473	. 8	285, 286	1. 0	521, 759	. 9	199, 258	. 3
New Hampshire	19	8, 338	(1)	18, 734	. 1	27, 072	(1)	5, 771	(1)
Rhode Island	13	38, 677	. 1	51, 258	. 2	89, 935	. 2	31, 036	. 1
Vermont	15	10, 676	(1)	15, 506	(1)	26, 182	(1)	10, 007	(1)
Total New England	245	460, 062	1. 5	561, 545	1. 9	1, 021, 607	1. 7	352, 297	. 6
Delaware	9	361, 274	1. 2	689, 463	2. 4	1, 050, 737	1. 7	312, 845	. 5
New Jersey [3]	110								
New York	214	1, 492, 676	4. 7	1, 302, 693	4. 4	2, 795, 369	4. 6	2, 966, 882	5. 1
Pennsylvania [3]	474	8, 247, 021	26. 1	6, 634, 370	22. 7	14, 881, 391	24. 5	17, 287, 166	29. 7
Total Middle Atlantic	807	10, 100, 971	32. 0	8, 626, 526	29. 5	18, 727, 497	30. 8	20, 566, 893	35. 3
Alabama	90	1, 407, 995	4. 5	756, 038	2. 6	2, 164, 033	3. 6	3, 356, 612	5. 8
District of Columbia	3								
Kentucky [3]	26	1, 489, 111	4. 7	1, 134, 081	3. 9	2, 623, 192	4. 3	3, 150, 317	5. 4
Maryland [3]	29								
Florida	17	56, 084	. 2	139, 737	. 5	195, 821	. 3	37, 525	. 1
Georgia	60								
Mississippi	11	1, 591	(1)	2, 542	(1)	4, 133	(1)	2, 596	(1)
North Carolina	51	18, 323	. 1	20, 039	. 1	38, 362	. 1	27, 466	(1)
South Carolina	21	9, 629	(1)	14, 563	(1)	24, 192	(1)	9, 169	(1)
Tennessee	64	236, 618	. 7	280, 383	. 9	517, 001	. 8	254, 202	. 4
Virginia	64								
West Virginia	33	420, 239	1. 3	711, 722	2. 4	1, 131, 961	1. 9	1, 379, 112	2. 4
Total Southeastern	469	3, 639, 590	11. 5	3, 059, 105	10. 4	6, 698, 695	11. 0	8, 216, 999	14. 1
Arkansas	11								
Louisiana	26	27, 414	. 1	88, 964	. 3	116, 378	. 2	5, 766	(1)
Oklahoma	19								
Texas	67	186, 649	. 6	443, 776	1. 5	630, 425	1. 0	120, 091	. 2
Total Southwestern	123	214, 063	. 7	532, 740	1. 8	746, 803	1. 2	125, 857	. 2
Illinois [3]	248	2, 849, 408	9. 0	3, 281, 534	11. 2	6, 130, 942	10. 1	4, 782, 722	8. 2
Indiana	152	3, 590, 232	11. 4	2, 376, 433	8. 1	5, 966, 665	9. 8	6, 810, 122	11. 7
Iowa	57	146, 738	. 5	257, 434	. 9	404, 172	. 7	98, 116	. 2
Kansas	34	39, 353	. 1	92, 398	. 3	131, 751	. 2	14, 041	(1)
Nebraska	16								
Michigan	192	2, 800, 053	8. 9	2, 181, 436	7. 4	4, 981, 489	8. 2	2, 737, 764	4. 7
Wisconsin	133								
Minnesota	74	237, 084	. 8	340, 020	1. 2	577, 104	1. 0	445, 584	. 8
Missouri	69	197, 296	. 6	617, 537	2. 1	814, 833	1. 3	80, 926	. 1
North Dakota	3	1, 237	(1)	960	(1)	2, 197	(1)	225	(1)
South Dakota	2								
Ohio [3]	376	5, 692, 159	18. 0	5, 110, 669	17. 5	10, 802, 828	17. 7	11, 674, 075	20. 0
Total North Central	1, 356	15, 553, 560	49. 3	14, 258, 421	48. 7	29, 811, 981	49. 0	26, 643, 575	45. 7

See footnotes at end of table.

Consumption of ferrous scrap and pig iron in the United States in 1947, by States and districts—Continued

State and district	Active plants reporting [2]	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
Arizona	10								
Nevada	3	4,974	(1)	73,918	.3	78,892	.1	1,215	(1)
New Mexico	4								
Colorado	28	752,567	2.4	396,083	1.3	1,148,650	1.9	1,511,704	2.6
Utah	26								
Idaho	6	1,079	(1)	5,091	(1)	6,170	(1)		
Wyoming	2	1	(1)	8	(1)	9	(1)	3,041	(1)
Montana	9	5,696	(1)	22,952	.1	28,648	.1		
Total Rocky Mountain	88	764,317	2.4	498,052	1.7	1,262,369	2.1	1,515,960	2.6
Oregon	44	108,312	.3	441,864	1.5	550,176	.9	17,812	(1)
Washington	60								
California [3]	166	563,438	1.8	1,282,676	4.4	1,846,114	3.0	635,164	1.1
Total Pacific Coast	270	671,750	2.1	1,724,540	5.9	2,396,290	3.9	652,976	1.1
Undistributed [3]	7	174,629	.5	24,490	.1	199,119	.3	216,198	.4
Total United States:									
1947	3,365	31,578,942	100.0	29,285,419	100.0	60,864,361	100.0	58,290,755	100.0
1946	3,381	26,134,163	100.0	23,349,948	100.0	49,484,111	100.0	45,071,630	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 department is counted as 1 plant.
[3] In 1947, some scrap and pig iron consumed in California, Illinois, Kentucky, Maryland, New Jersey, Ohio, and Pennsylvania—not separable—are included with "Undistributed."

CONSUMPTION BY TYPE OF FURNACE

Open-Hearth Furnaces.—Ferrous scrap and pig iron consumed in open-hearth furnaces in 1947 totaled 84,626,506 short tons, an increase of 26 percent over 1946. The use of home scrap increased 20 percent, purchased scrap 23 percent, total scrap 21 percent, and pig iron 31 percent. Open-hearth furnace melt in 1947 consisted of 46 percent total scrap and 54 percent pig iron, compared with 48 percent total scrap and 52 percent pig iron in 1946. Of the total scrap consumed, 45 percent was purchased compared with 44 percent in 1946 and 40 percent in 1945.

Pennsylvania led in the use of scrap in the open hearth in 1947, followed in order by Ohio, Indiana, and Illinois; this ranking was unchanged from 1946 and 1945.

Consumption of ferrous scrap and pig iron in open-hearth furnaces in the United States in 1947, 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	127, 441	231, 235	358, 676	96, 752
Rhode Island	1				
Total: 1947	4	127, 441	231, 235	358, 676	96, 752
1946	4	102, 723	208, 424	311, 147	92, 467
Middle Atlantic:					
Delaware	1				
New Jersey	2	1, 260, 581	987, 838	2, 248, 419	2, 678, 362
New York	8				
Pennsylvania	44	6, 452, 156	4, 920, 075	11, 372, 231	14, 179, 019
Total: 1947	55	7, 712, 737	5, 907, 913	13, 620, 650	16, 857, 381
1946	57	6, 327, 430	4, 453, 396	10, 780, 826	12, 507, 083
Southeastern and Southwestern:					
Alabama	2				
Georgia	1	978, 954	685, 418	1, 664, 372	2, 608, 298
Tennessee	1				
Texas	1				
Kentucky	2				
Maryland	1	1, 724, 721	1, 509, 757	3, 234, 478	3, 968, 185
Oklahoma	1				
West Virginia	2				
Total: 1947	11	2, 703, 675	2, 195, 175	4, 898, 850	6, 576, 483
1946	11	2, 290, 394	1, 887, 812	4, 178, 206	5, 167, 200
North Central:					
Illinois	10	1, 746, 661	1, 821, 055	3, 567, 716	3, 445, 789
Indiana	6	2, 993, 505	2, 012, 904	5, 006, 409	6, 192, 979
Michigan	4	855, 443	540, 432	1, 395, 875	1, 485, 309
Missouri	2				
Minnesota	1	261, 349	603, 304	864, 653	411, 564
Wisconsin	2				
Ohio	23	4, 186, 402	2, 925, 231	7, 111, 633	8, 313, 877
Total: 1947	48	10, 043, 360	7, 902, 926	17, 946, 286	19, 849, 518
1946	50	8, 658, 472	6, 653, 539	15, 312, 011	15, 715, 039
Rocky Mountain and Pacific Coast:					
Colorado	1				
California	6	1, 140, 726	1, 322, 856	2, 463, 582	1, 958, 328
Utah	1				
Washington	1				
Total: 1947	9	1, 140, 726	1, 322, 856	2, 463, 582	1, 958, 328
1946	9	766, 598	1, 092, 737	1, 859, 335	1, 126, 264
Total United States: 1947	127	21, 727, 939	17, 560, 105	39, 288, 044	45, 338, 462
1946	131	18, 145, 617	14, 295, 908	32, 441, 525	34, 608, 053

Bessemer Converters.—The 4,984,544 short tons of ferrous raw materials used in Bessemer converters in 1947 represents a 26-percent increase over the 1946 use of these materials. The proportion of scrap in the metal charges was 5 percent, of which three-fourths was home scrap.

Following the usual pattern, Pennsylvania was the principal consumer of scrap in converters in 1947.

Consumption of ferrous scrap and pig iron in Bessemer converters in the United States in 1947, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England and Middle Atlantic:					
Connecticut	1				
Delaware	2	3,090	3,147	6,237	1,793
New York	1				
Pennsylvania	8	103,196	31,025	134,221	1,588,380
Total: 1947	12	106,286	34,172	140,458	1,590,173
1946	13	76,966	34,168	111,134	1,348,279
Southeastern and Southwestern:					
Alabama	1				
Maryland	1				
West Virginia	1	24,597	12,281	36,878	408,803
Louisiana	1				
Texas	1				
Total: 1947	5	24,597	12,281	36,878	408,803
1946	5	26,176	20,080	46,256	359,750
North Central and Pacific Coast:					
Illinois	3	5,708	9,842	15,550	253,863
Indiana	1				
Iowa	1	10,413	3,626	14,039	298,759
Minnesota	1				
Missouri	1	118	168	286	87
Washington	1				
Ohio	5	65,580	172	65,752	2,159,896
Total: 1947	13	81,819	13,808	95,627	2,712,605
1946	13	69,883	15,302	85,185	2,014,727
Total United States: 1947	30	212,702	60,261	272,963	4,711,581
1946	31	173,025	69,550	242,575	3,722,756

Electric Steel Furnaces.—The total melt of ferrous scrap and pig iron used in electric furnaces in 1947 amounted to 5,351,699 net tons, an increase of 40 percent over the 3,811,063 tons used in 1946. Increases in the use of scrap occurred in all districts; pig iron increased in all except the New England, Rocky Mountain, and Pacific Coast districts. This over-all increase in electric furnace consumption was made possible by both an increase in the steel-making scrap supply and pig iron.

Consumption of ferrous scrap and pig iron in electric steel furnaces in the United States in 1947, by districts and States, in short tons

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total	Pig iron
New England:					
Connecticut	4	8,276	7,012	15,288	781
New Hampshire	1				
Massachusetts	9	13,208	10,249	23,457	187
Total: 1947	14	21,484	17,261	38,745	968
1946	13	21,222	16,456	37,678	1,540
Middle Atlantic:					
Delaware	1	13,795	21,528	35,323	369
New Jersey	12				
New York	17	54,368	64,026	118,394	7,588
Pennsylvania	57	591,269	673,651	1,264,920	16,885
Total: 1947	87	659,432	759,205	1,418,637	24,842
1946	90	511,609	503,355	1,014,964	22,961
Southeastern:					
District of Columbia	1				
Kentucky	1				
Maryland	3	20,288	55,831	76,119	361
West Virginia	1				
Alabama	4				
Florida	1	16,284	28,651	44,935	345
Georgia	3				
North Carolina	1				
South Carolina	1				
Tennessee	4	10,194	13,641	23,835	877
Virginia	4				
Total: 1947	24	46,766	98,123	144,889	1,583
1946	25	43,765	76,321	120,086	1,327
Southwestern:					
Arkansas	1				
Oklahoma	1				
Louisiana	4	32,555	36,817	69,372	451
Texas	8				
Total: 1947	14	32,555	36,817	69,372	451
1946	15	29,359	30,091	59,450	445
North Central:					
Illinois	26	362,440	537,692	900,132	17,345
Indiana	11	34,608	23,228	57,836	1,826
Iowa	1				
Kansas	1	9,524	11,201	20,725	182
Nebraska	1				
Michigan	20	187,345	278,724	466,069	7,806
Minnesota	4	6,323	8,902	15,225	160
Missouri	9	17,469	20,631	38,100	3,318
Ohio	35	501,447	957,237	1,458,684	62,645
Wisconsin	13	65,874	87,835	153,709	3,640
Total: 1947	121	1,185,030	1,925,450	3,110,480	96,922
1946	123	843,939	1,257,181	2,101,120	83,869
Rocky Mountain:					
Arizona	1				
Colorado	3				
Nevada	1	7,336	13,748	21,084	262
Utah	1				
Total: 1947	6	7,336	13,748	21,084	262
1946	6	5,664	9,996	15,660	388
Pacific Coast:					
Oregon	8	18,259	71,418	89,677	98
California	28	58,526	150,780	209,306	1,953
Washington	18	23,890	98,281	122,171	259
Total: 1947	54	100,675	320,479	421,154	2,310
1946	60	94,351	254,629	348,980	2,595
To al United States: 1947	320	2,053,278	3,171,083	5,224,361	127,338
1946	332	1,549,909	2,148,029	3,697,938	113,125

Cupolas.—Figures released by the United States Department of Commerce, Bureau of the Census, indicate that shipments of gray-iron castings exceeded the 1946 shipments by 22 percent. Accordingly, requirements for scrap and pig-iron cupola consumption increased in 1947 as they did in 1946. Cupola furnaces used 15,996,366 net tons of scrap and pig iron, an increase of 21 percent over the 13,171,926 tons used in 1946. The use of home scrap increased 21 percent, purchased scrap 26 percent, total scrap 23 percent, and pig iron 18 percent.

Charges to cupolas consisted of 33 percent home scrap, 33 percent purchased scrap, and 34 percent pig iron, compared with 33, 32, and 35 percent, respectively, in 1946.

Michigan, as in 1946, continued to be the largest consumer of cupola scrap, followed in order by Ohio, Illinois, Pennsylvania, Alabama, Indiana, Wisconsin, New York, and New Jersey.

Consumption of ferrous scrap and pig iron in cupola furnaces in the United States in 1947, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	51	76,455	76,880	153,335	69,299
Maine	19	15,370	17,798	33,168	14,111
Massachusetts	93	128,686	126,312	254,998	116,070
New Hampshire	16	3,723	17,070	20,793	3,687
Rhode Island	11	19,746	21,905	41,651	14,775
Vermont	15	10,676	15,506	26,182	10,007
Total: 1947	205	254,656	275,471	530,127	227,949
1946	201	225,830	220,808	446,638	183,707
Middle Atlantic:					
Delaware	4	3,644	6,754	10,398	3,866
New Jersey [1]	76	161,104	279,253	440,357	193,121
New York	153	261,663	235,946	497,609	270,602
Pennsylvania [1]	288	413,222	460,176	873,398	531,277
Total: 1947	521	839,633	982,129	1,821,762	998,866
1946	526	759,570	834,467	1,594,037	920,570
Southeastern:					
Alabama	74	340,572	283,684	624,256	792,967
District of Columbia	1	36,169	61,803	97,972	24,772
Maryland [1]	21				
Florida	16	1,746	4,181	5,927	1,369
Georgia	54	23,729	33,530	57,259	33,852
Kentucky [1]	21	17,386	20,273	37,659	58,589
Mississippi	11	1,591	2,542	4,133	2,596
North Carolina	50	18,269	20,039	38,308	27,361
South Carolina	19	9,583	12,803	22,386	9,152
Tennessee	57	155,296	125,988	281,284	182,570
Virginia	58	70,474	112,350	182,824	70,063
West Virginia	20	10,257	28,407	38,664	8,604
Total: 1947	402	685,072	705,600	1,390,672	1,211,895
1946	407	614,733	491,022	1,105,755	1,034,829

See footnote at end of table.

Consumption of ferrous scrap and pig iron in cupola furnaces in the United States in 1947, by districts and States, in short tons—Continued

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total	Pig iron
Southwestern:					
Arkansas	10	777	2,148	2,925	638
Louisiana	20	3,717	6,952	10,669	2,093
Oklahoma	16	5,376	10,904	16,280	2,878
Texas	51	35,620	94,854	130,474	26,500
Total: 1947	97	45,490	114,858	160,348	32,109
1946	95	36,716	101,096	137,812	29,240
North Central:					
Illinois [1]	177	512,999	447,769	960,768	385,549
Indiana	115	295,816	264,801	560,617	269,079
Iowa	53	129,439	125,472	254,911	92,311
Kansas	32	23,986	69,603	93,589	10,007
Michigan	158	1,169,058	887,048	2,056,106	935,885
Minnesota	62	62,701	114,319	177,020	47,154
Missouri	51	86,920	153,559	240,479	59,826
Nebraska	14	7,791	13,795	21,586	3,422
North Dakota	3	1,237	960	2,197	225
South Dakota	2				
Ohio [1]	250	487,809	545,697	1,033,506	571,097
Wisconsin	103	289,024	220,571	509,595	230,320
Total: 1947	1,020	3,066,780	2,843,594	5,910,374	2,604,875
1946	1,026	2,531,519	2,282,784	4,814,303	2,284,266
Rocky mountain:					
Arizona	4	2,891	20,011	22,902	1,005
Colorado	21	20,212	48,531	68,743	31,646
Idaho	5	737	2,840	3,577	250
Montana	6	5,139	4,665	9,804	1,715
New Mexico	2	373	6,612	6,985	159
Wyoming	2	1	8	9	3
Utah	15	48,024	37,180	85,204	39,266
Total: 1947	55	77,377	119,847	197,224	74,044
1946	56	68,785	106,048	174,833	60,809
Pacific Coast:					
California [1]	118	74,813	177,151	251,964	60,373
Oregon	34	10,261	30,175	40,436	4,389
Washington	36	11,981	43,632	55,613	5,029
Total: 1947	188	97,055	250,958	348,013	72,791
1946	190	92,130	193,714	285,844	99,283
Undistributed: [1]					
Total 1947	7	174,629	24,490	199,119	216,198
Total United States: 1947	2,495	5,240,692	5,316,947	10,557,639	5,438,727
1946	2,501	4,329,283	4,229,939	8,559,222	4,612,704

[1] In 1947, some scrap and pig iron consumed in California, Illinois, Kentucky, Maryland, New Jersey, Ohio, and Pennsylvania—not separable—are included with "Undistributed."

Air Furnaces.—Scrap and pig iron consumed in air furnaces (including two Brackelsbergs) in 1947 amounted to 1,724,004 short tons, an increase of 26 percent over the 1,367,540 tons melted in these furnaces in 1946. The use of home scrap increased 25 percent, purchased scrap 40 percent, and pig iron 16 percent.

There was a change in the relative position of the principal consuming States; Indiana, which was in the fifth position in 1946, advanced to the fourth position ahead of Michigan. Ohio led in the use of scrap in air furnaces, followed in order by Illinois, Pennsylvania, Indiana, Michigan, Wisconsin, and New York.

Consumption of ferrous scrap and pig iron in air furnaces [1] in the United States in 1947, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	7	46,227	15,068	61,295	25,819
Massachusetts	4				
New Hampshire	1				
Rhode Island	1				
Total: 1947	13	46,227	15,068	61,295	25,819
1946	12	39,642	17,227	56,869	18,594
Middle Atlantic:					
Delaware	1	11,102	3,242	14,344	6,275
New Jersey	2				
New York	10	50,778	24,154	74,932	27,038
Pennsylvania	23	115,497	64,485	179,982	62,620
Total: 1947	36	177,377	91,881	269,258	95,933
1946	36	135,176	63,604	198,780	81,015
Southeastern and Southwestern:					
West Virginia	2	17,330	13,051	30,381	7,334
Texas	1				
Total: 1947	3	17,330	13,051	30,381	7,334
1946	3	14,027	10,457	24,484	6,089
North Central:					
Illinois	14	232,137	126,730	358,867	109,400
Indiana	10				
Michigan	6	81,826	36,685	118,511	33,871
Iowa	1	11,967	5,174	17,141	9,478
Kansas	1				
Minnesota	1				
Missouri	1				
Ohio	22	224,609	108,482	333,091	94,527
Wisconsin	12	72,776	44,706	117,482	34,738
Total: 1947	68	623,315	321,777	945,092	282,014
1946	66	503,076	224,599	727,675	248,301
Rocky Mountain and Pacific Coast:					
Colorado	1	2,921	1,157	4,078	2,800
California	3				
Total: 1947	4	2,921	1,157	4,078	2,800
1946	3	2,588	708	3,296	2,437
Total United States: 1947	124	867,170	442,934	1,310,104	413,900
1946	120	694,509	316,595	1,011,104	356,436

[1] Includes 2 Brackelsberg furnaces, 1 each in Indiana and Ohio.

Crucible and Puddling Furnaces.—Crucible furnaces used 2,265 short tons of scrap and 1,312 tons of pig iron in 1947 compared with 2,021 and 985 tons, respectively, in 1946. Puddling furnaces used 20,264 tons of scrap and pig iron, an increase of 14 percent over 1946. Of the total puddling-furnace melt in 1947, 3,691 tons were scrap compared with 3,235 tons during the previous year. The bulk of the scrap consumed in puddling furnaces was in Kentucky, whereas New Jersey consumed the bulk of the pig iron.

Consumption of ferrous scrap and pig iron in crucible and puddling furnaces in the United States in 1947, 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	605	823	1,428	576
New Hampshire	1				
Total: 1947	4	605	823	1,428	576
1946	4	771	1,087	1,858	629
Middle Atlantic and Southeastern:					
District of Columbia	1				
New Jersey	1	95	2,622	2,717	10,583
Kentucky	1				
West Virginia	1				
Pennsylvania	6	83	1,541	1,624	6,282
Total: 1947	10	178	4,163	4,341	16,865
1946	8	23	3,270	3,293	14,559
North Central:					
Ohio	1	(1)	(1)	(1)	(1)
Wisconsin	1				
Total: 1947	2	(1)	(1)	(1)	(1)
1946	2				
Southwestern and Pacific Coast:					
Oklahoma	1	(1)	(1)	(1)	(1)
California	1				
Total: 1947	2	(1)	(1)	(1)	(1)
1946	2				
Total United States: 1947	18	864	5,092	5,956	17,885
1946	16	855	4,401	5,256	15,491

[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 1947 consisted of 104,990,638 short tons of iron ore, sinter, and manganiferous ores, 3,196,215 tons of mill cinder and roll scale, 4,213,940 tons of open-hearth and Bessemer slag, and 42,597 tons of miscellaneous materials.

Total consumption of scrap in 1947, by 71 plants operating blast furnaces, was 2,692,099 short tons, an 18-percent increase over 1946. The scrap charged to blast furnaces was 52 percent home and 48 percent purchased, compared with 51 and 49 percent, respectively, in 1946 and 39 and 61 percent, respectively, in 1945. The proportion of scrap used to pig iron produced was 4.6 percent compared with 5.1 percent in 1946; purchased scrap 2.2 percent and home scrap 2.4 percent in 1947.

Consumption of ferrous scrap in blast furnaces in the United States in 1947, by districts and States, in short tons

District and State	Active plants reporting	Scrap		
		Home	Purchased	Total
New England and Middle Atlantic:				
Massachusetts	1			
New York	6	38,842	62,995	101,837
Pennsylvania	17	536,517	376,901	913,418
Total: 1947	24	575,359	439,896	1,015,255
1946	24	477,754	343,682	821,436
Southeastern and Southwestern:				
Alabama	5	218,637	63.049	281,686
Kentucky	1			
Maryland	1			
Texas	2	77,152	105,391	182,543
West Virginia	2			
Total: 1947	11	295,789	168,440	464,229
1946	10	227,221	162,221	389,442
North Central:				
Illinois	6	90,782	125,660	216,442
Indiana	3	144,010	19,962	163,972
Michigan	2			
Minnesota	2	63,945	48,488	112,433
Ohio	20	226,056	488,307	714,363
Total: 1947	33	524,793	682,417	1,207,210
1946	30	412,352	597,128	1,009,480
Rocky Mountain and Pacific Coast:				
Colorado	1			
Utah	1	5,221	184	5,405
California	1			
Total: 1947	3	5,221	184	5,405
1946	4	51,263	1,317	52,580
Total United States: 1947	71	1,401,162	1,290,937	2,692,099
1946	68	1,168,590	1,104,348	2,272,938

USE OF SCRAP IN FERRO-ALLOY PRODUCTION

The production of ferro-alloys (other than blast furnaces) in 1947 consumed 316,974 short tons of scrap. Of this total, 475 tons were used in the aluminothermic process and the balance was used in the electric furnace. Scrap used in blast furnaces in the manufacture of ferro-alloys is included in this chapter under blast furnaces. Purchased scrap accounted for 97 percent of the quantity used and home scrap 3 percent, compared with 94 and 6 percent, respectively, in 1946.

Nineteen ferro-alloy plants used ferrous scrap in 1947 compared with 20 in 1946. Of these plants, 18 operated electric furnaces. One of this group employed both the electric and aluminothermic process, and one plant used the aluminothermic process only.

Consumption of ferrous scrap by ferro-alloy producers in the United States in 1947, by districts and States, in short tons

District and State	Active plants reporting	Scrap		
		Home	Purchased	Total
Middle Atlantic:				
New York	5	109	72,658	72,767
Pennsylvania	3		442	442
Total: 1947	8	109	73,100	73,209
1946	8	74	75,011	75,085
North Central:				
Iowa	1	8,949	142,271	151,220
Ohio	3			
Total: 1947	4	8,949	142,271	151,220
1946	5	17,022	127,612	144,634
Southeastern:				
Alabama	1		84,089	84,089
South Carolina	1			
Tennessee	1			
West Virginia	1			
Total: 1947	4		84,089	84,089
1946	4		50,976	50,976
Pacific Coast:				
California	1		8,456	8,456
Oregon	1			
Washington	1			
Total: 1947	3		8,456	8,456
1946	3		5,155	5,155
Total United States: 1947	19	9,058	307,916	316,974
1946	20	17,096	258,754	275,850

MISCELLANEOUS USES

Scrap consumed in 1947 for miscellaneous purposes—such as rerolling, nonferrous metallurgy, and as a chemical agent—remained at slightly less than 2 percent of the total consumption. This has been unchanged for the past 3 years. The quantity so used—1,196,221 short tons—was an increase of 22 percent over that used for these purposes in 1946. 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 1947, by districts and States, in short tons

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total
New England:				
Massachusetts	2	1,108	14,698	15,806
Connecticut	1			
Total: 1947	3	1,108	14,698	15,806
1946	4	912	12,022	12,934
Middle Atlantic:				
New Jersey	17	2,749	130,337	133,086
New York	12	666	107,267	107,933
Pennsylvania	17	35,081	106,074	141,155
Total: 1947	46	38,496	343,678	382,174
1946	47	32,845	307,423	340,268
Southeastern:				
Alabama	3	74	45,206	45,280
Georgia	2	674	910	1,584
Tennessee	1			
Maryland	1	586	76,145	76,731
Virginia	2			
West Virginia	1			
Total: 1947	10	1,334	122,261	123,595
1946	10	1,132	93,649	94,781
Southwestern:				
Louisiana	1	950	38,528	39,478
Texas	3			
Total: 1947	4	950	38,528	39,478
1946	5	289	24,450	24,739
North Central:				
Illinois	9	1,084	263,897	264,981
Indiana	5	15,268	4,427	19,695
Michigan	2	2,800	29,723	32,523
Nebraska	1			
Wisconsin	2			
Minnesota	2	207	585	792
Missouri	5	----------	57,400	57,400
Ohio	8	188	70,138	70,326
Total: 1947	34	19,547	426,170	445,717
1946	30	17,741	357,788	375,529
Rocky Mountain:				
Arizona	5	----------	45,741	45,741
Nevada	2			
New Mexico	2			
Colorado	1	967	24,032	24,999
Idaho	1			
Montana [1]	3			
Utah	6	3,135	28,837	31,972
Total: 1947	20	4,102	98,610	102,712
1946	21	1,926	75,762	77,688
Pacific Coast:				
California	7	540	84,112	84,652
Oregon	1	----------	2,087	2,087
Washington	3			
Total: 1947	11	540	86,199	86,739
1946	13	434	51,330	51,764
Total United States: 1947	128	66,077	1,130,144	1,196,221
1946	130	55,279	922,424	977,703

[1] In addition, 1,073 tons of pig iron were consumed in miscellaneous uses in Montana during 1947.

STOCKS

Complete iron and steel scrap figures covering 1947 year-end stocks are not available; producers (railroads and manufacturers) were not canvassed. Dealers and automobile wreckers reporting to the Bureau of Mines had 228,614 short tons of materials on hand December 31, 1947, compared with 398,020 short tons at the end of 1946, a decrease of 169,406 short tons or 43 percent. Shipbreakers reported having 151,430 short tons of material on hand December 31, 1947. Total stocks of iron and steel scrap on hand December 31, 1947 (exclusive of producers), amounted to 4,810,984 short tons compared with 3,795,441 short tons on December 31, 1946, an increase in stocks for the first time in 5 years.

The gain in stocks in 1947 was due to the 40-percent increase in consumers' stocks of purchased scrap. Stocks of home scrap increased from 1,230,276 short tons on December 31, 1946, to 1,400,719 short tons on December 31, 1947.

Consumers' Stocks.—Consumers' stocks of home and purchased iron and steel scrap on December 31, 1947, totaled 4,430,940 short tons—an increase of 1,033,519 short tons or 30 percent from the beginning of the year. Stocks of home scrap (1,400,719 tons) increased 14 percent, and purchased scrap (3,030,221 tons) increased 40 percent. Stocks of pig iron on December 31, 1947, totaled 988,435 short tons, an increase of 8 percent over the 915,168 short tons on hand December 31, 1946.

Suppliers' Stocks.—Stocks of iron and steel scrap in the hands of dealers (224,859 tons) and automobile wreckers (3,755 tons) totaled 228,614 short tons on December 31, 1947, compared with 398,020 tons on December 31, 1946—a drop of 43 percent. Stocks held by shipbreakers amounted to 151,430 short tons on December 31, 1947.

Consumers' stocks of ferrous scrap and pig iron on hand in the United States on Dec. 31, 1946, and Dec. 31, 1947, by States and districts, in short tons

State and district	Dec. 31, 1946				Dec. 31, 1947			
	Scrap			Pig iron	Scrap			Pig iron
	Home	Purchased	Total		Home	Purchased	Total	
Connecticut	6,029	11,596	17,625	8,917	5,060	11,376	16,436	10,478
Maine	159	3,443	3,602	1,312	1,234	3,045	4,279	2,630
Massachusetts	11,022	37,530	48,552	19,311	5,729	40,033	45,762	27,231
New Hampshire	297	2,698	2,995	612	375	1,854	2,229	611
Rhode Island	744	3,741	4,485	1,367	658	5,136	5,794	1,884
Vermont	416	3,903	4,319	886	473	5,507	5,980	1,280
Total New England	18,667	62,911	81,578	32,405	13,529	66,951	80,480	44,114
Delaware New Jersey [1]	14,785	62,642	77,427	19,457	14,480	73,917	88,397	26,332
New York	67,823	96,042	163,865	64,940	107,736	130,248	237,984	55,340
Pennsylvania [1]	436,222	403,228	839,450	247,940	465,267	597,441	1,062,708	229,458
Total Middle Atlantic	518,830	561,912	1,080,742	332,337	587,483	801,606	1,389,089	311,130
Alabama	27,892	34,382	62,274	50,107	32,244	65,569	97,813	52,035
District of Columbia Kentucky [1] Maryland [1]	42,488	32,980	75,468	28,010	54,314	34,953	89,267	20,990
Florida Georgia	1,528	11,981	13,509	4,766	1,094	9,371	10,465	4,178
Mississippi	153	201	354	232	129	447	576	288
North Carolina	137	1,842	1,979	2,197	176	1,639	1,815	1,444
South Carolina	121	1,502	1,623	1,047	130	1,635	1,765	1,783
Tennessee Virginia	4,424	32,952	37,376	13,064	8,313	39,180	47,493	17,355
West Virginia	4,232	41,320	45,552	11,710	8,132	87,322	95,454	10,002
Total Southeastern	80,975	157,160	238,135	111,133	104,532	240,116	344,648	108,075
Arkansas Louisiana Oklahoma	735	9,201	9,936	926	764	12,079	12,843	901
Texas	2,074	26,530	28,604	4,847	3,531	30,923	34,454	4,736
Total Southwestern	2,809	35,731	38,540	5,773	4,295	43,002	47,297	5,637
Illinois [1]	91,811	305,207	397,018	71,597	104,036	456,582	560,618	86,461
Indiana	72,553	123,874	196,427	46,708	130,571	149,955	280,526	64,693
Iowa	4,323	28,566	32,889	4,588	4,691	38,323	43,014	7,709
Kansas Nebraska	775	16,946	17,721	706	725	11,998	12,723	1,160
Michigan Wisconsin	117,123	199,714	316,837	101,866	108,199	223,223	331,422	139,125
Minnesota	6,852	25,789	32,641	4,977	8,965	69,966	78,931	5,748
Missouri	1,915	41,259	43,174	4,515	3,053	61,918	64,971	8,248
North Dakota South Dakota	311	60	371	84	234	81	315	24
Ohio [1]	235,723	357,762	593,485	154,243	266,798	570,566	837,364	156,440
Total North Central	531,386	1,099,177	1,630,563	389,284	627,272	1,582,612	2,209,884	469,608
Arizona Nevada New Mexico	1,949	12,392	14,341	288	2,426	18,936	21,362	238
Colorado Utah	25,685	63,833	89,518	15,490	9,672	61,167	70,839	11,066
Idaho	4	2,440	2,444	52	--------	1,953	1,953	66
Wyoming	3	1	4	6	3	1	4	3
Montana	2,386	10,482	12,868	295	2,408	9,418	11,826	165
Total Rocky Mountain	30,027	89,148	119,175	16,131	14,509	91,475	105,984	11,538
Alaska Oregon Washington	4,220	48,405	52,625	2,321	4,371	53,716	58,087	3,148
California [1]	43,362	112,701	156,063	25,784	43,823	146,461	190,284	29,996
Total Pacific Coast	47,582	161,106	208,688	28,105	48,194	200,177	248,371	33,144
Undistributed [1]	--------	--------	--------	--------	905	4,282	5,187	5,189
Total United States	1,230,276	2,167,145	3,397,421	915,168	1,400,719	3,030,221	4,430,940	988,435

[1] Some scrap and pig iron stocks in California, Illinois, Kentucky, Maryland, New Jersey, Ohio, and Pennsylvania—not separable—are included with "Undistributed."

PRICES

The prices of iron and steel scrap constituted a major problem in the iron and steel industry throughout 1947, and considerable consumer resistance to higher prices was experienced late in the year. When price controls were lifted on ferrous scrap in November 1946, there was an immediate increase in the price of this material. No. 1 Heavy-Melting steel in Pittsburgh was quoted in January 1947 at $32.25 per gross ton, an increase of $13.25 over October 1946. Prices continued to increase until April, when quotations at Pittsburgh dropped an average of $5.25 per ton. No. 1 Cast was the first to show a decline in price, dropping from $43.50 a ton in March to a low of $35.50 during May and then increasing to $39.00 during June. No. 1 Heavy-Melting steel dropped from $38.00 a ton during March to a low of $30.00 during May, and then in June it resumed the upward trend and reached $34.75 by the end of the month. The next 3 months witnessed further price increases, with August as an 8-month high at $40.00 per ton; early in August the published delivered prices of No. 1 Heavy-Melting scrap in the Pittsburgh area exceeded the published base price, f. o. b. mills, of ingot steel in the same area. In September, scrap prices decreased slightly, but in November reached a 1947 high of $41.88 per ton, based on the composite price published by the Iron Age. Cast-iron scrap was in even greater demand than steel scrap, and consequently commanded higher prices. At the end of the year, the quoted price for No. 1 Cast Cupola scrap was $54.50 per gross ton at Pittsburgh and $63.50 at Chicago.

FOREIGN TRADE [1]

Imports.—Imports of iron and steel scrap in 1947 increased 20 percent in quantity (36,191 short tons compared with 30,228 tons in 1946) and 151 percent in value ($668,790 compared with $266,733 in 1946). Of the 1947 imports, 21,491 tons came from Cuba, 5,468 tons from Curaçao, 4,069 tons from Canada, and the remainder in small tonnages from other countries. In addition, 34,492 tons of tin-plate scrap were imported (28,795 tons from Canada) compared with 27,473 tons in 1946.

Exports.—Exports of ferrous scrap from the United States in 1947 were 194,021 short tons valued at $9,800,005, a 30-percent increase in tonnage over 1946 and a 190 percent increase in value. Exports exceeded imports by 157,830 short tons (not counting 34,492 tons of imported tin-plate scrap). The tonnage exported amounted to 6 percent of the 5-year prewar average (for 1935–39) of 3,298,326 tons a year, compared with 5 percent during 1946. The high domestic requirement for scrap is the reason for the continued low level of exports. The 1947 exports included 29,745 tons of tin-plate circles, scrap strips, cobbles, waste-waste, and terneplate clippings and scrap valued at $5,519,847. The same materials in 1946 totaled 12,826 tons valued at $1,052,160. The accompanying table shows the principal countries to which scrap was exported during 1943–47.

[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.

Ferrous scrap exported from the United States, 1943–47, by countries, in short tons

[U. S. Department of Commerce]

Country	1943	1944	1945	1946	1947
Argentina		87	4,264	4,630	8,414
Brazil		271	1,088	787	1,165
Canada	34,085	71,518	47,465	82,346	119,394
Chile	615	72	7,447	1,334	5,719
China			112	7,930	6,315
Colombia	155	1,819	955	22	587
Cuba	1		687	521	845
Denmark				55	2,080
Hong Kong				649	2,572
Mexico	18,157	17,509	27,471	48,194	33,978
Philippines, Republic of				240	429
Portugal				97	2,074
Sweden			510	493	2,448
Turkey			59	50	1,077
Union of South Africa	461		168	393	477
United Kingdom	115		199	435	141
Uruguay		220	4,432	425	1,721
Other countries	1,305	4,186	877	505	4,585
Total: Short tons	54,894	95,682	95,734	149,106	194,021
Value	$1,070,809	$1,910,226	$2,589,239	$3,384,514	$9,800,005

Lead[1]

By RICHARD H. MOTE

GENERAL SUMMARY

EXTRAORDINARY consumer demand, which boosted the lead price to record-breaking levels, and a general absence of labor and reconversion problems, such as burdened the lead industry in 1946, together were chiefly responsible for increases of 15 percent in mine output of recoverable lead, of 32 percent in smelter production of refined lead, and of 30 percent in recovery of lead from secondary sources in 1947. The increased supply, however, was quickly absorbed by consumers for current needs and for liquidation of the backlog of civilian demand accumulated during the war. The over-all consumption of primary, antimonial, and secondary lead in 1947 is estimated at a record high of 1,172,000 short tons.

All previous peak records for recovery of lead from secondary sources were shattered in 1947. Recovery of secondary lead exceeded that in the previous record year 1941 by 29 percent and topped the 1946 output by 30 percent. For the second successive year, secondary lead production surpassed the output of recoverable lead from domestic mines.

Refined lead stocks (physical inventory) at primary smelters and refineries declined 67 percent during 1947, whereas consumers' inventories at the end of the year were 19 percent greater than on January 1.

The Office of Metals Reserve stock pile of refined lead was reduced to 4,996 tons at the end of 1947—approximately one-tenth of the quantity available for allocation at the beginning of the year.

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

[1] This report deals primarily with the smelting, refining, and consuming phases of the industry. For details of mining operations, see various State chapters of this volume.

Salient statistics of the lead industry in the United States, 1938–42 (average) and 1943–47, in short tons

	1938–42 (average)	1943	1944	1945	1946	1947
Production of refined primary lead:						
From domestic ores and base bullion	424,776	406,544	394,443	356,535	293,309	381,109
From foreign ores and base bullion	82,962	63,068	70,320	87,050	44,888	59,901
Total	507,738	469,612	464,763	443,585	338,197	441,010
Recovery of secondary lead	289,433	342,094	331,416	363,039	392,787	511,970
Imports:[1]						
Lead in pigs, bars, and old	161,118	244,510	226,073	230,313	114,706	175,449
Lead in base bullion	30,476	4,583	58	8	125	1,590
Lead in ores and matte	69,798	69,945	93,570	70,005	44,407	50,752
Exports of refined pig lead [2]	37,902	13,261	15,523	1,784	700	1,616
Estimated consumption of primary and secondary lead	817,600	1,113,000	1,118,643	1,051,602	956,476	1,172,000
Prices (cents per pound):						
New York:						
Average for year	5.45	6.50	6.50	6.50	8.11	14.67
Quotation at end of year	5.64	6.50	6.50	6.50	12.55	15.00
London average	3.98	4.49	4.49	4.99	8.63	15.27
Mine production of recoverable lead	439,752	453,313	416,861	390,831	335,475	384,221
World smelter production of lead	1,890,500	1,722,900	1,482,200	1,231,400	1,141,800	1,413,100

[1] Data include lead imported for immediate consumption plus material entering the country for storage under bond.
[2] Includes 11,258 tons of foreign lead reexported in 1943, less than 1 ton in 1944, 377 tons in 1945, 103 tons in 1946, and 102 tons in 1947, according to records of the U. S. Department of Commerce.

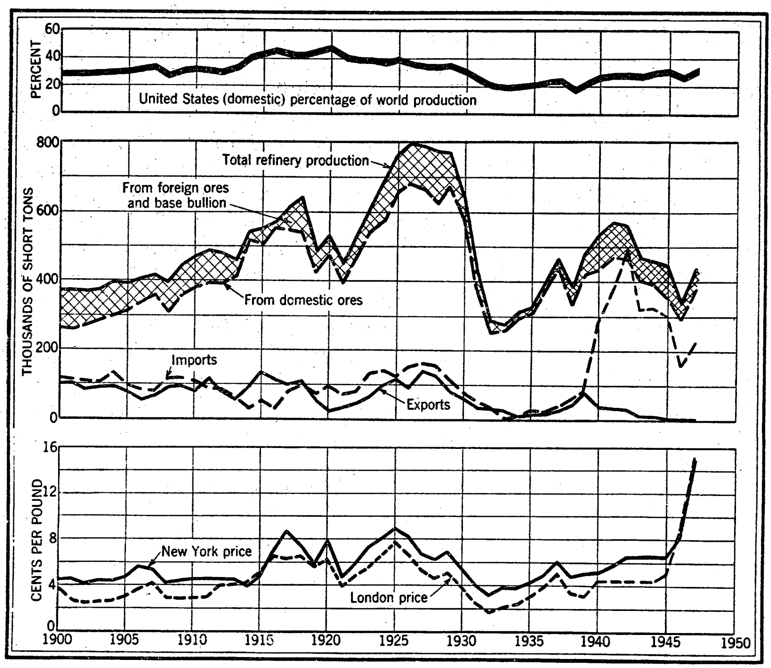

FIGURE 1.—Trends in the lead industry in the United States, 1900–1947. Imports include lead in ore, base bullion, pig lead, and scrap; exports include pigs, bars, and scrap lead exported in manufactures with benefit of draw-back. Data on lead exported in manufactures with benefit of draw-back not available for 1945–47.

RESERVES

The following information on reserves of lead in the United States was prepared by the Bureau of Mines and Geological Survey and published in hearings before a Subcommittee of the Committee on Public Lands, United States Senate, Eightieth Congress, 1st Sess., 1947 (pp. 257–258):

In the chapter on zinc a number of problems that prevent an accurate estimate of reserves are discussed. Because of the intimate association of the two metals, the same limitations apply to estimates of lead reserves. As with the zinc estimates, it has been necessary to include a relatively large quantity of inferred ore in estimates of potential lead supplies.

The existing technology for recovery of lead is so efficient and universally applicable that no significant reserves remain unexploited because of technologic difficulties. The lead reserves available under present technologic conditions are listed in the following categories: (1) Reserves that could be mined under normal economic conditions as reflected in the prices of lead and associated metals, particularly zinc, in relation to production costs ("6-cent lead" and "6-cent zinc" in the 20-year period, 1921–40); (2) additional reserves that could be mined only under more favorable economic conditions, assuming a cost-price spread somewhat better than normal; and (3) additional reserves that could be mined only under abnormal conditions similar to those of 1942–44, wherein the higher premiums for both lead and zinc were paid to operators of deposits of this class. As lead is the subordinate constituent in many base-metal ores, the price of the major constituent, usually zinc, will have a large effect on the quantity of lead mined. The price of silver also will be a critical determining factor in the exploitation of many lead-producing properties.

The [accompanying table] summarizes these estimated reserves. Probably 6.2 million short tons of lead—measured, indicated, and inferred—is in ore that can be mined under normal economic conditions. An additional 1.3 million tons is available in ore that should be workable under more favorable economic conditions. The quantity of lead that could be mined only at wartime premium prices is believed to be small, although it is realized that there may be a large tonnage of low-grade material available in Southeastern Missouri about which insufficient information is available for quantitative estimates. A considerable tonnage of lead contained in the low-grade zinc ores remaining in parts of the Tri-State region may never be recovered if this ore is not mined during the period of favorable metal prices following the war.

The estimate does not include inferred reserves in districts not yet discovered. or in known districts the lead potentialities of which have not yet been realized. Hence the estimate is a minimum that will undoubtedly be augmented by such factors to an unknown extent.

Estimated lead reserves of the United States as of January 1944, in short tons of metallic lead

	Measured and indicated [1]		Inferred		Total	
	Gross content in ground	Recoverable content [2]	Gross content in ground	Recoverable content [2]	Gross content in ground	Recoverable content [2]
A. Lead in deposits that could be mined under technologic conditions as in 1944:						
1. Under normal economic conditions [3]	2,090,000	1,770,000	4,120,000	3,500,000	6,210,000	5,270,000
2. Additional, under somewhat more favorable economic conditions	400,000	340,000	890,000	760,000	1,290,000	1,100,000
3. Additional, under emergency prices	110,000	90,000	140,000	120,000	250,000	210,000
Total	2,600,000	2,200,000	5,150,000	4,380,000	7,750,000	6,580,000
B. Lead in deposits whose exploitation is dependent on future technologic advances					Nil	

[1] This includes estimates of measured and indicated ore in some properties where such ore is known, but for which the tonnage figures are unavailable to us.

[2] Milling and smelting losses are considered to be roughly 15 percent.

[3] Price equivalent to 6 cents per pound for both lead and zinc, and prewar costs.

The Alaskan reserves, which as known at present amount to only 36,000 tons of metal, indicated and inferred, in all categories of ore, are not included in the table.

Without regard for price and productive capacity, the lead recoverable from measured and indicated ore by present technologic methods is equivalent to the domestic needs of this country for 4 years at an estimated minimum peacetime rate of 500,000 tons of primary metal per year. The additional inferred reserves in known districts should add another 9 years. At an annual wartime demand of about 750,000 tons, the total reserve is equivalent to only a 9-year supply. However because domestic lead-producing capacity is not rapidly adjustable to sudden increases in demand for the same reasons that make zinc production equally unadjustable, it would appear probable that, unless a huge stock pile is built up, heavy dependence will be placed on foreign sources in any future war period. The lead deposits of Mexico appear ample to supply a large share of such needs.

DOMESTIC PRODUCTION

Statistics on lead output may be prepared on a mine or on a 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 owing 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 increased 15 percent in 1947; but, except for 1946, the output was the smallest since 1938. The domestic mine production of lead 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 in 1947, about 65 percent came from the output of 25 mines. Missouri again ranked first in the production of lead, and the Southeastern Missouri district continued to be the largest lead-producing area, supplying 34 percent of the total domestic output. The St. Joseph Lead Co. continued, as in the past, to produce the bulk of the output from its Bonne Terre, Desloge, Federal, and Leadwood groups of mines. Each mine is equipped with a mill; the four have a combined daily capacity of 21,400 tons of ore. The Tri-State area produced 6 percent of the total domestic output in 1947 compared with 7 percent in 1946. The Western States contributed 58 percent of the total domestic production and recorded a 34-percent gain in output over 1946. Idaho continued to be the largest producer of lead in the Western States and second largest in the United States. More than 92 percent of the State total lead came from the Coeur d'Alene region. Six properties in Idaho produced 56 percent of the State total lead, and of the total 85 percent came from zinc-lead ore and old tailings. In 1947, lead mining in Utah had its best year since 1944. The United States & Lark property of the United States Smelting, Refining & Mining Co. in the West Mountain (Bingham) district remained first among the State lead producers. 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 19 percent greater than in 1946. The Copper Queen mine of the Phelps Dodge Corp. at Bisbee continued to be the largest Arizona lead producer in 1947; about 89 percent of the total lead was recovered from zinc-lead ore. Colorado lead production increased 10 percent; the California (Leadville) district continued to be the largest lead-producing area in the State. Zinc-lead ore yielded 44 percent of the State total in 1947.

Mine production of recoverable lead in the United States, 1938–42 (average) and and 1943–47, by States, in short tons

State	1938–42 (average)	1943	1944	1945	1946	1947
Western States and Alaska:						
Alaska	757	200	44	11	115	264
Arizona	13, 004	13, 727	16, 707	22, 867	23, 930	28, 566
California	2, 282	5, 820	5, 682	7, 224	9, 923	10, 080
Colorado	11, 382	18, 032	17, 698	17, 044	17, 036	18, 696
Idaho	101, 363	96, 457	83, 530	68, 447	59, 987	78, 944
Montana	18, 045	16, 324	13, 105	9, 999	8, 280	16, 108
Nevada	6, 283	4, 790	6, 605	6, 275	7, 175	7, 161
New Mexico	4, 688	5, 723	7, 265	7, 662	4, 899	6, 383
Oregon	31	4	4	1	2	12
South Dakota	18	41	34			8
Texas	228	13			47	78
Utah	70, 102	65, 257	52, 519	40, 817	30, 711	49, 698
Washington	3, 862	5, 022	5, 825	3, 802	2, 987	5, 359
Wyoming	1			3		
Total	232, 046	231, 410	209, 018	184, 152	165, 092	221, 357
West Central States:						
Arkansas	15	1		1	2	18
Kansas	12, 964	9, 213	9, 394	7, 370	6, 445	7, 285
Missouri	163, 163	184, 910	174, 683	176, 575	139, 112	132, 246
Oklahoma	23, 558	19, 733	13, 944	12, 664	13, 697	14, 289
Total	199, 700	213, 857	198, 021	196, 610	159, 256	153, 838
States east of the Mississippi River:						
Illinois	1, 342	2, 043	1, 971	3, 005	3, 865	2, 325
Kentucky	233	240	170	129	95	214
New York	2, 180	2, 355	1, 644	862	1, 073	1, 496
North Carolina	1					
Tennessee	381	200		54	125	22
Virginia	3, 239	2, 288	4, 622	4, 243	4, 381	3, 803
Wisconsin	630	920	1, 415	1, 776	1, 588	1, 166
Total	8, 006	8, 046	9, 822	10, 069	11, 127	9, 026
Grand total	439, 752	453, 313	416, 861	390, 831	335, 475	384, 221

Mine production of recoverable lead in the United States, by districts that produced 1,000 tons or more during any year, 1943–47, in short tons

District	State	1943	1944	1945	1946	1947
Southeastern Missouri region	Missouri	179,012	169,622	173,005	135,796	129,516
Coeur d'Alene region	Idaho	89,813	76,813	63,430	56,548	73,060
West Mountain (Bingham)	Utah	35,437	31,169	22,723	12,343	26,163
Tri-State (Joplin region)	Kansas, Southwestern Missouri, Oklahoma.	34,722	28,059	23,556	23,363	24,239
Warren (Bisbee)	Arizona	712	3,497	9,400	10,889	13,422
Park City region	Utah	16,022	11,660	8,916	8,373	10,987
Summit Valley (Butte)	Montana	3,290	3,251	2,870	2,357	10,630
Coso (Darwin)	California	2,448	2,609	5,214	7,708	6,551
Tintic	Utah	8,261	5,319	4,930	4,239	6,166
Old Hat	Arizona	3,140	4,161	5,216	[1] 4,790	4,603
California (Leadville)	Colorado	4,950	5,752	5,016	4,441	4,296
Rush Valley and Smelter (Tooele County).	Utah	3,505	3,293	3,137	3,490	3,829
Austinville	Virginia	1,760	4,235	4,222	4,381	3,803
Pioche	Nevada	2,942	4,056	2,987	3,493	3,487
Central	New Mexico	3,571	4,428	5,379	3,199	3,450
Metaline	Washington	4,581	5,278	3,506	2,224	3,450
Pima (Sierritas, Papago, Twin Buttes).	Arizona	578	2,445	2,063	2,296	2,909
Upper San Miguel	Colorado	2,074	1,442	1,986	2,376	2,559
Big Bug	Arizona	1,145	1,244	1,981	2,155	2,323
Animas	Colorado	2,657	2,236	2,613	3,207	2,241
Heddleston	Montana	2,350	2,436	3,175	2,648	2,087
Pioneer (Rico)	Colorado	2,566	2,826	2,440	2,176	2,042
Bayhorse	Idaho	1,481	2,069	1,302	553	2,039
Magdalena	New Mexico	1,320	1,620	1,243	1,273	1,987
Kentucky—Southern Illinois	Kentucky, Southern Illinois.	2,199	2,048	2,649	3,687	1,889
Warm Springs	Idaho	3,635	3,333	2,347	1,649	1,879
Upper Mississippi Valley	Iowa, Northern Illinois, Wisconsin.	1,004	1,508	2,261	1,861	1,816
St. Lawrence County	New York	2,355	1,644	862	1,073	1,496
Tomichi	Colorado	284	373	365	333	1,458
Harshaw	Arizona	3,496	2,212	1,066	692	1,393
Ten Mile	Colorado	226	241	680	810	1,167
Alder Creek	Idaho	50	32	38	136	1,103
Bossburg	Washington	49	5	158	428	1,010
Red Cliff	Colorado	1,761	1,444	572	690	924
Ophir	Utah	1,461	365	115	336	790
Wallapai	Arizona	1,392	784	752	369	654
Eagle	Montana	1,580	1,128	599	469	393
Smelter (Lewis and Clark County).	do	2,389	1,364	223	463	60
Barker	do	1,633	56	57	32	89
Resting Springs [2]	California	(3)	(3)	(3)	(3)	(3)

[1] Revised figure.
[2] Not listed in order of output.
[3] Bureau of Mines not at liberty to publish figures.

Mine production of recoverable lead in the United States, 1941–47, by months, in short tons [1]

Month	1941	1942	1943	1944	1945	1946	1947
January	[2] 37,627	44,182	37,265	38,656	34,830	32,475	31,545
February	[2] 37,627	42,946	36,286	37,982	31,567	29,442	30,251
March	[2] 37,627	45,305	40,052	39,272	35,229	30,298	32,735
April	38,197	44,318	39,180	37,753	33,592	28,108	33,302
May	39,078	43,301	37,868	36,352	35,346	25,555	33,361
June	38,099	42,238	36,873	33,733	31,944	23,269	32,826
July	36,829	41,770	36,488	29,554	30,717	25,050	29,942
August	36,872	39,821	38,280	35,727	30,805	28,641	31,281
September	37,769	37,834	36,654	31,522	29,947	27,250	31,124
October	39,503	38,191	38,111	31,987	32,942	26,198	33,682
November	40,423	37,065	37,524	32,158	32,007	28,860	31,550
December	41,775	39,268	38,732	32,165	31,905	30,329	32,622
Total	461,426	496,239	453,313	416,861	390,831	335,475	384,221

[1] Monthly data for 1941–44 were based largely on smelter receipts, whereas those for 1945–47 represent actual mine output. All monthly figures have been adjusted to final annual mine production totals.
[2] Monthly average for first quarter; actual monthly figures not available.

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The 25 leading lead-producing mines in the United States in 1947, listed in the following table, yielded 65 percent of the total domestic lead output; the 5 leading mines produced 37 percent and the 10 leading mines nearly 50 percent.

Twenty-five leading lead-producing mines in the United States in 1947, in order of output

Rank	Mine	District	State	Operator	Type of ore
1	Federal	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
2	Leadwood	do	do	do	Do.
3	United States & Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining, & Mining Co.	Zinc-lead.
4	Desloge	Southeastern Missouri	Missouri	St. Jospeh Lead Co.	Lead.
5	Bunker Hill & Sullivan	Yreka	Idaho	Bunker Hill & Sullivan Mining & Concentrating Co.	Zinc-lead.
6	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp.	Do.
7	Bonne Terre	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
8	Star	Hunter	Idaho	Sullivan Mining Co.	Zinc-lead.
9	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co.	Do.
10	Page	Yreka	Idaho	Federal Mining & Smelting Co.	Do.
11	Mine La Motte	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead.
12	Darwin group	Coso (Darwin)	California	Anaconda Copper Mining Co.	Do.
13	Madison	Southeastern Missouri	Missouri	St. Louis Smelting & Refining Co.	Lead-copper.
14	Chief, Gemini, etc.	Tintic	Utah	Chief Consolidated Mining Co.	Zinc-lead.
15	Morning	Hunter	Idaho	Federal Mining & Smelting Co.	Do.
16	Mammoth-Collins	Old Hat	Arizona	St. Anthony Mining & Development Co.	Do.
17	Sherman	Lelande	Idaho	Day Mines, Inc.	Do.
18	Austinville	Austinville	Virginia	New Jersey Zinc Co.	Do.
19	Sidney	Yreka	Idaho	Sidney Mining Co.	Do.
20	Silver King	Park City	Utah	Silver King Coalition Mines Co.	Do.
21	Park Galena & Mayflower	do	do	New Park Mining Co.	Do.
22	Combined Metals group	Pioche	Nevada	Combined Metals Reduction Co., & R. E. West Mining Co.	Do.
23	Park Utah	Park City	Utah	Park Utah Consolidated Mining Co.	Do.
24	Resurrection	California (Leadville)	Colorado	Resurrection Mining Co.	Do.
25	San Xavier	Pima	Arizona	Eagle-Picher Mining & Smelting Co.	Do.

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.

SMELTER AND REFINERY PRODUCTION

Pig lead in the United States is derived from three main sources—domestic mine production, imports of foreign ore and base bullion, and secondary smelter output 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 eight primary smelters operating in the Western States, only two (Selby, Calif., and Bradley, Idaho) produce refined merchant lead. The other six 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 Secondary Lead section of this chapter. The 15 primary smelters and refineries in operation in the United States in 1947 consumed 448,703 short tons (lead content) of ore and concentrates, 14 percent of which was of foreign origin, compared with 353,197 tons in 1946, 12 percent of which was foreign.

ACTIVE LEAD SMELTERS AND REFINERIES

Primary lead smelters and refineries operating in the United States in 1947 were as 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, Bunker Hill & Sullivan Mining & Concentrating Co. (smelter and refinery).
Illinois: Alton—Federal plant, American Smelting & Refining Co. (smelter and refinery).
Indiana: 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—Midvale plant, 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 1947 produced 456,672 short tons of refined lead, an increase of 32 percent over 1946 output of 346,210 tons.

Of the 441,010 tons of primary lead produced in 1947, domestic ores and base bullion supplied 86 percent and foreign ores and imported base bullion 14 percent. In 1946 the origin was 87 percent domestic and 13 percent foreign. The quantity of refined lead produced from foreign base bullion has been negligible since 1943. The accompanying 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 Mine Production section of this chapter.

Refined lead produced at primary refineries in the United States, by sources, 1943–47, in short tons

Source	1943	1944	1945	1946	1947
Refined lead:					
From domestic ores and base bullion	406,544	394,443	356,535	293,309	381,109
From foreign ores	62,936	70,225	86,932	44,790	59,838
From foreign base bullion	132	95	118	98	63
Total from primary sources	469,612	464,763	443,585	338,197	441,010
From scrap	1,863	11,368	18,525	8,013	15,662
Total refined lead	471,475	476,131	462,110	346,210	456,672
Average sales price per pound	$0.064	$0.064	$0.064	$0.084	$0.143
Total calculated value of primary refined lead [1]	$60,110,000	$59,490,000	$56,780,000	$56,820,000	$126,130,000

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

Refined primary lead produced in the United States, by country of origin, 1943–47, in short tons

Source	1943	1944	1945	1946	1947
Domestic ore and base bullion	406,544	394,443	356,535	293,309	381,109
Foreign ore:					
Australia	16,180	22,210	22,087	7,534	5,952
Canada	4,537	7,461	11,151	5,026	3,548
Mexico	2,213	5,250	3,097	2,056	5,523
South America	9,610	13,434	25,701	11,344	17,096
Other Foreign	30,396	21,870	24,896	18,830	27,719
Total	62,936	70,225	86,932	44,790	59,838
Foreign base bullion:					
Mexico	60	58	63	10	30
South America	72	37	55	88	33
Total	132	95	118	98	63
Total foreign	63,068	70,320	87,050	44,888	59,901
Grand total	469,612	464,763	443,585	338,197	441,010

ANTIMONIAL LEAD

Antimonial lead production at primary refineries increased to 86,075 tons in 1947, 71 percent greater than the 1946 output. The distribution of the lead, according to source, is shown in the following table. The quantity of antimony contained in antimonial lead produced in 1947 dropped to 5.7 percent owing to a greater demand for low-percentage alloys for use in manufacturing of such items as type metal, cable covering, 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 Secondary Metals—Nonferrous chapter of this volume.

Antimonial lead produced at primary lead refineries in the United States, 1943–47

Year	Production (short tons)	Antimony content		Lead content by difference (short tons)			
		Short tons	Percent	From domestic ore	From foreign ore	From scrap	Total
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
1946	50,480	3,285	6.5	11,196	2,149	33,850	47,195
1947	86,075	4,933	5.7	14,836	9,850	56,456	81,142

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 1943–47 is shown in the following table. Secondary lead recovery in 1947 exceeded the total domestic refined primary lead production by 16 percent and surpassed the domestic mine output of recoverable lead for the second successive year. Further details appear in the Secondary Metals—Nonferrous chapter of this volume.

Secondary lead recovered in the United States, 1943–47, in short tons

	1943	1944	1945	1946	1947
As refined metal:					
At primary plants	1,863	11,368	18,525	8,013	15,662
At other plants	56,459	43,678	42,598	65,691	95,843
Total	58,322	55,046	61,123	73,704	111,505
In antimonial lead:					
At primary plants	32,887	34,475	42,366	33,850	56,456
At other plants	144,040	146,343	151,713	159,834	209,479
Total	176,927	180,818	194,079	193,684	265,935
In other alloys	106,845	95,552	107,837	125,399	134,530
Grand total:					
Short tons	342,094	331,416	363,039	392,787	511,970
Value	$43,788,000	$42,421,248	$46,468,992	$65,988,216	$146,423,420

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 Lead and Zinc Pigments and Zinc Salts chapter of this volume.

CONSUMPTION AND USES

A survey of 575 plants in 1947 representing an estimated 98 percent of the consumers of refined lead indicated a total consumption of 660,657 short tons of refined lead, an increase of 25 percent over 1946. 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; 16 percent for storage batteries; 12 percent for tetraethyl fluid; 8 percent for white lead; 3 percent for solder; 4 percent for pipes, traps, and bends; 5 percent for sheet lead; 3 percent for ammunition; and 10 percent for a variety of products and uses shown in the following table. Total consumption of primary, antimonial, and secondary lead in 1947 is estimated at 1,172,000 tons compared with 956,476 tons in 1946.

Consumption of refined lead in the United States, 1943–47, by uses, in short tons

	1943	1944	1945	1946	1947
Ammunition	64,023	31,479	29,315	16,857	18,471
Bearing metals	10,189	15,941	14,104	11,012	8,487
Brass and bronze	5,748	7,845	7,069	5,328	4,051
Cable covering	117,802	110,417	86,158	69,004	91,826
Calking lead	8,618	9,411	13,374	8,314	11,174
Casting metals	3,072	4,425	5,322	3,566	993
Collapsible tubes	11,425	12,482	7,428	7,189	3,804
Foil	5,816	11,190	2,185	2,143	2,290
Pipe, traps, and bends	18,724	24,387	24,061	27,372	28,773
Sheet lead	27,738	31,546	30,624	26,430	32,667
Solder	15,472	22,390	27,475	32,279	22,402
Storage batteries	68,239	68,769	60,179	56,726	103,896
Terneplate	815	2,190	2,178	1,526	540
Type metals	812	1,269	1,401	1,487	1,077
White lead	36,809	54,333	35,611	43,294	51,347
Red lead and litharge	124,715	157,080	157,171	128,513	166,763
Tetraethyl lead	65,320	83,067	75,890	47,965	78,280
Chemicals and insecticides	8,172	10,703	8,567	8,169	1,843
Annealing	5,987	5,719	5,525	5,514	6,307
Galvanizing	819	1,073	988	1,132	1,271
Lead plating	941	494	1,130	1,182	1,222
Weights and ballast	9,269	22,964	9,539	3,089	3,181
Other	64,940	33,646	32,205	22,497	19,992
Total	675,465	722,820	637,499	530,588	660,657

STOCKS

Producers' Stocks.—Lead stocks, as reported monthly by the American Bureau of Metal Statistics, are shown in the following table. Inventories of refined lead and antimonial lead declined generally from a high of 48,826 tons on January 31 to a low of 21,328 tons at the end of the year.

Lead stocks at end of year at smelters and refineries in the United States, 1943–47, in short tons

[American Bureau of Metal Statistics]

	1943	1944	1945	1946	1947
Refined pig lead	28,821	15,602	[1] 37,584	[1] 40,870	13,634
Antimonial lead	4,269	3,934	[1] 7,283	[1] 6,717	7,694
Total	33,090	19,536	[1] 44,867	[1] 47,587	21,328
Lead in base bullion—					
At smelters and refineries	8,640	7,333	8,618	8,453	7,652
In transit to refineries	3,112	3,331	4,889	4,911	5,447
In process at refineries	16,020	14,473	15,097	16,042	16,328
Total	27,772	25,137	28,604	29,406	29,427
Lead in ore and matte and in process at smelters	68,678	80,461	89,462	111,836	77,199
Grand total	129,540	125,134	[1] 162,933	[1] 188,829	127,954

[1] Revised figure.

The Bureau of Mines annual survey of primary lead smelters and refiners indicated stocks of 40,963 tons (lead content) of refined lead at plants on January 1, 1947, and 13,633 tons on December 31, 1947. Primary antimonial lead stocks at these same plants increased from 5,935 short tons (lead content) at the beginning of 1947 to 7,009 tons at the end of the year. In terms of lead content, stocks of ore at the 15 operating smelters and refineries decreased 36 percent from 72,400 tons to 46,295 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 7,581 tons at the beginning of January and 7,767 tons at the end of December 1947. Stocks of "in-process" base bullion or work lead at five 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 575 consumer plants reported stocks of 48,816 tons of domestic and foreign refined lead on hand December 31, 1947—a 19-percent increase over the 41,144-ton inventory (revised figure) reported at the end of 1946.

Consumers' stocks of refined soft lead at the end of 1946 and 1947, by grades, in short tons

	Domestic and foreign					Foreign (all grades)
	Corroding	Chemical	Common	Other	Total	
Dec. 31, 1946 [1]	11,769	9,981	16,598	2,796	41,144	2,713
Dec. 31, 1947	25,524	6,151	13,778	3,363	48,816	3,793

[1] Revised figures

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 of the Office of Metals Reserve, Government stocks of refined lead (mostly corroding grade) were 4,996 short tons on December 31, 1947, compared with 45,493 tons of refined lead on January 1, 1947.

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 per pound, an amount approximating the freight charges between the two points.

The market price for common lead, New York, was quoted at $0.1255 per pound until January 7, 1947 (the previous record high which prevailed for a brief period in June 1917 was $0.1225, New York). On January 7 the price advanced to $0.13 per pound and a further advance to $0.14 occurred on February 25. Several days later on March 3 domestic producers again advanced the price to $0.15 per pound, at which level it remained the balance of the year.

The official London maximum price of £70 per long ton, duty paid, for Empire and foreign soft lead, fixed by the British Ministry of Supply January 1, 1947, was advanced to £90 March 31 but remained unchanged the balance of the year. Quotations of the London Metal Exchange, discontinued at the outbreak of the war in September 1939, were not resumed during 1947.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1945–47, in cents per pound [1]

	1945			1946			1947		
	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	6.28	12.76	12.93	12.58
February	6.35	6.50	4.49	6.35	6.50	7.01	13.01	13.18	12.58
March	6.35	6.50	4.49	6.35	6.50	7.01	14.77	14.96	12.58
April	6.35	6.50	4.49	6.35	6.50	7.84	14.82	15.00	16.17
May	6.35	6.50	4.49	6.35	6.50	8.09	14.82	15.00	16.17
June	6.35	6.50	5.13	8.03	8.18	8.09	14.82	15.00	16.17
July	6.35	6.50	5.39	9.10	9.25	9.88	14.82	15.00	16.17
August	6.35	6.50	5.39	8.10	8.25	9.88	14.82	15.00	16.17
September	6.35	6.50	5.39	8.10	8.25	9.88	14.82	15.00	16.17
October	6.35	6.50	5.39	8.10	8.25	9.88	14.82	15.00	16.17
November	6.35	6.50	5.39	10.29	10.44	9.88	14.82	15.00	16.17
December	6.35	6.50	5.39	12.02	12.19	9.88	14.82	15.00	16.17
Average	6.35	6.50	4.99	7.96	8.11	8.63	14.50	14.67	15.27

[1] St. Louis: Metal Statistics, 1948, p. 519. New York: Metal Statistics, 1948, p. 513. London: E&MJ Metal and Mineral Markets.

[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; Jan. 15, 1946; Apr. 8, 1946; July 1, 1946; Jan. 1, 1947; and Mar. 31, 1947.

HISTORY OF THE PREMIUM PRICE PLAN

The Premium Price Plan, which involved a 5⅓-year period of unprecedented entry through legislation of Government into the economics of mining, originated in 1942. Although the necessity for increased domestic lead output to meet national defense needs was a matter of concern to Government and industry following the outbreak of war in Europe, the gravity of the domestic supply situation was not seriously considered until the Japanese attack on Pearl Harbor.

In an effort to expand domestic mine output of lead for the war program, the Office of Production Management jointly with the Office of Price Administration announced on January 13, 1942, the details of a plan whereby producers (miners) of lead (copper and zinc were also included in the plan) received through the Metals Reserve Company 9.25 cents a pound for lead produced in excess of quotas based upon 1941 output as against the regular ceiling price of 6.50 cents a pound, New York, established on the same date. This plan, originally scheduled for 2½ years' duration, became effective February 1, 1942. In the Tri-State district the miner was paid an extra $39.60 a ton for 80-percent lead sulfide concentrates, this being declared the equivalent of 2.75 cents a pound premium. Later in 1942 the figure was adjusted to $41.80. The Premium Price Plan was continued without further change in 1942.

Although the lead situation was relatively easy in 1942, the record of zinc output under the Premium Price Plan in that year indicated the need for materially higher prices if wartime production objectives were to be achieved. New premiums were approved by the Metals Reserve Company on December 23, 1942 in a revision of the plan whereby a second premium price level for lead above the existing subsidy of 2.75 cents was established. The additional premium on lead was justified only on the ground that it would serve to keep in operation mines whose output might later be needed on short notice and that it would be an additional incentive to zinc production in those mines producing both metals. The Quota Committee thus interpreted the additional premium for lead as an added zinc bonus and, in fact, granted it only to mines in which zinc occurred. In accordance with the revised plan the quotas were designated "A" quotas and "B" quotas. An "A" quota was defined as the ore tonnage for which a mine received the ceiling price of 6.50 cents. A mine with an "A" quota would thus receive the first premium price of 2.75 cents per pound for lead produced in excess of the "A" quota. Similarly, a "B" quota was the tonnage for which a mine received the first premium price, and all production in excess of the "B" quota received the second premium price of 2.75 cents. Thus it was possible to receive up to 12.00 cents a pound for mine production of lead. Under the revised plan, which became effective January 1, 1943, the period of premium prices was extended until July 31, 1945, and provision was made for increase or revocation of the new quotas upon 30 days' notice.

During the latter part of 1943, the supply of lead (and zinc) was considered adequate by the War Production Board in view of increased production, large Government stocks, revised military requirements, and labor supply. Accordingly, on October 27, this agency issued a statement denying the premium price in the "B" range to mines not already operating on that date. Subsequently this was clarified by considering a mine as "already operating" on October 27 if a quota was assigned, the mine shipped metal (lead in ore or concentrates), or expenditures for development, reconditioning, or on capital account were made on or before October 27 to bring the mine into production under the benefits of the quota plan.

The Premium Price Plan functioned without further change through 1944 and 1945. Before the date set for expiration of the original plan—July 31, 1945—Congress voted the Hayden-McFarland Bill, S. 502, into Public Law 88 on June 14, extending the Plan until June 30, 1946.

A bill to extend the OPA and ceiling prices, with which the structure and operation of the Premium Price Plan were intimately related, was vetoed by President Truman on June 29, 1946. Thus on June 30, without legislative approval for continuation and without fixed prices upon which to base subsidy payments, the Premium Price Plan ceased to exist. Reestablishment of the OPA on July 25 provided for retroactive premium payments to cover the period when no plan was in effect, and the Premium Price Plan was extended until June 30, 1947, under the same terms as in the past, except that, incorporated in the subsidy section of the bill extending the OPA, was a provision that "adjustments shall be made to encourage exploration and development work and adequate allowances for depreciation and depletion." The bill provided further that all classes of premiums were noncancelable unless necessary to make individual adjustments of income to specific mines. With the abandonment of metal price ceilings on November 10, subsidies to mines financially aided by the Premium Price Plan were computed with average monthly market quotations as a base.

Continuation of the Premium Price Plan for 2 years beyond June 30, 1947, was proposed in the Allen Bill (H. R. 1602). This legislation, which was vetoed by President Truman on August 8, included provisions for subsidy payments on domestic mine production of copper, lead, zinc, and manganese at an annual cost of not more than $35,000,000.

A compilation of important data showing production of lead under the Premium Price Plan, 1942–47, at the various quota levels and the payments made, is given in the accompanying table.

Salient statistics on lead with regard to operation of Premium Price Plan, 1942–47 [1]

	1942 [2]	1943	1944	1945	1946	1947 [3]
TRI-STATE DISTRICT						
Total production of recoverable lead [4] short tons	30,746	34,830	28,956	23,097	23,887	14,102
Ceiling production at 6.50 cents a pound short tons	10,811	1,863	3,138	1,164	2,000	9,989
Percent of ceiling production to total production	35.16	5.35	10.84	5.04	8.37	70.83
Production under Premium Price Plan:						
"A" quota only (9.25 cents a pound) short tons	19,700	26,259	19,494	13,009	[5] 4,004	
"B" quota (12.00 cents a pound) do	235	6,514	5,633	8,159	[5] 14,203	(6)
					[7] 3,680	
Total premium production do	19,935	32,773	25,127	21,168	21,887	4,113
Metals Reserve mine contracts do		194	691	765		
Total overceiling production do	19,935	32,967	25,818	21,933	21,887	4,113
Percentage of overceiling production to total:						
Production under Premium Price Plan:						
"A" quota only percent	64.07	75.39	67.32	56.32	[5] 16.76	
"B" quota (also received "A") do	.77	18.70	19.45	35.33	[5] 59.46	(6)
					[7] 15.41	
Total premium production do	64.84	94.09	86.77	91.65	91.63	29.17
Metals Reserve mine contracts do		.56	2.39	3.31		
Total overceiling production do	64.84	94.65	89.16	94.96	91.63	29.17
Payments under Premium Price Plan: [8]						
"A" premium dollars	1,096,435	1,802,497	1,381,983	1,164,240	[5] 726,713	
"B" premium do	12,910	358,279	309,813	448,722	[5] 1,171,068	(6)
					[7] 255,818	
Total premium production do	1,109,345	2,160,776	1,691,796	1,612,962	2,153,599	130,983
Metals Reserve mine contracts: [8] do		16,127	66,394	68,934		
Total overceiling payments do	1,109,345	2,176,903	1,758,190	1,681,896	2,153,599	130,983
Average prices per pound of lead: [9]						
Average premium production cents	9.282	9.797	9.866	10.310	13.320	14.789
Metals Reserve mine contracts do		10.651	11.307	11.005		
Total overceiling production do	9.282	9.802	9.905	10.334	13.320	14.789
Total production do	8.304	9.625	9.536	10.141	12.908	14.892

See footnotes at end of table.

Salient statistics on lead with regard to operation of Premium Price Plan, 1942–47 [1]—Continued

	1942 [2]	1943	1944	1945	1946	1947 [3]
OTHER DISTRICTS						
Total production of recoverable lead [4] short tons	416,310	409,170	381,060	367,734	308,590	175,668
Ceiling production at 6.50 cents a pound short tons	358,447	294,001	200,619	146,791	69,327	115,417
Percent of ceiling production to total production	86.10	71.85	52.65	39.92	22.47	65.70
Production under Premium Price Plan:						
"A" quota only (9.25 cents a pound) short tons	56,321	83,023	142,925	155,566	[5] 81,330	
"B" quota (12.00 cents a pound) do	1,542	32,146	37,516	65,377	[5] 133,076	(6)
					[7] 24,857	
Total premium production do	57,863	115,169	180,441	220,943	239,263	60,251
Metals Reserve mine contracts do						
Total overceiling production do	57,863	115,169	180,441	220,943	239,263	60,251
Percentage of overceiling production to total:						
Production under Premium Price Plan:						
"A" quota only percent	13.53	20.29	37.51	42.30	[5] 26.36	
"B" quota (also received "A") do	.37	7.86	9.84	17.78	[5] 43.12	(6)
					[7] 8.05	
Total premium production do	13.90	28.15	47.35	60.08	77.53	34.30
Metals Reserve mine contracts do						
Total overceiling production do	13.90	28.15	47.35	60.08	77.53	34.30
Payments under Premium Price Plan: [8]						
"A" premium dollars	3,182,450	6,334,273	9,924,261	12,151,860	[5] 7,536,723	
"B" premium do	84,789	1,768,050	2,063,364	3,595,711	[5] 5,984,005	(6)
					[7] 1,176,462	
Total premium production do	3,267,239	8,102,323	11,987,625	15,747,571	14,697,190	697,572
Metals Reserve mine contracts [8] do						
Total overceiling payments do	3,267,239	8,102,323	11,987,625	15,747,571	14,697,190	697,572
Average prices per pound of lead: [9]						
Average premium production cents	9.323	10.018	9.822	10.064	11.471	14.981
Metals Reserve mine contracts do						
Total overceiling production do	9.323	10.018	9.822	10.064	11.471	14.981
Total production do	6.892	7.490	8.073	8.641	10.781	14.553

See footnotes at end of table.

Salient statistics on lead with regard to operation of Premium Price Plan, 1942–47 [1]—Continued

	1942 [2]	1943	1944	1945	1946	1947 [3]
TOTAL UNITED STATES						
Total production of recoverable lead [4] short tons	447,056	444,000	410,016	390,831	332,477	189,770
Ceiling production at 6.50 cents a pound short tons	369,258	295,864	203,757	147,955	71,327	125,406
Percent of ceiling production to total production	82.60	66.64	49.69	37.86	21.45	66.08
Production under Premium Price Plan:						
"A" quota only (9.25 cents a pound) short tons	76,021	109,282	162,419	168,575	[5] 85,334	(6)
"B" quota (12.00 cents a pound) do	1,777	38,660	43,149	73,536	[5] 147,279 [7] 28,537	
Total premium production do	77,798	147,942	205,568	242,111	261,150	64,364
Metals Reserve mine contracts do	----------	194	691	765	----------	----------
Total overceiling production do	77,798	148,136	206,259	242,876	261,150	64,364
Percentage of overceiling production to total:						
Production under Premium Price Plan:						
"A" quota only percent	17.00	24.61	39.61	43.13	[5] 25.67	(6)
"B" quota (also received "A") do	.40	8.71	10.53	18.82	[5] 44.30 [7] 8.58	
Total premium production do	17.40	33.32	50.14	61.95	78.55	33.92
Metals Reserve mine contracts do	----------	.04	.17	.19	----------	----------
Total overceiling production do	17.40	33.36	50.31	62.14	78.55	33.92
Payments under Premium Price Plan: [8]						
"A" premium dollars	4,278,885	8,136,770	11,306,244	13,316,100	[5] 8,263,436	(6)
"B" premium do	97,699	2,126,329	2,373,177	4,044,433	[5] 7,155,073 [7] 1,432,280	
Total premium production do	4,376,584	10,263,099	13,679,421	17,360,533	16,850,789	828,555
Metals Reserve mine contracts [8] do	----------	16,127	66,394	68,934	----------	----------
Total overceiling payments do	4,376,584	10,279,226	13,745,815	17,429,467	16,850,789	828,555
Average prices per pound of lead: [9]						
Average premium production cents	9.313	9.969	9.827	10.085	11.626	14.969
Metals Reserve mine contracts do	----------	10.651	11.307	11.005	----------	----------
Total overceiling production do	9.313	9.970	9.832	10.088	11.626	14.969
Total production do	6.989	7.658	8.176	8.730	10.934	14.578

[1] From published and unpublished reports of the Office of Price Administration and the Office of Premium Price Plan for Copper, Lead, and Zinc. Excludes exploration premiums totaling $6,213,545 paid from July 1, 1946, through December 31, 1947, to encourage exploration and development of copper, lead, and zinc deposits; this total cannot be broken down by metals.
[2] Premium Price Plan effective Feb. 1, 1942; data refer to February–December, inclusive.
[3] Premium Price Plan effective until June 30, 1947; data refer to January–June, inclusive.
[4] Production of Tri-State lead from Office of Metals Reserve, Joplin, Mo.; all other from Bureau of Mines monthly reports. Data do not exactly check final annual totals for the United States except for 1945.
[5] January–October. "A" and "B" quotas and premium payments for November and December are not separable by kinds and are shown with data footnoted 7.
[6] "A" and "B" quotas and premium payments unavailable separately.
[7] Total "A" and "B" quotas and premium payments for November and December; separation by kinds not available.
[8] Data on premium payments and Metals Reserve mine-contract payments from Office of Metals Reserve.
[9] All average prices shown include OPA ceiling price.

FOREIGN TRADE[2]

Tariff.—The import duty set by the Tariff Act of 1930 on lead-bearing ores, flue dust, and mattes (lead content) was 1½ cents per pound and on lead bullion, pigs, bars, scrap lead, antimonial lead, type metal, babbitt metal, solder, and alloys not specifically provided for, 2⅛ cents per pound. In accordance with the Mexican Trade Agreement of January 30, 1943, these rates were reduced to three-fourths cent and 1$\frac{1}{16}$ cents per pound, respectively. A provision of the agreement permits the increase in the tariff on lead-bearing

Total lead imported into the United States in ore, matte, base bullion, pigs, bars, and reclaimed, 1943–47, by countries, in short tons [1]

[U. S. Department of Commerce]

Country	1943	1944	1945	1946	1947
Ore and matte:					
Africa	16,438	3,459	2,338	399	5,616
Argentina	----	----	4,716	2,112	6
Australia	19,743	27,130	17,913	8,341	7,054
Bolivia	6,934	1,093	1,580	2,202	6,234
Canada	6,828	9,909	8,687	4,940	4,310
Chile	----	4,247	2,330	1,456	3,048
Mexico	2,931	3,693	667	376	3,065
Newfoundland and Labrador	13,473	32,273	17,046	19,037	10,523
Peru	3,426	11,295	14,524	5,192	10,477
Other countries	172	471	204	352	419
Total	69,945	93,570	70,005	44,407	50,752
Base bullion:					
Australia	3,846	----	----	----	----
Korea	----	----	----	----	285
Mexico	639	11	8	----	1,255
Peru	94	47	----	125	50
Other countries	4	----	----	----	----
Total	4,583	58	8	125	1,590
Pigs and bars:					
Australia	8,994	560	13,747	8,190	10,639
Canada	16	8	19,389	22,822	59,079
Japan	----	----	----	12,126	----
Korea	----	----	----	----	1,659
Mexico	214,865	167,704	160,179	53,534	85,783
Peru	20,158	54,486	34,153	15,568	1,151
Yugoslavia	----	----	----	----	1,120
Other countries	----	----	1	1	82
Total	244,033	222,758	227,469	112,241	159,513
Reclaimed, scrap, etc.:					
Africa	----	----	----	----	478
Australia	----	2,738	1,470	1,337	1,111
Canada	348	488	1,374	1,078	8,070
Canal Zone	----	----	----	9	202
Chile	----	15	----	----	62
Italy	----	----	----	----	69
Japan	----	----	----	----	5,336
Malta, Gozo, and Cyprus	----	----	----	----	78
Panama, Republic of	128	----	----	12	41
Philippines, Republic of	----	----	----	----	344
Other countries	1	74	----	29	145
Total	477	3,315	2,844	2,465	15,936
Grand total	319,038	319,701	300,326	159,238	227,791

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

[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.

ores, flue dust, and mattes to 1⅛ cents per pound (lead content), and lead bullion, pigs, bars, scrap lead, etc., to 1$\frac{1}{16}$ cents per pound 30 days after the war emergency is officially terminated. As termination of the emergency was not declared in 1947, the lower rates applied throughout the year.

Imports.—Imports of lead increased sharply in 1947 but remained well below the high levels established during wartime. As in previous years, the greater part of the lead imported was in the form of pigs and bars, 54 percent of which came from Mexico, 37 percent from Canada, 7 percent from Australia, and 2 percent from Korea, Peru, Yugoslavia, British East Africa, and Union of South Africa. Imports of lead in base bullion increased over twelvefold in 1947. Of the 1,590 tons imported, 1,255 tons came from Mexico, 285 tons from Korea, and 50 tons from Peru. Receipts of lead in ore, concentrate, and matte—principally from Newfoundland, Peru, Australia, Bolivia, Union of South Africa, and Canada—increased 14 percent.

Lead imported for consumption in the United States, 1943–47, by classes [1]

[U. S. Department of Commerce]

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		
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	76,126	5,758,695	20	2,242	227,311	25,280,638	17	2,778	32,515	31,312,708
1946	28,377	3,056,111	20	2,302	100,820	14,205,992	24	10,251	21,517	17,491,086
1947	44,442	8,561,174	1,768	422,332	158,705	38,008,443	67	42,434	10,453	50,086,077

[1] In addition to quantities shown (values included in total values), "reclaimed, scrap, etc." imported as follows—1943: 496 tons, $56,158; 1944: 3,315 tons, $298,712; 1945: 2,848 tons, $235,840; 1946: 2,481 tons, $194,913; 1947: 15,874 tons, $3,041,241. Figures for 1943–47 include foreign lead received by the Government and held in stock piles.

Miscellaneous products, containing lead, imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

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
1943	236	69	$330,824	3,703	3,422	$447,019
1944	50	43	15,368	7,562	7,174	954,255
1945	143	73	101,132	26,110	24,730	3,241,735
1946	157	72	211,122	1,740	1,494	220,645
1947	240	161	170,247	2,406	2,219	753,664

Exports.—Total exports of pig lead in 1947 increased 154 percent over 1946. Export restrictions imposed under the Export Control Act of 1940 remained in force throughout the year.

Lead exported from the United States, 1943–47

[U. S. Department of Commerce]

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	
1943	2,003	$244,433	15,491	1946	597	$106,457	[1]
1944	15,523	2,073,145	20,237	1947	1,514	383,132	[1]
1945	1,407	202,754	[1]				

[1] Data not available.

Pig lead exported from the United States, 1943–47, by destinations, in short tons [1]

[U. S. Department of Commerce]

Destination	1943	1944	1945	1946	1947
Countries:					
Argentina					894
Brazil	779	450	406	281	63
Canada	9	5	8	40	6
Canal Zone				6	52
Chile	7	23	215	2	52
China		1		8	6
Colombia	51	34	25	49	12
Cuba	26	18	156	58	38
Curaçao (N. W. I.)	9	9	14	11	
Czechoslovakia				10	
Hong Kong					27
India	[2]			[2]	19
Madagascar					44
Mexico	5	8	32	17	15
Netherlands				1	100
Panama, Republic of	8	18	23	17	[2]
Philippines, Republic of				16	23
Portugal		542	257		
Turkey			22		50
U. S. S. R.	14	14,314	66		5
United Kingdom	1,017				
Uruguay		7	2	10	27
Venezuela	8	17	75	34	30
Other countries	70	77	106	37	51
Total [1]	2,003	15,523	1,407	597	1,514
Continents:					
North America	80	80	273	170	139
South America	883	541	761	381	1,078
Europe	1,031	14,867	323	11	118
Asia	6	30	44	35	133
Africa and Oceania	3	5	6	[2]	46

[1] In addition, 11,258 tons of foreign lead were reexported in 1943, less than 1 ton in 1944, 377 tons in 1945, 103 tons in 1946, and 102 tons in 1947.
[2] Less than 1 ton.

WORLD PRODUCTION

World production of lead in recent years, insofar as data are available, is shown in the following table.

World production of lead, 1940–47, in metric tons [1]

[Compiled by B. B. Mitchell]

Country	1940	1941	1942	1943	1944	1945	1946	1947
Argentina	12,864	18,021	20,760	23,800	19,100	21,159	16,190	[2] 20,000
Australia	256,129	239,052	255,409	192,322	157,026	158,353	139,665	161,093
Austria	8,202	8,879	8,787	12,043	10,123	1,272	4,476	3,567
Belgium	30,800	8,880	16,240	7,960	7,690	7,340	23,762	40,520
Burma	80,709	74,456	17,130	----	----	----	----	----
Canada	199,662	206,862	220,722	203,091	129,347	147,999	150,360	146,963
China	1,210	1,405	1,169	1,179	153	850	14	771
Czechoslovakia	(3)	(3)	(3)	(3)	(3)	645	2,800	4,700
France	25,577	23,220	12,462	12,428	1,923	2,765	34,680	34,621
Germany [4]	167,100	163,900	140,100	157,200	[2] 139,900	(5)	[6] 28,929	[6 7] 24,356
Greece	1,250	890	2,300	1,150	600	700	609	1,000
Guatemala	(5)	95	119	114	136	115	131	110
Hungary	110	4,640	4,810	6,370	[8 9] 3,230	[9] 10	10	60
Indochina, French	8	3	2	16	51	----	----	(5)
Italy	36,909	36,993	28,996	[8] 12,372	----	829	14,010	17,543
Japan	[10] 27,748	[10] 30,585	[10] 26,919	[10] 32,511	[10] 38,048	[10] 12,568	4,965	8,747
Korea	7,630	10,000	11,900	18,467	21,200	[11] 2,548	[11] 0	[11] 250
Mexico	191,980	151,167	192,989	212,452	178,270	201,078	137,742	217,827
Northern Rhodesia	293	378	1,118	1,265	1,047	1,748	8,371	15,891
Norway	123	39	----	----	----	52	(5)	(5)
Peru	31,131	32,871	37,915	43,171	38,906	40,001	36,478	32,810
Poland	16,593	16,748	16,311	15,506	15,833	[2] 7,000	10,915	12,761
Rumania	49	258	154	187	261	3,363	3,225	3,316
South-West Africa	690	----	----	----	----	----	----	64
Spain	45,991	46,865	41,149	36,760	30,978	31,922	32,346	34,383
Sweden	----	----	230	2,193	10,553	12,501	11,223	11,000
Tunisia	26,620	15,679	8,210	1,867	5,335	7,023	7,850	12,590
U. S. S. R. [2]	75,000	90,000	100,000	125,700	100,000	40,000	47,500	59,900
United Kingdom	10,364	10,262	5,487	4,877	3,353	2,911	2,738	2,282
United States (refined) [12]	468,675	494,126	497,908	425,903	421,538	402,304	306,717	400,018
Yugoslavia	32,949	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Total (estimate)	1,756,400	1,701,300	1,684,300	1,563,000	1,344,600	1,117,100	1,035,800	1,281,900

[1] By countries where smelted but not necessarily refined. Data derived in part from Monthly Bulletin of the United Nations, The Mineral Industry of the British Empire and Foreign Countries Statistical Summary, and from the Yearbook of the American Bureau of Metal Statistics.
[2] Approximate production.
[3] Included with Germany.
[4] Exclusive of secondary material. Includes Upper Silesia and Sudetenland through 1944.
[5] Data not yet available; estimate by author of chapter included in total.
[6] Includes scrap.
[7] British zone only. Includes antimonial lead.
[8] January to June, inclusive.
[9] Data represent Trianon Hungary subsequent to October 1944.
[10] Preliminary data.
[11] South Korea only.
[12] Figures cover lead refined from domestic and foreign ores; refined lead produced from foreign base bullion not included.

Lead and Zinc Pigments and Zinc Salts

By HELENA M. MEYER AND ALETHEA W. MITCHELL

GENERAL SUMMARY

ON THE whole, the pigments covered by this report were shipped in increasing quantities in 1947, but the larger tonnages made available still left consumers inadequately supplied. Continuing high demand for pigments and persistent shortages of essential crude materials, among which the shortage of pig lead has been preeminent for a number of years, resulted in some requirements remaining unsatisfied and some being met by competitive products. Labor-management relations, in pigment-consuming industries as well as in industries supplying crude materials used by the pigments makers, improved in 1947; and such important pigment users as the automobile, construction, rubber, and storage-battery industries were among those to show marked gains. The manufacture of passenger automobiles and trucks gained more than 50 percent in 1947, the value of new construction rose 41 percent, and maintenance construction increased 26 percent. Consumption of natural rubber, which uses considerably more zinc oxide than the synthetic type, approximately doubled in quantity in 1947, whereas that of the synthetic type fell 27 percent, the over-all total rising 8 percent. The value of paint, varnish, and lacquer materials sold in 1947 passed the anticipated new peak of $1,000,000,000; the high level of lead and zinc pigment prices, however, was a noteworthy factor in obtaining the new record.

Lead-pigment prices established new high records by substantial margins in 1947, exceeding even the peaks reached at the end of 1946 after price controls on them were removed. The supply-demand situations in these pigments, the removal of price controls at the end of 1946, and the general inflationary trend of prices as a whole in the United States and abroad were responsible for the noteworthy pigment price gains. Quoted prices for zinc pigments at the end of 1947 were the highest for many years and for some items probably higher than ever before.

Shipments of zinc pigments on the whole gained less in 1947 than of lead pigments but fared better than the lead group in relation to earlier years. The total weight and value of zinc pigments in 1947 were higher than ever before. Leaded zinc oxide and litharge shipments established new high records in 1947 and of zinc oxide duplicated earlier peak tonnages for 1928–29.

As has been pointed out in previous reports of this series, for several recent years supplies of zinc have been more plentiful, though far from abundant, than of lead. Lead supplies rose sharply in 1947 but continued to fall short of total requirements. Domestic production rose in response to the greatly improved labor-management relationship and to the aforementioned highest price on record. Production from scrap was higher than ever before, and imports gained substantially. Not only was more lead made available as indicated, but, in helping to handle demand, producers' stocks were cut to less than half, and Government inventories were reduced to a very small tonnage.

Total supplies of zinc in relation to requirements in 1947 were again more abundant than of lead, as evidenced by the sharp advance in deliveries for Government account (probably almost entirely for stock piling). Production and imports were more than adequate for current demand, but the large gain in shipments to the Government came chiefly from producers' inventories.

Salient statistics of the lead and zinc pigments industry of the United States, 1942–47

	1942	1943	1944	1945	1946	1947
Production (sales) [1] of principal pigments:						
White lead (dry and in oil) short tons	83,639	76,167	85,726	51,170	[2] 66,501	68,787
Litharge do	91,513	113,091	138,203	138,798	133,799	167,050
Red lead do	48,369	53,378	53,972	47,381	32,526	36,064
Zinc oxide do	99,677	143,402	140,675	127,955	157,851	160,771
Leaded zinc oxide do	48,128	43,828	64,395	62,598	67,971	81,459
Lithopone do	137,320	135,723	142,905	136,161	147,001	165,024
Value of products:						
All lead pigments	$39,393,000	$41,897,000	$46,601,000	$39,045,000	$43,595,000	[3] $90,199,000
All zinc pigments	30,785,000	36,260,000	39,288,000	36,644,000	44,195,000	63,891,000
Total	70,178,000	78,157,000	85,889,000	75,689,000	87,790,000	[3] 154,090,000
Value per ton received by producers:						
White lead (dry)	160	163	163	159	[2] 207	308
Litharge	150	152	146	148	175	313
Red lead	171	171	164	168	196	333
Zinc oxide	138	137	139	138	144	186
Leaded zinc oxide	129	132	132	132	143	204
Lithopone	79	79	78	78	81	105
Foreign trade:						
Lead pigments:						
Value of exports	957,000	1,439,000	1,387,000	1,427,000	851,000	1,041,000
Value of imports	4,000	3,000	6,000	8,000	13,000	150,000
Zinc pigments:						
Value of exports	2,741,000	2,737,000	2,017,000	2,279,000	2,911,000	6,554,000
Value of imports	8,000	5,000	1,500	(4)	9,000	31,000
Export balance	3,686,000	4,168,000	3,396,500	3,698,000	3,740,000	7,414,000

[1] Reported as shipments, 1945–47.
[2] Data for basic lead sulfate in 1946 included under white lead; Bureau of Mines not at liberty to show separately.
[3] Excludes value of basic lead sulfate; Bureau of Mines not at liberty to publish.
[4] Less than $500.

On their own merits and because of inadequate supplies of lead and zinc pigments, shipments of the titanium group established new records in each of the years 1944–47. The 1947 peak, as well as the others, would have been higher except for plant-capacity limitations.

Total plant capacity has been expanded several times in the past several years and will be extended further in 1948. Like the lead and zinc classes, titanium pigments shipments have lagged behind demand for several years.

Features of the distribution of lead and zinc pigments and zinc salts in 1947 are given in the following discussion. Ceramics made noteworthy gains in 1946 in the use of the pigments covered by this report and a further conspicuous advance in 1947. Litharge shipments to ceramic manufacturers rose 39 percent and of zinc oxide 25 percent, both new peaks; ceramics became the second-most-important use of litharge. White-lead shipments for ceramics likewise advanced in 1947, but did not represent an important quantity, whereas red-lead shipments for this purpose fell 20 percent against the 1946 trend. Shipments of leaded zinc oxide, lithopone, red lead, and white lead to paint makers advanced in 1947—those of leaded zinc oxide to a new peak by a substantial margin. Use of litharge in storage batteries gained 47 percent, or 40 percent above the previous record for 1945, and red lead rose 9 percent. The agricultural use of litharge, on the other hand, continued the poor showing since 1944, falling 49 percent from 1946, and this use of zinc sulfate likewise showed an important drop—28 percent. Nonetheless, shipments of zinc sulfate for this purpose were the second highest on record. The use of zinc sulfate in manufacturing rayon in 1947 was unsurpassed, exceeding the previous high record for 1946 by 8 percent.

According to figures released by the Dominion Bureau of Statistics, manufacturers of paints and varnishes in Canada used, among other items, the following pigments in 1946 (comparisons with 1945 in parentheses): 2,989 (3,370) short tons of basic carbonate white lead—dry, 2,087 (2,147) tons of the "in oil" variety, 20 (66) tons of basic sulfate white lead, 8,078 (9,197) tons of lithopone (30 percent zinc sulfide), 3,416 (3,153) tons of titanium dioxide, 6,442 (6,060) tons of extended titanium pigments, 4,923 (2,901) tons of zinc oxide (lead-free), 700 (1,327) tons of zinc oxide (leaded), and 1,354 (263) tons of other white pigments; 567 (722) tons of red lead (including orange mineral), and 413 (364) tons of litharge.

Tariff Action.—At the United Nations Conference on Trade and Employment held at Geneva in 1947, the following action, effective in 1948, was taken on lead and zinc compounds covered by this report:

Litharge—bound at 2¼ cents a pound.
Orange mineral—reduced from 2½ to 2 cents.
White lead—bound at 2⅒ cents.
Red lead—reduced from 2¼ to 1⅞ cents.
Lead suboxide—bound at 3 cents, with provision that ad valorem could not be less than 15 percent nor more than 30 percent.
Lead compounds n. s. p. f.—bound at 20 percent ad valorem.
Zinc oxide, containing not more than 25 percent lead:
- In dry powder form—reduced from 1⅒ to ⅗ cent.
- Ground in or mixed with water or oil—reduced from 1½ to 1 cent.

Lithopone:
- Containing less than 30 percent zinc sulfide—reduced from 1½ to ⅞ cent.
- Containing 30 percent or more zinc sulfide—reduced from 1¾ and 15 percent ad valorem to ⅞ cent and 7½ percent ad valorem.

Zinc chloride—reduced from 1⅗ to ¾ cent.

PRODUCTION

The value of lead and zinc pigments in 1947, exclusive of that for basic lead sulfate, which cannot be shown, was $154,090,000, a 76-percent increase over 1946, which included the comparatively small lead sulfate value. In 1945 basic lead sulfate accounted for less than 1 percent of the total value of lead and zinc pigments. Lead and zinc pigments represented 59 and 41 percent of the total value in 1947, compared with 55 and 45 percent, respectively, in 1939.

For many years, figures on sales were used in this series of reports as a better guide to activity in the pigments industry than production. Beginning with 1945, the base was changed to shipments to conform with data compiled on Bureau of Mines lead and zinc schedules. Available information for 1945 (the year of change) indicated that there was little difference between sales and shipments in that year. In reporting tonnages of pigments, an attempt is made to avoid all duplication. One of the chief problems is that finished pigments frequently are blended to make another product. Basic lead sulfate and zinc oxide, for example, are blended to make leaded zinc oxide, and in this instance the pigment weights appear in the total for the last-named class only. Pigments consumed by producing companies to make products beyond those covered by this report—that is, paints, storage batteries, and other articles—are considered as shipments.

LEAD PIGMENTS

Shipments of lead pigments gained 17 percent in 1947 over 1946, and because of new peak pigment prices the value of shipments more than doubled. Basic lead sulfate, which represented less than 2 percent of the quantity and value in 1945, is included in 1946 but not in 1947, so the actual increases in 1947 were slightly greater than indicated. Data for basic lead sulfate may not be published. All other lead pigments contributed to the foregoing gains, litharge shipments rising 25 percent over 1946 and establishing a new peak by a substantial margin over the previous record in 1945. White lead in oil increased 21 percent, but shipments of this product were low compared with most earlier years. Supplies of pig lead continued in-

Lead pigments shipped by domestic manufacturers in the United States, 1946–47

Pigment	1946			1947		
	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	(1)	(1)	(1)	(2)	(2)	(2)
Red lead	32,526	[3]$6,398,035	[3]$196	36,064	$12,022,585	$333
Orange mineral	123	(3)	(3)			
Litharge	133,799	23,440,389	175	167,050	52,345,941	313
White lead:						
Dry	[1]41,892	[1]7,491,217	[1]179	39,075	12,036,554	308
In oil [4]	24,609	6,265,030	255	29,712	13,794,387	464

[1] Basic lead sulfate included with white lead (dry) in 1946; Bureau of Mines not at liberty to publish.
[2] Bureau of Mines not at liberty to publish.
[3] Value of orange mineral included with red lead in 1946; Bureau of Mines not at liberty to publish.
[4] Weight of white lead only but value of paste.

adequate for all needs, a factor that impeded production of pigments and made it impossible for manufacturers to satisfy all demands. Average values per ton for the lead pigments covered by this report rose 70 to 82 percent over those for 1946. Average quoted prices in 1947 were substantially above the previous peak levels at the end of 1946.

Lead pigments sold[1] by domestic manufacturers in the United States, 1943–47, in short tons

Year	White lead		Basic lead sulfate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
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
1946	[2] 41,892	24,609	(2)	(2)	32,526	123	133,799
1947	39,075	29,712	(3)	(3)	36,064	----------	167,050

[1] Reported as shipped, 1945–47.
[2] Basic lead sulfate included with white lead (dry) in 1946; Bureau of Mines not at liberty to publish.
[3] Bureau of Mines not at liberty to publish.

ZINC PIGMENTS AND SALTS

Shipments of zinc pigments in 1947 rose 9 percent over 1946, and value of shipments gained 45 percent, both establishing new high records. The foregoing gains are smaller than shown for the lead group; but zinc pigments made a better showing than the lead types, nonetheless, in relation to earlier years. Zinc oxide (leaded) shipments were 18 percent above the previous record in 1941, the lead-free type virtually duplicated the peak rate for 1928–29, and lithopone shipments were larger than in years other than 1941 and 1927–29. The relatively more abundant supply position of zinc as compared with lead was responsible in part for the smaller percentage increases in average values for zinc pigments, 29 to 43 percent. The 43-percent top of the range was made by leaded zinc oxide and was due to the lead content of this class.

Zinc pigments and salts shipped by domestic manufacturers in the United States, 1946–47

Pigment or salt	1946			1947		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide [1]	157,851	$22,660,450	$144	160,771	$29,873,882	$186
Leaded zinc oxide [1]	67,971	9,694,067	143	81,459	16,634,516	204
Lithopone	147,001	11,840,596	81	165,024	17,382,592	105
Zinc chloride, 50° B	57,316	3,133,891	55	65,521	4,279,737	65
Zinc sulfate	24,931	2,192,706	88	21,547	2,235,683	104

[1] Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide. In this table data for leaded zinc oxide include a small quantity containing less than 5 percent lead.

Shipments of zinc chloride totaled 65,521 tons (50° B.), 14 percent above 1946, and may have established a new record; the larger tonnage for 1920 is a production figure, and complete data for 1935–41 are not available. Zinc sulfate shipments fell 14 percent below the all-time record for 1946 but were second only to the tonnage for that year.

Zinc pigments and salts sold [1] by domestic manufacturers in the United States, 1943–47, in short tons

Year	Zinc oxide	Leaded zinc oxide [2]	Lithopone	Zinc chloride (50° B.)	Zinc sulfate
1943	143,402	43,828	135,723	53,707	15,649
1944	140,675	64,395	142,905	57,545	17,156
1945	127,955	62,598	136,161	56,230	20,854
1946	157,851	67,971	147,001	57,316	24,931
1947	160,771	81,459	165,024	65,521	21,547

[1] Reported as shipped, 1945–47.
[2] Includes a small quantity containing less than 5 percent lead.

CONSUMPTION BY INDUSTRIES

WHITE LEAD

Shipments of white lead (dry and in oil) in 1947 continued the uptrend begun in 1946 from the very low levels of 1945. White lead (in oil) in 1947 was 21 percent above 1946, itself 3 percent higher than 1945. Trade reports indicated that the increased quantities of both varieties of white lead available in 1947 failed to fill the demand. Reports show that 89 percent of total white-lead shipments in 1947 was for the manufacture of paint, but this percentage would doubtless be increased if a more complete breakdown of the "Other" classification were possible. A postwar development has been the increased use of several pigments for the manufacture of ceramics, a trend for white lead that was continued in 1947.

Production of white lead (dry) amounted to 39,337 tons and of white lead in oil to 32,677 tons in 1947.

Distribution of white lead (dry and in oil) sales [1] 1943–47, by industries, in short tons

Industry	1943	1944	1945	1946 [2]	1947
Paint	66,441	79,948	46,418	60,943	61,265
Ceramics	1,444	946	839	1,367	1,665
Other	8,282	4,832	3,913	4,191	5,857
	76,167	85,726	51,170	66,501	68,787

[1] Reported as shipments, 1945–47.
[2] Data for basic lead sulfate in 1946 included with white lead; Bureau of Mines not at liberty to show separately.

The manufacture of white lead in Germany was discussed in a recent report.[1]

[1] Causer, H. and Frith, J. S., Manufacture of White Lead: British Intelligence Objectives Subcommittee Final Rept. 1521, item 22, 14 pp.

BASIC LEAD SULFATE

The Bureau of Mines is not at liberty to publish figures on basic lead sulfate for 1946–47. Shipments in 1946 were covered by figures on "white lead" (dry), but 1947 data are not shown in any way. Basic lead sulfate is used almost entirely in paints. Substantial quantities are used as an intermediate product in the manufacture of leaded zinc oxide. Such quantities have always been shown in this series under leaded zinc oxide rather than basic lead sulfate.

Distribution of basic lead sulfate sales,[1] 1943–47, by industries, in short tons

Industry	1943	1944	1945	1946	1947
Paints	4,802	5,496	3,009	(2)	(3)
Rubber	131	268	200		
Storage batteries	3	2			
Other	661	567	686		
	5,597	6,333	3,895	(2)	(3)

[1] Reported as shipments, 1945–47.
[2] Data for basic lead sulfate in 1946 included with white lead; Bureau of Mines not at liberty to show separately.
[3] Bureau of Mines not at liberty to publish.

RED LEAD

Shipments of red lead in 1947 gained 11 percent over 1946 but were lower than in every year from 1939 to 1945 and 1923 to 1929, inclusive. This condition was due not to lack of demand for the pigment in 1947 but because not enough pig lead was available for the manufacture of pigments and other items to meet all needs. Storage batteries continued to use the largest quantities of red lead, increasing 9 percent over 1946, whereas paints—the second most-important red lead use—rose 22 percent. The use of red lead for ceramics, which, along with other pigments, had been trending upward in the postwar period, fell 20 percent in 1947.

Production of red lead amounted to 36,041 tons in 1947 compared with 29,874 tons in 1946.

Distribution of red-lead sales,[1] 1943–47, by industries, in short tons

Industry	1943	1944	1945	1946	1947
Storage batteries	26,616	30,211	26,725	19,115	20,883
Paints	22,271	18,074	16,438	9,318	11,362
Ceramics	622	878	626	1,228	977
Other	3,869	4,809	3,592	2,865	2,842
	53,378	53,972	47,381	32,526	36,064

[1] Reported as shipments, 1945–47.

ORANGE MINERAL

No shipments nor production of orange mineral was reported in 1947, compared with 123 tons shipped and 125 tons produced in 1946.

Distribution of orange mineral sales,[1] 1942–47,[2] by industries, in short tons

Industry	1942	1943	1944	1945	1946
Ink manufacture	93	49	56	63	78
Color pigments	7	8	205	151	18
Other	28	22	23	16	27
	128	79	284	230	123

[1] Reported as shipments, 1945 and 1946.
[2] No shipments reported for 1947.

LITHARGE

The use of litharge in storage batteries rose to a new peak by a substantial margin in 1947, causing total shipments of litharge also to establish a new high record. Litharge shipments in 1947 were 25 percent higher than in 1946 and 20 percent above the previous record for 1945. Storage-battery use of litharge rose 47 percent above 1946 and 40 percent above the previous peak in 1945. This use accounted for 67 percent of the total shipments of litharge. In addition to the litharge used to make batteries, the storage-battery manufacturers themselves produce from pig lead a black or suboxide of lead which they use as a substitute for litharge. The quantity produced in 1947—69,000 tons—was higher than ever before, exceeding 1946 by 50 percent and the previous record tonnages for 1944 and 1941 by 13 percent. Black oxide figures are not included in the Bureau of Mines totals for litharge.

The sharp postwar advance in use of litharge in ceramics placed this industry second in importance as a consumer of litharge in 1947; the tonnage shipped for that purpose rose 39 percent and slightly exceeded the previous record for 1941. Chrome pigments took 15 percent less litharge than in 1946 and likewise less than in 1945 and the peak of 13,927 tons in 1941. The oil-refining industry received 15 percent more than in 1946, or the largest tonnage since 1937; the tonnages for 1929 and 1930, the earliest data available, were considerably higher than that for 1947. Use of litharge in insecticides fell 49 percent in 1947, a continuation of the sharp downward movement since 1944. The advance of 29 percent in shipments to varnish makers carried this use back to the level of 1936, above all intervening years.

Litharge production totaled 174,341 tons in 1947 compared with 133,266 tons in 1946.

Distribution of litharge sales,[1] 1943–47, by industries, in short tons

Industry	1943	1944	1945	1946	1947
Storage batteries	54, 984	72, 342	79, 981	75, 836	111, 840
Ceramics	9, 866	12, 381	11, 511	13, 166	18, 360
Chrome pigments	9, 351	8, 233	11, 394	10, 877	9, 228
Oil refining	5, 227	5, 608	6, 419	6, 682	7, 688
Insecticides	20, 236	25, 957	18, 061	14, 259	7, 288
Varnish	3, 453	2, 988	2, 752	3, 302	4, 258
Rubber	4, 302	3, 023	1, 864	2, 131	2, 205
Floor coverings	98	117	115	106	141
Other	5, 574	7, 554	6, 701	7, 440	6, 042
	113, 091	138, 203	138, 798	133, 799	167, 050

[1] Reported as shipments, 1945–47.

ZINC OXIDE

Continuing large demand for zinc oxide (lead-free) resulted in shipments of this pigment gaining 2 percent over 1946 and equaling the peak rate established in 1928–29. Rubber, the chief use, accounted for 51 percent of the total but took 2 percent less oxide than in 1946. Paints, the second-largest use, took 6 percent less than in 1946 and coated fabrics and textiles 9 percent less. Use of zinc oxide in ceramics has been gaining since 1942 and in 1947 was 25 percent more than in 1946, the previous record year. Thus ceramics rose to third place in importance as a consumer of zinc oxide in 1947. Floor coverings likewise increased substantially in 1947, but a long-term record for this use separately is not available.

Production of lead-free oxide amounted to 159,149 tons compared with 142,567 tons in 1946. Of the total for 1947, 73 percent was made by the American process from ores and primary residues, 19 percent by the French process from metal and scrap, and 8 percent by other processes, compared with 74, 20, and 6 percent, respectively, in 1946.

Distribution of zinc oxide sales,[1] 1943–47, by industries, in short tons

Industry	1943	1944	1945	1946	1947
Rubber	67,898	59,518	63,447	83,776	82,248
Paints	29,852	24,999	28,014	34,785	32,867
Ceramics	3,203	3,653	5,086	9,056	11,350
Coated fabrics and textiles	6,633	9,563	12,177	[2] 10,022	[3] 9,100
Floor coverings				2,848	4,735
Chemical warfare	21,801	27,686	2,053		
Other	14,015	15,256	17,178	17,364	20,471
	143,402	140,675	127,955	157,851	160,771

[1] Reported as shipments, 1945–47.
[2] Includes 9,363 tons for rayon.
[3] Includes 7,302 tons for rayon.

According to a recent note,[2] Durham Chemicals (Canada), Ltd., Montreal, is planning to convert to the manufacture of zinc oxide and other chemicals a plant, recently purchased from the War Assets Administration, at Cap de la Madeleine, Quebec. Durham Chemicals was formed by Harrisons & Crosfield, Ltd., London, and Newcastle-upon-Tyne Zinc Oxide, Ltd., Birtley, County Durham, England.

Another report [3] stated that a new company, Durham Chemicals (Aust.), Ltd., would manufacture zinc oxide and other industrial chemicals. It was to acquire the Mascot Smelting Works in New South Wales and to build plants and laboratories in Victoria.

The December 5, 1947, issue of Rzeczspolita commented as follows on Polish exports of zinc white:

> The domestic production of zinc white is increasing fast. Many chemical plants have already reached their prewar production level. The output of the Feniks foundry at Bedzin has been doubled and this foundry, together with the Marta foundry at Olawa and the Polish Zinc Works at Bedzin, produce some 12,000 metric tons of zinc white annually. (The prewar level was the same.) Poland has an adequate supply of zinc white and is, therefore, in a position to increase exports of that product. Exports in 1946 amounted to 5,300 metric

[2] Oil, Paint and Drug Reporter, vol. 152, No. 10, Sept. 8, 1947, p. 74.
[3] Chemical Engineering, vol. 54, No. 10, October 1947, p. 206.

tons, but this year they will increase to 9,000 metric tons. The number of foreign buyers of Polish zinc white has also increased. Poland now exports this article to: USSR, Sweden, Great Britain, Denmark, Finland, Switzerland, Holland, Norway, and Palestine.

LEADED ZINC OXIDE

The use of leaded zinc oxide has continued at high levels for several years. Shipments of this pigment were at a new all-time peak in 1947 by a wide margin, exceeding the 1946 total by 20 percent and the previous high in 1941 by 18 percent. Of total shipments, 96 percent in 1947 was reported used for paint, but a better break-down of the "Other" class doubtless would increase this percentage. Figures for basic lead sulfate used in blending to make leaded zinc oxide are included in tonnages for the latter pigment.

Leaded zinc oxide production totaled 78,799 tons in 1947 compared with 71,016 in 1946. The totals comprise grades as follows (1946 for comparison in parentheses): 68,413 (61,251) tons of 35 percent lead and under and 10,386 (9,765) tons of over 35 percent lead.

Distribution of leaded zinc oxide sales,[1] 1943–47, by industries, in short tons

Industry	1943	1944	1945	1946	1947
Paints	42,303	62,223	58,852	64,816	77,994
Rubber	42	119	200	166	131
Other	1,483	2,053	3,546	2,989	3,334
	43,828	64,395	62,598	67,971	81,459

[1] Reported as shipments, 1945–47.

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 that always dominates the output of the high-strength product and has been the only producer in some years. In 1947 one company, operating two plants, produced high-strength lithopone, whereas two companies, operating three plants, produced in 1946. Shipments of lithopone increased 12 percent in 1947, were the largest since 1941, and were smaller only than in that year and in the 3 years 1927–29. Sales to manufacturers of paints increased 9 percent, and all other broad classifications gained. Rubber manufacturers took 92 percent more than in 1946 but accounted for only 2 percent of the total. Separation of the lithopone shipped for floor coverings and textiles shows that 8,421 tons were for coated fabrics and textiles and 9,048 for floor coverings, compared with 7,626 and 7,541 tons, respectively, in 1946. The use of lithopone by paper manufacturers, which had been rising before 1945 and continued at about the 1945 rate in 1946, moved upward again in 1947; it amounted to 4,069 tons compared with 3,011 tons in 1946 and 6,488 tons in 1944. Shipments reported for use in ink manufacture are trending downward; the tonnages were 1,216 in 1944, 864 in 1945, 830 in 1946, and 720 in 1947. A tonnage sold for use in making ink is regularly shown by one manufacturer as not separable from that sold for paint, but the tonnages given here are for identical companies. Exports are included mainly under "Other," but at least one company classifies part of its exports according to end use.

Plant capacity for the manufacture of lithopone was reported to total 157,000 tons in 1947.

Production of lithopone amounted to 162,685 tons in 1947 compared with 148,926 tons in 1946.

Distribution of lithopone sales,[1] 1943–47, by industries, in short tons

Industry	1943	1944	1945	1946	1947
Paints, varnishes, and lacquers [2]	103,860	108,800	109,398	123,279	134,830
Floor coverings and textiles	15,999	14,746	15,821	15,167	17,469
Rubber	1,078	726	977	1,607	3,085
Other	14,786	18,633	9,965	6,948	9,640
	135,723	142,905	136,161	147,001	165,024

[1] Reported as shipments, 1945–47.
[2] Includes a quantity, not separable, used for printing ink.

Consumption of ordinary lithopone in the production of titanated lithopone has trended downward almost continuously since the peak, 19,400 tons, was used in 1937. There was a further sharp drop in 1947, owing chiefly to the discontinuance of production in that year by one of the large manufacturers. 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, 1943–47, in short tons

Year	Titanated lithopone produced	Ordinary lithopone used	Year	Titanated lithopone produced	Ordinary lithopone used
1943	9,800	8,400	1946	7,500	6,350
1944	9,800	8,300	1947	2,600	2,200
1945	9,200	7,800			

The lithopone industry in Germany was the subject of a recent report.[4]

ZINC SULFIDE

In 1947, as in several earlier years, only one company produced zinc sulfide; the Bureau of Mines is not at liberty to publish figures for this pigment.

A report [5] on luminescent pigments in Germany was recently issued.

[4] Hill, B. P. and others, Barium Compounds and Lithopone Industry in Germany: British Intelligence Objectives Subcommittee Final Rept. 1140, Item 22, 34 pp.
[5] Hillier, G. E. and Clay, H. F., Luminescent Pigments at I. G. Farbenindustrie, Leverkusen, and Riedel de Haen A. G.: British Intelligence Objectives Subcommittee Final Rept. 1455, Item 22, 24 pp.

ZINC CHLORIDE

Shipments of zinc chloride, in terms of 50° B. solution, totaled 65,521 tons in 1947, a gain of 14 percent over 1946. The total for 1947 may be a new all-time peak, although data for 1935–41 are incomplete, because the only annual total known to have been higher—that for 1920—represented production rather than shipments. The figures shown here include the zinc chloride equivalent of zinc ammonium and chromated zinc chloride produced. Complete figures covering distribution of zinc chloride shipments by uses are not available.

Production amounted to 67,475 tons in 1947 and 57,088 in 1946.

ZINC SULFATE

Increased shipments of zinc sulfate in 1947 for use in the manufacture of rayon (8 percent more than in 1946) contrasted with smaller shipments for agricultural purposes (28 percent below 1946), together with less consequential changes for other uses, resulted in an over-all drop of 14 percent in zinc sulfate shipments in 1947. Shipments in 1947, nonetheless, were second only to those for 1946. The gain in rayon manufacture, coincident with the drop in agriculture, caused the former use to resume first place, relinquished in 1946, in consumption of zinc sulfate. Rayon shipments established a new all-time record in 1947, and those for agriculture were second only to the peak established in 1946. Chemicals, electrogalvanizing, paints, and textile dyeing and printing all dropped in 1947, whereas flotation reagents and glue made gains. A more complete break-down of the chemicals classification probably would add to some of the other classifications.

In 1947, 23,423 tons of zinc sulfate were produced, compared with 25,004 tons in 1946.

Distribution of zinc sulfate sales,[1] 1943–47, by industries, in short tons

Industry	1943	1944	1945		1946		1947	
	Gross weight	Gross weight	Gross weight	Dry basis	Gross weight	Dry basis	Gross weight	Dry basis
Rayon	4, 537	5, 954	6, 729	5, 393	7, 634	5, 883	8, 210	6, 173
Agriculture	3. 329	4, 974	6, 645	5, 062	10, 816	8, 178	7, 827	6, 125
Chemicals	1, 642	1, 459	2, 617	1, 749	2, 254	1, 488	2, 120	1, 439
Flotation reagent	1, 282	1, 131	1, 232	935	1, 084	643	1, 112	717
Glue	635	293	260	186	511	335	624	444
Electrogalvanizing	187	278	255	161	488	315	233	146
Paints and varnish processing	2, 439	1, 330	589	539	174	151	61	51
Textile dyeing and printing	213	--------	534	474	552	491	60	38
Other	1, 385	1, 737	1, 993	1, 342	1, 418	943	1, 300	864
	15, 649	17, 156	20, 854	15, 841	24, 931	18, 427	21, 547	15, 997

[1] Reported as shipments, 1945–47.

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 1946 was prepared. Data for 1946 are given below, and those for 1947 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 1946, roughly 90 percent of the lead in pigments was derived from pig lead and the remainder from ore. Of the lead in ore used to make leaded zinc oxide, about 8 percent was from foreign sources. The proportion for zinc pigments in 1946 was 73 percent from ore and concentrates, 10 percent from slab zinc, and 17 percent from secondary materials; about 15 percent of the ore used was foreign.

The following tables give the source of the metal used in manufacturing 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 (60 percent in 1946) and most of that in zinc chloride (all in 1946) made in the United States are derived from secondary material. For a number of years before the United States entered the recent World War, 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 comparatively low in 1943–46, despite the fact that the percentage from metal and scrap rose in 1943 and continued upward in 1944, 1945, and 1946. 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, 19 percent in 1943, 22 percent in 1944, 25 percent in 1945, and 26 percent in 1946.

Lead content of lead and zinc pigments produced by domestic manufacturers, 1945–46, by sources, in short tons

Pigment	1945					1946				
	Lead in pigments produced from—				Total lead in pigments	Lead in pigments produced from—				Total lead in pigments
	Ore		Pig lead	Secondary material		Ore		Pig lead	Secondary material	
	Domestic	Foreign				Domestic	Foreign			
White lead			39,742		39,742			49,825		49,825
Red lead			43,685		43,685			27,084		27,084
Litharge			131,116		131,116			123,698		123,698
Orange mineral			196		196			113		113
Basic lead sulfate	2,807		327		3,134	(1)		(1)		(1)
Leaded zinc oxide	14,436	1,453	529	1	16,419	17,412	1,434	170		19,016
	17,243	1,453	215,595	1	234,292	2 17,412	1,434	2 200,890		2 219,736

1 Bureau of Mines not at liberty to publish.
2 Excludes lead in basic lead sulfate; Bureau of Mines not at liberty to publish.

Zinc content of zinc pigments and salts produced by domestic manufacturers, 1945–46, by sources, in short tons

Pigment or salt	1945: Zinc in pigments and salts produced from— Ore: Domestic	1945: Ore: Foreign	1945: Slab zinc	1945: Secondary material [1]	1945: Total zinc in pigments and salts	1946: Zinc in pigments and salts produced from— Ore: Domestic	1946: Ore: Foreign	1946: Slab zinc	1946: Secondary material [1]	1946: Total zinc in pigments and salts
Zinc oxide	65, 505	18, 240	15, 462	12, 161	111, 368	68, 113	15, 799	17, 991	12, 050	113, 953
Leaded zinc oxide	25, 395	4, 197	--------	706	30, 298	31, 845	3, 010	278	--------	35, 133
Lithopone	11, 474	2, 998	--------	12, 207	26, 679	11, 370	110	26	17, 582	29, 088
Total pigments [2]	102, 374	25, 435	15, 462	25, 074	168, 345	111, 328	18, 919	18, 295	29, 632	178, 174
Zinc chloride	--------	--------	22	12, 472	12, 494	--------	--------	--------	12, 559	12, 559
Zinc sulfate	2, 383	808	34	3, 289	6, 514	3, 673	75	--------	3, 837	7, 585

[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] Excludes zinc sulfide, data for which Bureau of Mines not at liberty to publish.

PRICES

Total and average values received by producers for lead and zinc pigments and zinc salts are given in the tables in the first part of this report. Average values for lead pigments in 1947 were the highest ever recorded, and those for zinc pigments and salts were the highest in many years.

Quoted prices for lead pigments were at all-time peaks at the beginning of the year and all price changes during the year were upward, the quotations following the movement of prices for pig lead. Such changes as took place in zinc price quotations in 1947 were likewise upward, so that for both classes the lower parts of the ranges for 1947, shown in the accompanying table, were for the first of the year and the higher parts for the last of the year.

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1944–47, in cents per pound

[Oil, Paint and Drug Reporter]

Product	1944	1945	1946	1947
Basic lead sulfate, or sublimed lead, less than carlots, barrels	7. 50– 7. 75	7. 50– 7. 75	7. 50–13. 50	13. 25–15. 75
White lead, or basic lead carbonate, dry, carlots, barrels	8. 25	8. 25	8. 25–13. 75	13. 75–16. 00
Litharge, commercial, powdered, barrels	8. 00– 9. 00	8. 00– 9. 00	8. 00–14. 75	13. 75–17. 60
Red lead, dry, 95 percent or less, less than carlots, barrels	9. 50–10. 00	9. 50–10. 00	9. 50–16. 00	15. 75–18. 60
Orange mineral, American, small lots, barrels	12. 00–12. 50	12. 00–12. 50	12. 00–18. 25	17. 75–21. 00
Zinc oxide:				
American process, lead free, bags, carlots	7. 25	7. 25	7. 25– 9. 00	9. 00–10. 00
American process, 5 to 35 percent lead, barrels, carlots	7. 25– 7. 38	7. 25– 7. 38	7. 25–10. 75	9. 25–12. 00
French process, red seal, bags, carlots	8. 50	8. 50	8. 50–10. 25	10. 25–11. 25
French process, green seal, bags, carlots	9. 00	9. 00	9. 00–10. 75	10. 75–11. 75
French process, white seal, barrels, carlots	9. 75	9. 75	9. 75–12. 00	11. 50–12. 50
Lithopone, ordinary, small lots, bags	4. 50	4. 50	4. 50– 5. 25	5. 25– 6. 25
Zinc sulfide, less than carlots, bags, barrels	8. 50– 8. 75	8. 50– 8. 75	8. 50–10. 00	10. 00–11. 00
Zinc chloride, works:				
Solution, tanks	2. 50	2. 50	2. 50	2. 50– 3. 00
Fused, drums	5. 00– 6. 50	5. 00– 6. 50	5. 00– 6. 50	5. 00– 7. 40
Zinc sulfate, crystals, barrels	3. 65– 4. 60	3. 65– 4. 40	3. 65– 4. 40	3. 65– 5. 00

FOREIGN TRADE [6]

Imports of lead and zinc pigments are insignificant in relation to domestic shipments of the various items. Both classes advanced in total value in 1947, chiefly because receipts of litharge increased and because the average values gained. The total value of lead pigments exported likewise gained in 1947, but not as much as pigment prices increased. The total value of zinc pigments exported more than doubled in 1947, and the grand total of lead and zinc pigments and salts exported likewise doubled in that year. Exports of zinc pigments are much larger than the lead group, zinc oxide and lithopone each amounting to 10 times or more than litharge, the largest lead class.

Value of foreign trade of the United States in lead and zinc pigments and salts, 1946–47 [1]

[U. S. Department of Commerce]

	1946		1947	
	Imports	Exports	Imports	Exports
Lead pigments:				
White lead	$339	$183,857	$238	$334,631
Red lead	3,806	292,451	7,687	296,796
Litharge	4,576	374,583	127,375	409,417
Other lead pigments	4,312	(2)	15,060	(2)
	13,033	850,891	150,360	1,040,844
Zinc pigments:				
Zinc oxide	8,426	2,022,902	30,594	4,769,836
Lithopone	58	888,555	21	1,784,414
Zinc sulfide	324	(2)		(2)
	8,808	2,911,457	30,615	6,554,250
Lead and zinc salts:				
Lead arsenate	5	333,981	20,700	591,299
Zinc chloride	495	(2)		(2)
Zinc sulfate	17,225	(2)	16,867	(2)
	17,725	333,981	37,567	591,299
Grand total	39,566	4,096,329	218,542	8,186,393

[1] Changes for table in Minerals Yearbook, 1946, p. 706, are as follows—1945: White lead imports $220, exports $618,002; lead pigments import total $7,783, export $1,427,483; grand total imports $24,607, exports $4,716,725.
[2] Data not available.

Lead pigments and salts imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons					Total value
	Basic carbonate white lead	Red lead	Litharge	Suboxide of lead	Other lead compounds	
1943		4	1	3		$3,349
1944	(1)		1	10		5,962
1945	1		8	10	(1)	7,801
1946	1	54	15	11		[2] 13,038
1947	1	22	416	33		[2] 171,060

[1] Less than 1 ton.
[2] Includes also lead pigments, n. s. p. f., as follows—1946: $97 (522 pounds); lead arsenate: 1946, $5 (552 pounds) and 1947, $20,700 (120,000 pounds).

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

Lead pigments and salts exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons						Total value
	White lead	Red lead	Litharge	Orange mineral	Sublimed lead	Lead arsenate	
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	2,162,548
1946	910	1,355	2,180	(1)	(1)	1,398	1,184,872
1947	863	787	1,212	(1)	(1)	1,552	1,632,143

[1] Data not available.

Zinc pigments and salts imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons						Total value
	Zinc oxide		Lithopone	Zinc sulfide	Zinc chloride	Zinc sulfate	
	Dry	In oil					
1943	10	11	----------	----------	----------	546	$34,033
1944	(1)	5	----------	(1)	----------	542	30,220
1945	(1)	----------	(1)	----------	----------	421	16,806
1946	41	----------	(1)	(1)	2	415	26,528
1947	117	1	(1)	----------	----------	295	47,482

[1] Less than one ton.

Zinc pigments and salts exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons		Total value [1]	Year	Short tons		Total value [1]
	Zinc oxide	Lithopone			Zinc oxide	Lithopone	
1943	6,019	17,320	$2,898,253	1946	10,955	9,651	$2,911,457
1944	5,511	11,551	2,194,203	1947	19,082	13,652	6,554,250
1945	7,102	11,576	2,554,177				

[1] Includes also—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 pounds); 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, $62,119 (1,243,826 pounds); other zinc salts and compounds, $119,747 (750,108 pounds). Beginning January 1, 1946, none of the foregoing classes separately recorded.

Lime[1]

By G. W. JOSEPHSON AND M. G. DOWNEY

GENERAL SUMMARY

DURING 1947 the high demand in chemical, industrial, and refractory uses, coupled with the requirements of the building boom, expanded the sales of lime to a record total of 6,778,979 short tons. This output was 13 percent greater than in 1946 and exceeded the historical record set in 1943 by 3 percent. Of the total sales, 74 percent were in the form of quicklime and 26 percent hydrated. In harmony with the general rise in prices, the average value per short ton for quicklime increased from \$8.27 in 1946 to \$9.04 in 1947; hydrated advanced from \$9.15 to \$10.50. Although there was a very strong demand for virtually all types of lime in 1947, the trend toward concentration of production in large plants continued. The number of active plants declined from 182 in 1946 to 179 in 1947. In 1925–29 an average of 419 plants produced open-market lime in the United States.

Salient statistics of the open-market lime industry in the United States, 1925–29 (average), 1935–39 (average), and 1945–47

	1925–29 (average)	1935–39 (average)	1945	1946	1947
Active plants	419	310	189	182	179
Sold by producers:					
By types:					
Quicklime short tons	2,871,236	2,488,269	4,565,551	4,344,331	5,021,156
Hydrated do	1,585,631	1,204,128	1,355,028	1,648,369	1,757,823
Total lime:					
Short tons	4,456,867	3,692,397	5,920,579	5,992,700	6,778,979
Value [1]	\$38,548,498	\$26,592,115	\$45,918,468	\$51,032,517	\$63,826,387
Per ton	\$8.65	\$7.20	\$7.76	\$8.52	\$9.42
By uses:					
Agricultural short tons	318,224	350,535	373,410	384,658	340,363
Building do	2,096,744	870,335	549,547	845,604	1,008,211
Chemical and industrial do	1,623,885	1,929,947	3,810,288	3,684,455	4,035,202
Refractory (dead-burned dolomite) short tons	418,014	541,580	1,187,334	1,077,983	1,395,203
Imported for consumption:					
Short tons	18,683	14,108	[2] 20,819	25,275	27,410
Value	\$344,887	\$240,909	[2] \$179,184	\$256,849	\$298,035
Exported:					
Short tons	15,752	10,905	24,276	33,540	50,784
Value	\$221,177	\$123,167	\$268,875	\$423,948	\$713,703

[1] Selling value, f. o. b. plant, excluding cost of containers.
[2] Revised figure.

[1] Figures in this chapter pertain to open-market lime and exclude coverage of most captive lime operations.

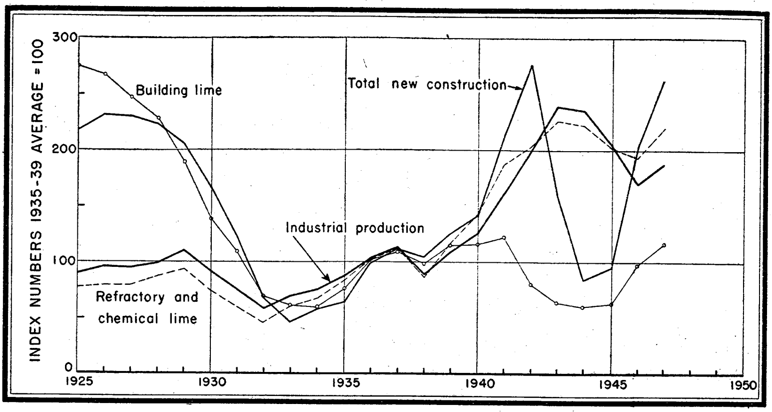

FIGURE 1.—Sales of refractory and building lime compared with total new construction and industrial production, 1925–47. Units are reduced to percentages of the 1935–39 average. Statistics on value of construction from the Bureau of Foreign and Domestic Commerce and on industrial production from the Federal Reserve Board.

Of the major uses, a decline in demand was noted only in agricultural lime. As may be seen in figure 1, sales of building lime do not always follow the index of new construction. However, since the war, the proportion of permanent construction in which lime requirements are comparatively large has increased, and the building limes have benefited accordingly. The quantity of refractory and chemical lime follows in general the curve of industrial production.

Trends in sales of open-market lime by principal uses during the past 23 years are shown in figure 2. In that period markets in the chemical and refractory industries have increased substantially, whereas the requirements for building construction have declined and agricultural lime has remained relatively constant.

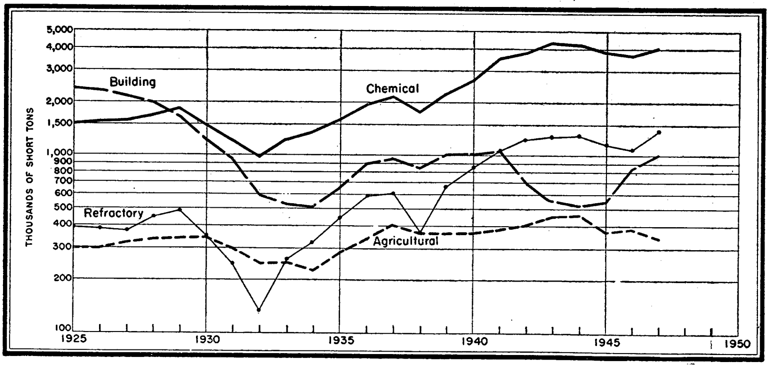

FIGURE 2.—Trends in major uses of lime, 1925–47.

DOMESTIC PRODUCTION

Total production of open-market lime (as indicated by sales) increased to a record level in 1947—3 percent above the previous high set in 1943. As stocks of lime are small and comparatively constant, the sales statistics presented in the following table are considered equivalent to production, and therefore the two terms are used interchangeably in this chapter.

Captive Tonnage.—Lime statistics presented in this chapter are in general limited to "open-market" lime—the lime sold under com-

Lime sold by producers in the United States, 1946–47, by types and major uses

	1946				1947					
	Quantity		Value [1]		Quantity		Value [1]		Percent change from 1946 in—	
	Short tons	Percent of total	Total	Average	Short tons	Percent of total	Total	Average	Tonnage	Average value
By types:										
Quicklime	4,344,331	72	$35,949,118	$8.27	5,021,156	74	$45,377,205	$9.04	+16	+9
Hydrated lime	1,648,369	28	15,083,399	9.15	1,757,823	26	18,449,182	10.50	+7	+15
Total lime [2]	5,992,700	100	51,032,517	8.52	6,778,979	100	63,826,387	9.42	+13	+11
By uses:										
Agricultural:										
Quicklime	113,486	2	899,677	7.93	106,364	2	913,992	8.59	−6	+8
Hydrated lime	271,172	5	2,251,936	8.30	233,999	3	2,243,846	9.59	−14	+16
	384,658	7	3,151,613	8.19	340,363	5	3,157,838	9.28	−12	+13
Building:										
Quicklime	206,055	3	2,350,760	11.41	241,711	4	2,901,128	12.00	+17	+5
Hydrated lime	639,549	11	6,275,938	9.81	766,500	11	8,651,897	11.29	+20	+15
	845,604	14	8,626,698	10.20	1,008,211	15	11,553,025	11.46	+19	+12
Chemical and industrial:										
Quicklime	2,946,807	49	22,596,974	7.67	3,277,878	48	27,266,726	8.32	+11	+8
Hydrated lime	737,648	12	6,555,525	8.89	757,324	11	7,553,439	9.97	+3	+12
	3,684,455	61	29,152,499	7.91	4,035,202	59	34,820,165	8.63	+10	+9
Refractory (dead-burned dolomite)	1,077,983	18	10,101,707	9.37	1,395,203	21	14,295,359	10.25	+29	+9

[1] Selling value, f. o. b. plant, excluding cost of container.
[2] Includes lime used by producers (captive tonnage) as follows—1946: 328,837 tons, valued at $2,216,551; 1947: 392,223 tons, valued at $2,821,404.

petitive conditions to consumers—as such statistics are of greatest interest and value to the industry. However, in certain instances where it is particularly desirable to present complete figures of consumption by use, some captive tonnage appears in the sales figures. In the statistics of lime sold or used in the United States in 1947 are included 392,223 short tons of captive tonnage as follows: 10,436 tons for building lime, 275,871 tons for metallurgical uses, 61,716 tons for miscellaneous chemical uses, and 44,200 tons of refractory lime. If a more comprehensive view of lime production is desired, it can be determined approximately by adding the lime equivalent of limestone tonnages (shown in the Stone chapter of this volume) consumed in those uses, such as "alkali," "calcium carbide," and "refractory," for which limestone is generally calcined to lime before use. These limestone statistics can be computed to lime by calculating the loss of weight in calcining. It must be pointed out, however, that in some of these uses some limestone is employed without being previously calcined; consequently, a precise captive-lime figure cannot be compiled.

Size of Plants.—Whereas in 1925 there were 450 active lime plants in the United States, by 1947 the number had declined to 179. As indicated in the accompanying table, output is gradually being concentrated in larger plants, and the total number of small plants is declining.

Distribution of open-market lime (including refractory) plants, 1945–47, according to size of production

Size group (short tons)	1945			1946			1947		
	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	27	11,448	(1)	19	7,708	(1)	19	7,538	(1)
1,000 to less than 5,000	38	109,488	2	43	115,786	2	38	109,809	2
5,000 to less than 10,000	22	153,868	3	20	145,782	3	20	149,205	2
10,000 to less than 25,000	29	480,582	8	28	427,514	7	29	459,445	7
25,000 to less than 50,000	35	1,267,909	21	30	1,104,538	18	26	950,047	14
50,000 to less than 100,000	24	1,544,176	26	27	1,759,109	29	31	2,080,594	31
100,000 and over	14	2,353,108	40	15	2,432,263	41	16	3,022,341	44
	189	5,920,579	100	182	5,992,700	100	179	6,778,979	100

[1] Less than 1 percent.

PRODUCTION BY STATES

In 1947, open-market lime was produced in 33 States and 2 Territories. The leading States were Ohio, Pennsylvania, and Missouri, in that order, which together contributed about 55 percent of the total. Details for each State are shown in the accompanying table.

Lime (quick and hydrated) sold by producers in the United States, 1946–47, by States

State or Territory	1946			1947		
	Active plants	Short tons	Value	Active plants	Short tons	Value
Alabama	7	294,654	$2,164,209	7	345,160	$2,727,464
Arizona	3	50,354	489,091	3	54,562	582,074
Arkansas	1	(1)	(1)	1	(1)	(1)
California	9	172,623	2,144,712	10	181,296	2,615,599
Colorado	2	(1)	(1)	2	(1)	(1)
Connecticut	1	(1)	(1)	1	(1)	(1)
Florida	2	(1)	(1)	1	(1)	(1)
Georgia	1	2,691	33,251	1	10,141	110,983
Hawaii	1	7,824	172,404	1	9,130	228,370
Illinois	7	280,051	2,365,455	7	299,187	2,736,262
Indiana	1	(1)	(1)	1	(1)	(1)
Louisiana	1	(1)	(1)	-------	-------	-------
Maine	2	(1)	(1)	2	(1)	(1)
Maryland	9	83,580	692,262	8	71,892	673,241
Massachusetts	4	117,709	1,136,428	4	113,420	1,276,693
Michigan	3	(1)	(1)	3	(1)	(1)
Minnesota	1	(1)	(1)	1	(1)	(1)
Missouri	9	799,742	5,931,485	9	889,090	7,006,426
Montana	2	(1)	(1)	2	(1)	(1)
Nevada	2	(1)	(1)	2	(1)	(1)
New Jersey	3	(1)	(1)	3	(1)	(1)
New York	3	(1)	(1)	3	(1)	(1)
Ohio	18	1,469,278	12,926,310	18	1,774,847	17,685,220
Oklahoma	1	(1)	(1)	1	(1)	(1)
Oregon	1	(1)	(1)	1	(1)	(1)
Pennsylvania	28	972,311	8,272,202	29	1,045,566	9,861,812
Puerto Rico	4	(1)	(1)	4	(1)	(1)
South Dakota	2	(1)	(1)	2	(1)	(1)
Tennessee	6	160,698	1,232,480	6	181,039	1,533,737
Texas	7	121,841	1,053,493	6	134,530	1,274,095
Utah	6	29,057	271,526	5	47,096	366,127
Vermont	3	(1)	(1)	3	(1)	(1)
Virginia	13	181,282	1,365,931	14	260,663	2,138,707
Washington	2	(1)	(1)	2	(1)	(1)
West Virginia	8	409,952	3,103,183	7	471,914	4,050,950
Wisconsin	9	74,686	760,432	9	70,233	805,000
Undistributed [1]	-------	764,367	6,917,663	-------	819,213	8,153,627
	182	5,992,700	51,032,517	179	6,778,979	63,826,387

[1] Figures that may not be shown separately are combined as "Undistributed."

Hydrated Lime.—Lime is sold in both quick and hydrated form. Output of hydrated lime increased about 7 percent in 1947. Of the total tonnage of lime marketed in 1947, hydrated material constituted 26 percent, which compares with 28 percent in 1946 and 20 percent in 1944. The total number of plants reporting hydrated lime declined from 120 in 1946 to 116 in 1947 and output came from 32 States and 2 Territories. Further details are shown in the accompanying table.

Hydrated lime sold by producers in the United States, 1946–47, by States

State or Territory	1946			1947		
	Active plants	Short tons	Value	Active plants	Short tons	Value
Alabama	5	41,219	$422,101	5	37,152	$452,648
California	7	47,642	624,104	7	47,611	706,482
Georgia	1	2,691	33,251	1	10,141	110,983
Hawaii	1	7,812	171,864	1	9,124	228,100
Illinois	4	39,464	333,956	4	37,463	343,706
Maryland	6	37,575	302,239	5	27,940	257,063
Massachusetts	4	54,627	489,480	4	48,038	483,668
Missouri	7	207,140	1,713,821	6	229,085	2,004,217
Ohio	14	454,271	4,033,255	14	570,079	6,066,483
Pennsylvania	11	329,525	2,968,590	11	310,677	3,274,507
Tennessee	6	51,813	454,252	6	47,043	451,043
Texas	5	46,026	460,409	5	48,652	540,040
Virginia	9	46,652	416,829	10	47,155	508,909
West Virginia	5	56,536	405,425	4	53,311	439,937
Other States [1]	[1] 35	225,376	2,253,823	[1] 33	234,352	2,581,396
	120	1,648,369	15,083,399	116	1,757,823	18,449,182

[1] Includes the following States and numbers of plants in 1947 (1946 same as 1947 unless shown differently in parentheses): Arizona 1, Arkansas 1, Colorado 1, Connecticut 1, Florida 1, Indiana 1, Louisiana 0 (1), Maine 2, Michigan 1, Minnesota 1, Montana 1, Nevada 1, New Jersey 3, New York 3, Oklahoma 1, Puerto Rico 2, South Dakota 1, Utah 2, Vermont 2, Washington 1 (2), and Wisconsin 6.

CONSUMPTION AND USES

Lime is consumed in such a great variety of uses that it is generally credited with being one of the most vital of raw materials. As shown in the accompanying tables of lime sales, there were marked increases in the tonnages required in nearly all of the major uses. An exception to the general trend was the 12-percent decline in sales of agricultural lime. The building boom was in full swing; and, as there was general emphasis on the construction of permanent housing, lime requirements were high. In the chemical and industrial uses listed in the following table, consumption increased in every category except "other." Refractory materials (dead-burned dolomite) sales increased by 29 percent, owing principally to the high activity of the steel industry.

Details of quantities and values of lime consumed in various uses are shown in an accompanying table. Some conception of the use of lime produced in individual States may be obtained from the table of sales by States and uses.

Lime (quick and hydrated) sold by producers in the United States in 1947, by States and uses

State or Territory	Agricultural		Building		Chemical and industrial										Refractory		Total	
					Metallurgical		Paper mills		Tanneries		Water purification		Other					
	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	(1)	(1)	48,291	$455,597	154,384	$1,002,512	92,877	$768,904	(1)	(1)	11,460	$138,227	22,182	$238,592	(1)	(1)	345,160	$2,727,464
Arizona	------	------	(1)	(1)	42,462	403,970	------	------	------	------	(1)	(1)	(1)	(1)	------	------	54,562	582,074
Arkansas	------	------	(1)	(1)	(1)	(1)	(1)	(1)	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)
California	(1)	(1)	76,652	1,221,951	20,507	226,115	(1)	(1)	1,154	$18,985	11,913	146,887	34,754	518,147	(1)	(1)	181,296	2,615,599
Colorado	------	------	(1)	(1)	(1)	(1)	------	------	------	------	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Connecticut	(1)	(1)	(1)	(1)	------	------	(1)	(1)	------	------	------	------	(1)	(1)	------	------	(1)	(1)
Florida	(1)	(1)	(1)	(1)	------	------	------	------	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)
Georgia	2,110	$11,177	8,031	99,806	------	------	------	------	------	------	------	------	------	------	------	------	10,141	110,983
Hawaii	------	------	979	24,595	------	------	------	------	------	------	------	------	8,151	203,775	------	------	9,130	228,370
Illinois	------	------	15,399	156,496	111,590	897,527	(1)	(1)	(1)	(1)	40,324	357,778	15,175	135,981	(1)	(1)	299,187	2,736,262
Indiana	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(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)	------	------	------	------	------	------	------	------	------	------	------	------	71,892	673,241
Massachusetts	8,194	67,153	36,110	423,547	(1)	(1)	18,004	196,678	10,494	111,743	(1)	(1)	33,155	393,124	------	------	113,420	1,276,693
Michigan	------	------	(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	------	------	57,931	572,712	145,848	1,068,084	(1)	(1)	(1)	(1)	(1)	(1)	418,104	3,066,496	(1)	(1)	889,090	7,006,426
Montana	------	------	(1)	(1)	(1)	(1)	------	------	------	------	------	------	(1)	(1)	------	------	(1)	(1)
Nevada	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)	(1)	(1)	(1)	(1)	------	------	(1)	(1)
New Jersey	(1)	(1)	(1)	(1)	------	------	------	------	------	------	------	------	(1)	(1)	------	------	(1)	(1)
New York	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	------	------	(1)	(1)
Ohio	46,850	436,052	464,841	5,081,404	100,474	810,731	35,332	283,910	------	------	(1)	(1)	(1)	(1)	831,212	$8,510,675	1,774,847	17,685,220
Oklahoma	------	------	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)
Oregon	------	------	------	------	------	------	------	------	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)
Pennsylvania	133,614	1,314,955	85,607	1,034,673	250,060	2,135,462	88,709	769,369	39,566	334,264	48,823	437,895	(1)	(1)	(1)	(1)	1,045,566	9,861,812
Puerto Rico	------	------	(1)	(1)	------	------	------	------	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)
South Dakota	------	------	(1)	(1)	------	------	------	------	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)
Tennessee	1,548	12,733	11,380	119,814	27,901	228,538	61,557	497,939	2,246	19,925	26,934	226,451	49,473	428,337	------	------	181,039	1,533,737
Texas	------	------	38,800	399,050	27,417	227,342	(1)	(1)	------	------	37,247	345,380	(1)	(1)	------	------	134,530	1,274,095
Utah	------	------	(1)	(1)	43,481	311,205	------	------	------	------	(1)	(1)	(1)	(1)	------	------	47,096	366,127
Vermont	(1)	(1)	------	------	------	------	(1)	(1)	------	------	------	------	(1)	(1)	------	------	(1)	(1)
Virginia	22,526	222,973	21,363	221,741	93,146	693,945	31,193	251,217	1,258	9,758	(1)	(1)	(1)	(1)	------	------	260,663	2,138,707
Washington	------	------	(1)	(1)	(1)	(1)	(1)	(1)	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)
West Virginia	28,459	203,932	5,547	47,442	211,948	1,667,006	(1)	(1)	(1)	(1)	12,071	110,693	(1)	(1)	(1)	(1)	471,914	4,050,950
Wisconsin	(1)	(1)	23,643	251,815	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	8,878	217,048	------	------	70,233	805,000
Undistributed [1]	97,062	888,863	113,637	1,442,382	201,327	1,869,752	317,993	2,949,355	34,311	309,462	265,567	2,296,728	825,752	7,494,928	563,991	5,784,684	819,213	8,153,627
	340,363	3,157,838	1,008,211	11,553,025	1,430,545	11,542,189	645,665	5,717,372	89,029	804,137	454,339	4,060,039	1,415,624	12,696,428	1,395,203	14,295,359	6,778,979	63,826,387

[1] Figures that may not be shown separately are combined as "Undistributed."

Lime (quick and hydrated) sold by producers in the United States, 1946–47, by uses

Use	1946 Short tons	1946 Value Total	1946 Value Average	1947 Short tons	1947 Value Total	1947 Value Average
Agricultural	384,658	$3,151,613	$8.19	340,363	$3,157,838	$9.28
Building:						
Finishing lime	347,237	3,535,208	10.18	467,527	5,430,925	11.62
Mason's lime	389,003	3,996,480	10.27	389,515	4,411,907	11.33
Prepared masonry mortars	45,631	352,950	7.73	50,330	470,803	9.35
Unspecified	63,733	742,060	11.64	100,839	1,239,390	12.29
	845,604	8,626,698	10.20	1,008,211	11,553,025	11.46
Chemical and industrial:						
Alkalies (ammonium, potassium, and sodium compounds)	2,572	21,528	8.37	3,945	36,586	9.27
Asphalts and other bitumens	(1)	(1)	(1)	(1)	(1)	(1)
Bleach, liquid and powder [2]	13,872	124,239	8.96	9,604	105,370	10.97
Brick, sand-lime and slag	18,667	164,049	8.79	18,272	191,022	10.45
Brick, silica (refractory)	14,665	133,153	9.08	16,955	174,088	10.27
Calcium carbide and cyanamide	377,694	2,806,965	7.43	354,104	2,791,244	7.88
Chromates and bichromates	28,378	201,700	7.11	25,267	199,736	7.91
Coke and gas (gas purification and plant byproducts)	25,675	198,976	7.75	27,466	230,725	8.40
Explosives	1,579	14,399	9.12	1,403	13,922	9.92
Food products:						
Creameries and dairies	3,232	37,546	11.62	3,849	42,082	10.93
Gelatin	5,270	44,186	8.38	10,188	91,581	8.99
Stock feed	8,503	114,564	13.47	15,753	171,945	10.92
Other [3]	9,333	90,992	9.75	2,091	21,843	10.45
Glassworks	248,693	1,949,215	7.84	244,043	2,086,323	8.55
Glue	8,179	67,786	8.29	4,909	41,006	8.35
Grease, lubricating	2,722	22,346	8.21	5,333	52,281	9.80
Insecticides, fungicides, and disinfectants	96,457	888,114	9.21	97,723	989,261	10.12
Magnesia (85 percent)	26,376	246,495	9.35	(1)	(1)	(1)
Medicines and drugs	10,517	77,345	7.35	9,744	80,980	8.31
Metallurgy:						
Nonferrous smelter flux	9,560	76,030	7.95	8,152	76,978	9.44
Steel (open-hearth and electric furnace flux)	874,243	6,390,713	7.31	1,130,613	9,021,853	7.98
Ore concentration [4]	205,541	1,585,993	7.72	251,663	2,035,905	8.09
Wire drawing	13,527	125,111	9.25	15,309	162,375	10.61
Other [5]	41,073	348,467	8.48	24,808	245,078	9.88
Paints	25,598	239,113	9.34	21,149	205,731	9.73
Paper mills [2]	565,839	4,489,033	7.93	645,665	5,717,372	8.86
Petroleum refining	48,387	446,532	9.23	48,720	501,091	10.29
Rubber manufacture	3,193	26,516	8.30	589	8,034	13.64
Salt refining	4,384	32,067	7.31	6,874	49,509	7.20
Sewage and trade-wastes treatment	65,514	563,037	8.59	84,870	840,543	9.90
Soap and fat	2,897	20,572	7.10	5,104	37,213	7.29
Sugar refining	26,887	345,687	12.86	28,412	430,929	15.17
Tanneries	80,182	649,290	8.10	89,029	804,137	9.03
Varnish	302	3,766	12.47	179	3,064	17.12
Water purification	431,772	3,565,522	8.26	454,339	4,060,039	8.94
Wood distillation	3,830	29,660	7.74	4,186	36,244	8.66
Undistributed [6]	73,614	704,753	9.57	81,439	927,225	11.39
Unspecified	305,728	2,307,039	7.55	283,453	2,336,850	8.24
	3,684,455	29,152,499	7.91	4,035,202	34,820,165	8.63
Refractory lime (dead-burned dolomite)	1,077,983	10,101,707	9.37	1,395,203	14,295,359	10.25
Total lime [7]	5,992,700	51,032,517	8.52	6,778,979	63,826,387	9.42
Hydrated lime included in above distribution	1,648,369	15,083,399	9.15	1,757,823	18,449,182	10.50

[1] Included with "Undistributed."
[2] Bleach used in paper mills excluded from "Bleach" and included with "Paper mills."
[3] Includes baking powders, citrates, fruit juices, tartrates, and unspecified food products.
[4] Includes flotation, cyanidation, bauxite purification, and magnesium manufacture.
[5] Includes mold coating and unspecified metallurgical uses.
[6] Includes acid neutralization, alcohol, calcium carbonate (precipitated), polishing compounds, retarder, sulfur, textiles, and miscellaneous industrial uses; in addition, asphalts and other bitumens in 1946–47 and magnesia in 1947.
[7] Includes lime used by producers (captive tonnage) as follows—1946: 328,837 tons, valued at $2,216,551; 1947: 392,223 tons, $2,821,404.

Hydrated lime sold by producers in the United States, 1946–47, by uses

Use	1946			1947		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Agricultural	271, 172	$2, 251, 936	$8. 30	233, 999	$2, 243, 846	$9. 59
Building	639, 549	6, 275, 938	9. 81	766, 500	8, 651, 897	11. 29
Chemical and industrial:						
Bleach, liquid and powder	5, 468	48, 121	8. 80	2, 283	21, 645	9. 48
Brick, sand-lime and slag	3, 270	31, 395	9. 60	4, 420	46, 837	10. 60
Brick, silica	12, 405	115, 810	9. 34	14, 461	152, 939	10. 58
Coke and gas	1, 124	9, 888	8. 80	1, 648	16, 611	10. 08
Food products	15, 215	157, 333	10. 34	15, 227	162, 191	10. 65
Glass	(1)	(1)	(1)	(1)	(1)	(1)
Insecticides	72, 910	687, 638	9. 43	69, 890	738, 956	10. 57
Metallurgy	39, 706	349, 430	8. 80	56, 365	561, 842	9. 97
Paints	10, 406	101, 657	9. 77	10, 331	112, 168	10. 86
Paper mills	39, 852	330, 086	8. 28	51, 176	484, 351	9. 46
Petroleum	29, 349	306, 250	10. 43	33, 584	386, 682	11. 51
Sewage	33, 157	287, 798	8. 68	45, 693	480, 566	10. 52
Sugar	16, 477	242, 003	14. 69	19, 261	328, 630	17. 06
Tanneries	44, 567	372, 910	8. 37	47, 357	455, 023	9. 61
Water purification	226, 939	2, 021, 579	8. 91	210, 796	2, 057, 599	9. 76
Other uses	186, 803	1, 493, 627	8. 00	174, 832	1, 547, 399	8. 85
	737, 648	6, 555, 525	8. 89	757, 324	7, 553, 439	9. 97
Total hydrated lime	1, 648, 369	15, 083, 399	9. 15	1, 757, 823	18, 449, 182	10. 50

[1] Included under "Other uses."

Agricultural lime and other liming materials sold by producers in the United States, 1946–47, by kinds

Kind	1946				1947			
	Short tons		Value		Short tons		Value	
	Gross weight	Effective lime content [1]	Total	Average	Gross weight	Effective lime content [1]	Total	Average
Lime:								
Quicklime	113, 486	96, 460	$899, 677	$7. 93	106, 364	90, 410	$913, 992	$8. 59
Hydrated lime	271, 172	189, 820	2, 251, 936	8. 30	233, 999	163, 800	2, 243, 846	9. 59
Oystershells (crushed) [2]	[3] 45, 590	[3] 21, 430	[3] 177, 048	[3] 3. 88	46, 447	21, 830	189, 164	4. 07
Limestone	22,781,750	10,707,420	32, 482, 907	1. 43	22,605,500	10,624,590	35,075,883	1. 55
Calcareous marl	213, 448	89, 650	248, 530	1. 16	176, 187	74, 000	235, 190	1. 33
	----------	[3] 11,104,780	[3] 36,060,098	------	----------	10,974,630	38,658,075	------

[1] Calculated upon basis of average percentages used by the National Lime Association, as follows: Quicklime (including lime from oystershells), 85 percent; hydrated lime, 70 percent; pulverized uncalcined limestone and oystershells, 47 percent; calcareous marl, 42 percent.
[2] Figures compiled by Fish and Wildlife Service.
[3] Revised figure.

Apparent Consumption.—Lime is produced so widely in the United States that most of it is used near the point of production. However, there is considerable interstate trade as shown in the accompanying table. The principal "export" States are Ohio, Missouri, Pennsylvania, and West Virginia. The following two tables present the details of sales, shipments, and supply of lime by States and groups of States.

Apparent consumption of open-market lime in continental United States in 1947, by States, in short tons

State	Sales by producers	Shipments from State [1]	Shipments into State	Apparent consumption		
				Quicklime	Hydrated lime	Total
Alabama	345,160	103,495	63,447	284,574	20,538	305,112
Arizona	54,562	8,070	11,621	53,115	4,998	58,113
Arkansas	(2)	(2)	(2)	28,615	5,702	34,317
California	181,296	35,501	52,212	142,767	55,240	198,007
Colorado	(2)	(2)	(2)	16,157	7,800	23,957
Connecticut	(2)	(2)	(2)	22,163	13,945	36,108
Delaware			57,845	39,159	18,686	57,845
District of Columbia			13,154	247	12,907	13,154
Florida	(2)		(2)	41,511	38,559	80,070
Georgia	10,141	1,410	74,410	54,746	28,395	83,141
Idaho			5,780	3,172	2,608	5,780
Illinois	299,187	137,254	272,378	334,325	99,986	434,311
Indiana	(2)	(2)	(2)	174,839	45,079	219,918
Iowa			63,093	44,037	19,056	63,093
Kansas			33,524	18,802	14,722	33,524
Kentucky			208,157	185,336	22,821	208,157
Louisiana			118,760	97,878	20,882	118,760
Maine	(2)	(2)	(2)	71,884	7,784	79,668
Maryland	71,892	16,145	119,369	117,391	57,725	175,116
Massachusetts	113,420	69,489	44,039	47,358	40,612	87,970
Michigan	(2)	(2)	(2)	227,620	64,301	291,921
Minnesota	(2)	(2)	(2)	61,239	18,309	79,548
Mississippi			20,050	13,500	6,550	20,050
Missouri	889,090	635,034	35,924	169,007	120,973	289,980
Montana	(2)	(2)	(2)	17,706	3,420	21,126
Nebraska			11,193	1,920	9,273	11,193
Nevada	(2)	(2)	(2)	28,961	2,623	31,584
New Hampshire			16,798	10,381	6,417	16,798
New Jersey	(2)	(2)	(2)	53,552	126,698	180,250
New Mexico			5,966	1,036	4,930	5,966
New York	(2)	(2)	(2)	259,032	139,801	398,833
North Carolina			67,198	24,017	43,181	67,198
North Dakota			7,830	800	7,030	7,830
Ohio	1,774,847	1,197,965	335,427	761,011	151,298	912,309
Oklahoma	(2)	(2)	(2)	27,310	12,600	39,910
Oregon	(2)	(2)	(2)	35,792	4,004	39,796
Pennsylvania	1,045,566	483,632	554,696	893,244	223,386	1,116,630
Rhode Island			13,801	5,333	8,468	13,801
South Carolina			14,657	6,071	8,586	14,657
South Dakota	(2)	(2)	(2)	2,304	4,062	6,366
Tennessee	181,039	148,579	19,205	22,138	29,527	51,665
Texas	134,530	41,417	32,923	76,842	49,194	126,036
Utah	47,096	1,425	20,363	61,641	4,393	66,034
Vermont	(2)	(2)	(2)	1,150	1,427	2,577
Virginia	260,663	193,095	89,048	102,601	54,015	156,616
Washington	(2)	(2)	(2)	28,811	9,102	37,913
West Virginia	471,914	430,690	201,828	218,976	24,076	243,052
Wisconsin	70,233	20,917	87,690	94,804	42,202	137,006
Wyoming			1,176	317	859	1,176
Undistributed [2]	809,313	417,630	1,212,179			
	6,759,949	3,941,748	3,885,741	4,985,192	1,718,750	6,703,942

[1] Includes 56,007 tons exported or unclassified as to destination.
[2] Figures that may not be shown separately are combined as "Undistributed."

Apparent consumption of open-market lime in continental United States in 1947, by region of origin and destination, in short tons

Destination	Origin: Illinois, Indiana, Michigan, Ohio			Maryland, New Jersey, New York, Pennsylvania, West Virginia			Connecticut, Maine, Massachusetts, Vermont			Florida, Georgia, Virginia			Alabama, Tennessee		
	Quick-lime	Hydrated lime	Total	Quick-lime	Hydrated lime	Total	Quick-lime	Hydrated lime	Total	Quick-lime	Hydrated lime	Total	Quick-lime	Hydrated lime	Total
Illinois, Indiana, Michigan, Ohio	1,035,256	280,055	1,315,311	139,097	11,930	151,027	-------	-------	-------	57,216	625	57,841	2,474	3,113	5,587
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	422,283	163,194	585,477	1,006,535	399,555	1,406,090	30,306	21,574	51,880	94,538	11,180	105,718	7,696	1,278	8,974
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	1,692	20,823	22,515	76,521	9,952	86,473	79,612	47,563	127,175	320	315	635	-------	-------	-------
Florida, Georgia, North Carolina, South Carolina, Virginia	7,440	62,477	69,917	31,676	21,721	53,397	-------	120	120	60,966	51,995	112,961	118,401	35,457	153,858
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	86,735	38,158	124,893	3,086	1,499	4,585	-------	-------	-------	3,847	476	4,323	312,249	39,801	352,050
Arkansas, Kansas, Nebraska, Oklahoma, Texas	2,751	9,346	12,097	-------	2	2	-------	-------	-------	-------	-------	-------	1,184	-------	1,184
Iowa, Minnesota, Missouri, Wisconsin	58,719	52,326	111,045	-------	10	10	-------	-------	-------	-------	-------	-------	-------	200	200
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	16,579	4,275	20,854	709	660	1,369	-------	-------	-------	-------	-------	-------	-------	70	70

Apparent consumption of open-market lime in continental United States in 1947, by region of origin and destination, in short tons—Con.

Destination	Origin											
	Arkansas, Oklahoma, Texas			Minnesota, Missouri, Wisconsin			Arizona, California, Colorado, Montana, Nevada, 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	623	--------	623	263,129	64,941	328,070	--------	--------	--------	1,497,795	360,664	1,858,459
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	1,752	1	1,753	18,491	6,497	24,988	--------	--------	--------	1,581,601	603,279	2,184,880
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	--------	--------	--------	124	--------	124	--------	--------	--------	158,269	78,653	236,922
Florida, Georgia, North Carolina, South Carolina, Virginia	1,742	--------	1,742	8,721	966	9,687	--------	--------	--------	228,946	172,736	401,682
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	63,121	7,516	70,637	134,388	12,868	147,256	--------	--------	--------	603,426	100,318	703,744
Arkansas, Kansas, Nebraska, Oklahoma, Texas	114,031	60,165	174,196	35,523	21,833	57,356	--------	145	145	153,489	91,491	244,980
Iowa, Minnesota, Missouri, Wisconsin	14,939	654	15,593	295,402	147,265	442,667	27	85	112	369,087	200,540	569,627
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	7,063	4,742	11,805	17,073	15,249	32,322	351,155	86,073	437,228	392,579	111,069	503,648

Apparent consumption of open-market hydrated lime from plants in Ohio and total continental United States in 1947, by region of destination

Destination	From Ohio plants			From all plants in continental United States	
	Short tons	Distribution (percent)	Percent of total shipments	Short tons	Distribution (percent)
Illinois, Indiana, Michigan, Ohio	248,539	44	69	360,664	21
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	162,959	28	27	603,279	35
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	20,823	4	26	78,653	4
Florida, Georgia, North Carolina, South Carolina, Virginia	62,316	11	36	172,736	10
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	32,487	6	32	100,318	6
Arkansas, Kansas, Nebraska, Oklahoma, Texas	9,166	2	10	91,491	5
Iowa, Minnesota, Missouri, Wisconsin	29,941	5	15	200,540	12
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	2,979	(1)	3	111,069	6
Undistributed and exports	869	(1)	4	22,077	1
	570,079	100	33	1,740,827	100

[1] Less than 1 percent.

Small quantities are shipped from the United States to various island Territories, as shown in the following table.

Lime shipped to noncontiguous Territories of the United States, 1944–47

[U. S. Department of Commerce]

Territory	1944		1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Hawaii	511	$8,197	246	$4,555	406	$8,373	833	$17,330
Puerto Rico	415	5,572	1,458	20,144	365	5,276	2,698	27,844
Virgin Islands	121	3,876	80	2,100	142	3,160	57	1,603

PRICES

Prices of lime have been rising steadily since the war. In 1947, the average valuation of all lime sold was $9.42 per ton—$0.90 more than in the previous year. Quicklime was valued at an average of $9.04 in 1947 ($8.27 in 1946) and hydrated lime at $10.50 ($9.15 in 1946).

FOREIGN TRADE [2]

Imports.—Adequate supplies of lime are available in most sections of the United States. However, there are local shortages in the Northwest, and consequently there is a market for imports in that area. As shown in the accompanying table, most of the imports enter through the Washington customs district.

Exports.—Exports of lime are made to many countries, but the total tonnage is not large. Principal export markets are in Canada and in Latin America.

Lime imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Hydrated lime		Other lime		Dead-burned dolomite [1]		Total	
	Short tons [2]	Value	Short tons [2]	Value	Short tons	Value	Short tons	Value
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	20,142	172,676	(3)	7	20,819	179,184
1946	611	8,538	24,664	248,311	----	----	25,275	256,849
1947	1,903	24,588	25,454	271,253	53	2,194	27,410	298,035

[1] "Dead-burned basic refractory material consisting chiefly of magnesia and lime."
[2] Includes weight of immediate container.
[3] Less than 1 ton.

Lime imported for consumption in the United States, 1945–47, by countries and customs districts [1]

[U. S. Department of Commerce]

Country of origin	Customs district of entry	1945		1946		1947	
		Short tons [2]	Value	Short tons [2]	Value	Short tons [2]	Value
Canada	Alaska	----	----	----	----	(3)	$12
	Buffalo	----	----	3,559	$27,187	3,440	27,397
	Connecticut	----	----	(3)	1	----	----
	Duluth and Superior	----	----	372	3,345	----	----
	Maine and New Hampshire	25	$352	71	1,122	318	2,297
	Michigan	1	6	----	----	----	----
	Montana and Idaho	----	----	----	----	118	1,157
	Oregon	40	334	----	----	----	----
	St. Lawrence	20	91	(3)	1	(3)	2
	San Francisco	1	26	----	----	----	----
	Vermont	----	----	122	1,337	----	----
	Washington	20,732	178,368	21,151	223,848	23,474	264,614
Dominican Republic	Puerto Rico	----	----	(3)	8	----	----
United Kingdom	Philadelphia	----	----	----	----	7	362
		20,819	179,177	25,275	256,849	27,357	295,841

[1] Exclusive of dead-burned basic refractory material.
[2] Includes weight of immediate container.
[3] Less than 1 ton.

[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.

Lime exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1943	23,284	$255,135	1946	33,540	$423,948
1944	22,689	216,642	1947	50,784	713,703
1945	24,276	268,875			

Lime exported from the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Algeria			452	$1,434		
Argentina	6	$187	30	1,145	89	$3,162
Bahamas	97	2,633	19	598	63	3,069
Belgium and Luxembourg			185	8,746	95	6,156
Brazil	22	1,196	39	1,095	36	665
Canada	8,376	48,646	11,430	91,320	16,435	173,257
Chile	6	371	3	518	529	8,435
Colombia	14	406	18	540	806	13,500
Costa Rica	38	415	4,117	48,173	7,486	90,281
Cuba	38	692	110	2,185	82	1,227
Curaçao (N. W. I.)	50	677	75	1,299	145	3,097
Dominican Republic	20	188	25	251	208	3,303
El Salvador	49	1,179	76	1,847	218	5,951
Haiti	363	4,686	130	2,025	307	4,640
Honduras	6,017	69,758	6,700	75,483	8,722	109,629
Liberia	39	1,318	43	1,190	46	1,499
Mexico	4,590	73,809	5,008	82,233	5,070	70,558
Nicaragua	127	2,632	115	2,741	465	9,338
Panama, Republic of	3,715	38,955	3,713	48,265	6,623	78,785
Peru	278	4,299	126	2,498	76	1,569
Philippines, Republic of			89	1,638	1,030	22,561
Sweden	16	1,326	156	9,272	169	11,543
United Kingdom	170	8,342	733	34,197	1,098	56,903
Other countries	245	7,160	148	5,255	986	34,575
	24,276	268,875	33,540	423,948	50,784	713,703

TECHNOLOGIC DEVELOPMENTS

The "Fluosolids" process of calcining limestone was revealed in 1947 after several years of development. The limestone is calcined in a vertical kiln having several perforated hearths. Limestone, sized to −6, +65 mesh, is fed onto the floor of the top hearth, and hot gases, coming from below, pass through the bed and keep the solids in constant agitation. The mass behaves like a fluid. The fluidized solids gradually come to the top of the bed, overflow into a pipe and drop down to the floor of the next hearth. This is repeated until the product leaves the kiln from the bottom (cooling) compartment. Fuel is injected directly into the fluid bed on the calcining hearth just above the cooling compartment. As fluidization has many attractive features, such as rapid and efficient heat transfer and close temperature control, it is receiving wide attention. A number of articles on fluidization were presented during the year in trade magazines.[3] A

[3] Bauer, W. G., Fluidization—Its Implications for the Lime and Nonmetallic Industries: Pit and Quarry, vol. 39, No. 11, May 1947, pp. 90–94, 104.

kiln having a production capacity of 100 tons of lime per day is being designed for the New England Lime Co.

Several Ellernan calciners have been installed since the war. This is a vertical-type kiln in which the fuel is burned in a fire box at the side and the hot gases are distributed throughout the stone by rows of tunnel beams at two levels. Cooling air is admitted through the lime discharge spouts and withdrawn by means of another set of tunnel beams. This kiln has continuous feed and discharge and uses ½-inch to 1½-inch stone. Advantages claimed are uniformity of product and low labor costs.[4]

[4] Trauffer, W. E., Calciners at Utah Lime and Stone Co. Set Operating Records: Pit and Quarry, vol 39, No. 11, May 1947, pp. 95-99.
Lenhart, W. B., Continuous Discharge Automatic Lime Kilns: Rock Products, vol. 56, No. 11, Nov. 1947, pp. 86-87.

Magnesium

By HERBERT L. CULLEN

GENERAL SUMMARY

MAGNESIUM, in terms of supply and demand, was relatively more abundant than any other metal in 1947, as actual and potential production was many times greater than the demand for it. It is unique among metals in having no raw-material supply problem, since reserves of the principal present source—sea water—are inexhaustible, whereas world reserves of ores of most of the other common metals are subject to depletion. Nevertheless, production in 1947 was limited to the lowest practical operating level; and consumption declined further, despite the strong demand for the more firmly established metals. Progress in the adaptation of magnesium to common industrial uses has been accomplished more along technological lines than in practical usage. However, on the bases of shortage of other metals, present price relationships, and recent advances technologically, magnesium has potential applications that may soon lead to consumption many times that of 1947.

Salient statistics of the magnesium industry in the United States, 1943–47

	1943	1944	1945	1946	1947
Production of primary magnesium [1] short tons	183,584	157,100	32,792	5,317	12,344
Quoted price per pound [2] cents	20.5	20.5	20.5	20.5	20.5
Exports [3] short tons	35,631	21,001	518	207	315
World production do	[4] 262,100	232,800	[4] 54,900	[4] 12,900	19,700

[1] Ingot equivalent.
[2] Lowest nominal price (New York) for primary metal ingot, 99.8 percent pure, carlots.
[3] Magnesium metal and alloys, 1943–45; metal, 1946–47.
[4] Revised figure.

Domestic primary production of magnesium increased 132 percent over 1946 but was still only 7 percent of the 1943 record output of 183,584 short tons. Consumption of primary metal and alloy declined 29 percent, as many consumers turned to the enormous surplus of scrap and secondary ingot as a source of supply. Recovery of secondary magnesium increased substantially over that in 1946, and the quantity of secondary magnesium recovered exceeded consumption of primary for the first time. Estimated world production increased by approximately the same tonnage as that in the United States, as foreign production exhibited little change. The price of standard virgin ingot remained unchanged at 20.5 cents a pound throughout the year.

PRODUCTION

Primary.—Domestic production of primary magnesium in 1947 totaled 12,344 short tons, a gain of 132 percent over the 5,317 tons produced in 1946. It should be emphasized, however, that this output represented the optimum operating level of the sole producing plant at Freeport, Tex., rather than demand for primary magnesium, as the Dow Chemical Co. found it necessary to stock much of the ingot produced because of the adverse supply-demand situation.

As had been the case in 1946, the large tonnage of scrap and secondary magnesium available from various sources constituted a serious threat to continued operation of the Freeport plant. By the end of 1947, stocks of magnesium at the plant had increased considerably over those at the beginning of the year, and the Dow Co. faced the possibility of halting production unless consumption increased or purchases of the metal for the national strategic stock pile were authorized.

Production of primary magnesium (ingot equivalent), 1942–47, by months, in thousands of pounds [1]

Month	1942	1943	1944	1945	1946	1947
January	5,026	20,683	41,988	7,697	195	2,797
February	4,677	21,414	40,947	5,960	97	2,463
March	5,183	26,098	41,015	6,658	19	2,943
April	5,014	27,197	37,846	6,412	----------	2,306
May	5,271	30,269	34,308	6,407	----------	1,851
June	5,264	30,236	29,372	6,873	457	1,696
July	6,599	33,251	30,141	9,236	1,345	1,811
August	6,854	34,402	24,994	9,064	1,739	1,698
September	8,245	32,480	18,463	4,190	1,934	1,772
October	11,682	36,104	16,611	2,092	1,962	1,825
November	15,909	36,830	12,475	1,488	1,078	1,740
December	18,235	39,192	8,514	207	1,551	1,786
Total: Preliminary	97,959	[2] 368,156	[2] 336,674	66,284	10,377	24,688
Final	97,926	[2] 367,168	[2] 314,200	65,584	10,634	24,688

[1] Producers' reports to War Production Board, January 1942–August 1945, thereafter to Bureau of Mines. Monthly figures are preliminary and do not generally add to final totals derived from the Bureau's annual industry canvass.

[2] Excludes crystal equivalent of magnesium content of incendiary bomb mixture ("goop")—919,000 pounds in 1943 and 12,945,000 pounds in 1944.

The approximately 50,000 tons of magnesium, in the form of ingot, structural shapes, castings, and scrap, that was in the hands of Federal agencies at the beginning of the year remained so for the most part, comparatively little being marketed or transferred to the national strategic stock pile. One of the principal items of scrap was incendiary bomb bodies, which presented a problem if either storage in that form or conversion to ingot were to be undertaken. The existence of this material and the fact that it was available to industry for purchase of course lowered the demand for primary magnesium. The Dow Co., recognizing the urgent need for magnesium in an emergency, requested the Munitions Board to place it on the list of materials to be purchased for stock piling. The immediate effect of such action would have been to remove the surplus stocks in the hands of Government agencies and thus bring about a normal market for primary magnesium whether or not actual purchases were made. However, no action was taken on the matter during 1947.

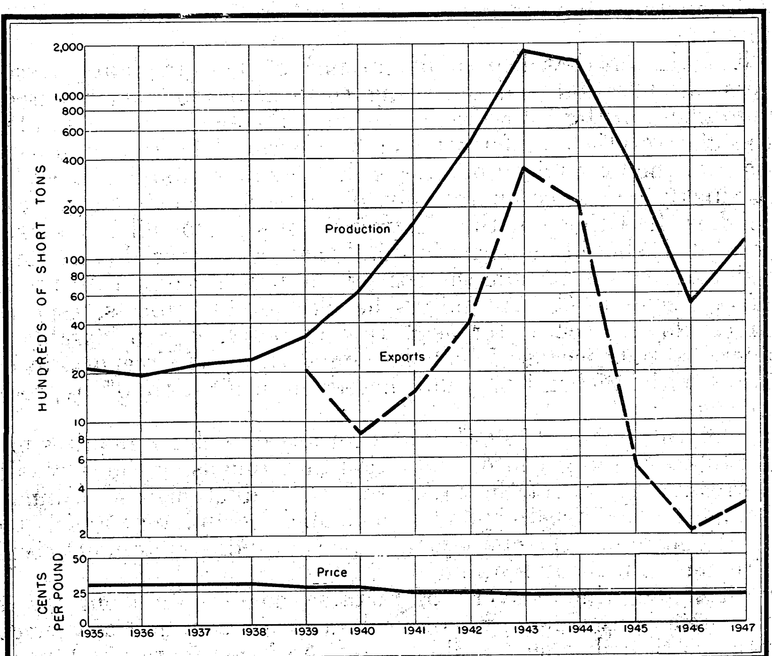

FIGURE 1.—Trends in domestic production, exports, and quoted price of primary magnesium, 1935–47.

Production, sales, exports, and apparent consumption of primary magnesium in the United States, 1943–47, in short tons

	Production		Sales	Exports [1]	Apparent consumption [2]
	Raw, crude, and pure ingot	Ingot equivalent			
1943	[3] 190, 025	[3] 183, 584	170, 267	14, 720	155, 547
1944	[3] 161, 935	[3] 157, 100	146, 585	4, 830	141, 755
1945	[3] 33, 106	32, 792	43, 496	496	43, 000
1946	5, 317	5, 317	8, 916	207	8, 709
1947	12, 344	12, 344	5, 264	315	4, 949

[1] Primary metal only. Alloy exports in addition: 20,911 tons in 1943, 16,171 tons in 1944, 22 tons in 1945, and none in 1946–47.
[2] Does not consider fluctuations in consumers' stocks and metal derived from scrap. Withdrawals from producers' stocks totaled 10,704 tons in 1945 and 3,599 in 1946. Additions to producers' stocks totaled 13,317 tons in 1943, 10,515 tons in 1944, and 7,080 tons in 1947.
[3] Does not include magnesium content of incendiary mixture produced direct.

Of the reduction plants operated during World War II, there remained two privately owned and seven Government-owned facilities with a total rated annual capacity of 133,000 tons capable of magnesium production at the end of the year, all others being disposed of, or listed for disposal, for other purposes. One of the privately owned plants, however—that of the Permanente Metals Corp. at Permanente, Calif.—may never again be used for magnesium production. All of the Government-owned plants were covered by the National Security clause, which permitted leasing them for other uses, with the stipulation that they be kept in condition to produce magnesium if required.

It is significant that disposal of wartime magnesium plants, based on success of operation and operating costs achieved, has resulted in abandonment of the Hansgirg carbothermic reduction process in favor of the electrolytic and ferrosilicon processes. The outstanding advantage of the ferrosilicon process is that plants employing it could be built quickly and at comparatively low cost in an emergency. Costs are higher than those of the electrolytic process for all items except power, but it should be borne in mind that raw-material costs for the ferrosilicon process include the cost of the power required to produce the ferrosilicon used. Actually, the electrolytic process, especially when employing sea water as a raw material, is considerably the cheaper process, because it can be operated, as at Freeport, in conjunction with a chemical plant based on utilization of byproduct chemicals.

An electrolytic plant like that at Freeport or Velasco requires much longer to build and get into production than one using the ferrosilicon process but, in view of the ultimate low production cost attainable, is a much better investment from a financial standpoint and is most likely to continue to be employed by private industry to meet civilian requirements for magnesium.

In principle, the recovery of metallic magnesium from raw sea water is relatively simple, yet development of a commercially successful process to utilize such a dilute source of raw material (1 part of magnesium in 770 parts of ocean water) calls for unusual chemical engineering equipment, methods, and control. As developed by the Dow Chemical Co. for use at the Freeport, Tex., plant, the process consists of the following steps:

(1) Magnesium hydrate is precipitated from sea water, using milk of lime made from calcined oyster shells.

(2) After filtration, the hydrate is converted into magnesium chloride, using a 10-percent solution of hydrochloric acid.

(3) The magnesium chloride solution is concentrated, first in direct-fired evaporators, then on shelf driers, and finally in a rotary drier.

(4) Flaked magensium chloride, in virtually anhydrous condition, is fed into the cells where it is electrolyzed to produce metallic magnesium of average purity between 99.9 and 99.95 percent, along with byproduct chlorine (which is used to make hydrochloric acid).

Additional chlorine for make-up in the hydrochloric acid process is supplied from electrolytic chlorine cells. The dilute caustic soda coming from these cells is concentrated and sold in liquid, solid, and flake form. Natural gas is used throughout the plant for power generation, process heating, and as a raw material for the production of chlorinated hydrocarbons.

Secondary.—Recovery of secondary magnesium, including alloying ingredients, from magnesium-base scrap only, totaled 8,529 short tons (including secondary magnesium incorporated in primary ingot) in 1947, compared with 4,539 tons from the same source in 1946. This metal was derived from 9,420 tons of magnesium-base scrap, and 40 percent was from old scrap compared with only 24 percent in 1946. Of the quantity of magnesium recovered, 5,138 tons were as ingot, 1,377 tons were in castings, 85 tons in magnesium-alloy shapes, 909 tons in aluminum alloys, 3 tons in zinc alloys, 179 tons in chemicals, and 20 tons in other forms. An additional 818 tons were recovered in anodes and strip used for cathodic protection of steel. Further information on secondary magnesium will be found in this volume in the Secondary Metals—Nonferrous chapter.

CONSUMPTION AND USES

Reflecting the efforts of the magnesium industry to adjust itself to a greatly altered pattern of use, consumption of primary magnesium experienced a further decline in 1947. Total consumption, expressed as ingot equivalent and magnesium content of primary alloys, was 7,008 short tons in 1947 compared with 9,873 tons in 1946. However, the decline in use of primary metal was offset by a corresponding gain in recovery of secondary, and total consumption of magnesium was about the same in the 2 years.

Actual domestic consumption of primary magnesium (ingot equivalent and magnesium content of magnesium-base alloys) in 1944–47, by uses, in short tons

Product	1944	1945 [1]	1946	1947
Structural products:				
Castings:				
Sand	44,773	18,405	920	970
Die	1,165	803	341	201
Permanent mold	59,181	8,307	38	10
Sheet	1,543	1,517	1,990	1,095
Structural shapes, rods, tubing (extrusions)	4,784	2,452	2,689	1,684
Forgings	344	157	99	105
Total structural	111,790	31,641	6,077	4,065
Other products:				
Powder	9,080	4,769	192	9
Aluminum alloys	6,868	5,589	2,391	1,935
Other alloys	12	24	41	39
Scavenger and deoxidizer	159	228	248	427
Chemical	156	182	150	266
Other [2]	4,633	1,554	774	267
Total other products	20,908	12,346	3,796	2,943
Grand total	132,698	43,987	9,873	7,008

[1] Figures are incomplete owing to lack of returns from a number of wartime companies whose operations terminated during the year.
[2] Includes primary metal consumed in making secondary alloy.

Military outlets for magnesium, in the form of sheet, extrusions, forgings, and castings for plane construction, were limited during the year; and, as progress toward the application of magnesium to civilian products was slower than had been expected, consumption of magnesium in structural uses continued its declining trend. Use of primary magnesium in all types of castings declined 9 percent, in sheet 45 percent, and in extruded products 37 percent, whereas consumption in forgings exhibited a slight gain of 6 percent. In the uses for other products, the most significant decline was in the consumption of primary magnesium for the production of powder—only 9 tons in 1947, compared with 192 tons in 1946 and 9,080 tons in 1944 (the first year of the consumption survey). Use of primary magnesium in aluminum alloys and miscellaneous products also declined, but use in chemicals and as a scavenger and deoxidizer increased.

The distribution pattern on consumption of magnesium changed as technical research designed to further the use of the metal continued. One new use that was first widely reported in 1947 was that for cathodic protection of steel, where the conditions leading to electrolytic corrosion were present, as in buried pipe lines and hot-water tanks. It was found that a small quantity of magnesium placed close to the steel article would bear the brunt of electrolytic action and leave the steel relatively untouched. During 1947, 94 tons of primary magnesium and 818 tons of secondary were reported used for this and other purposes necessitating the casting of anodes.

Use of magnesium in various household appliances and mobile equipment of all kinds holds promise for the future, but universal application thus far has been limited by the high cost of the metal in semifinished shapes and castings. It is to be expected that the expansion of the Air Force during the next 4 years will raise domestic requirements for magnesium, and this may lead to lower processing costs that will encourage substitution of the metal for others in a more critical supply situation.

PRICES

The base price of standard virgin magnesium ingot remained 20.5 cents a pound throughout the year, the last price change having occurred in January 1943. Likewise, the price of secondary magnesium ingot was unchanged through the year, being quoted at 18–18.5 cents a pound. Prices for the principal types of primary casting alloy remained unchanged through 1947. Prices for extrusions were adjusted in March but returned to the former level in April. The Dow Chemical Co. discontinued sales of extrusion billet in 1947, unless made on a special quotation basis.

In the United Kingdom, the price of primary ingot was firm at 1s.6d. a pound until September, when it was reduced to 1s.2d. and remained there for the rest of the year. In Canada, the price was unchanged at 23 cents (Canadian) a pound.

FOREIGN TRADE [1]

Imports of magnesium in all forms in 1947 were 202 tons, a decline of 16 percent from the 241 tons received in 1946 but still an abnormally high figure in view of the protective tariff of 20 cents a pound on magnesium ingot. Part of the tonnage consisted of ingot of exceptionally high purity from Canada, for which a temporary market existed that could not be supplied from domestic sources. Of the total, 191 tons came from Canada and the remainder from the 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.

Exports of magnesium from the United States, 1945–47

[U. S. Department of Commerce]

Magnesium	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Metal in primary form	[1] 518	$216,793	207	$85,382	315	$140,214
Metal in other forms	140	292,430	87	48,892	40	80,210
Powder	720	579,736	12	6,104		

[1] Includes 22 tons of magnesium-base alloy.

Exports of primary magnesium increased 52 percent in 1947. Of the total of 315 tons, 271 tons went to Mexico, 26 tons to Saudi Arabia, 11 tons to Switzerland, 6 tons to Canada, and 1 ton to Australia. Of magnesium metal in other forms, Canada received 16 tons, Colombia 8 tons, China 5 tons, Mexico 4 tons, and 12 other countries the remainder (7 tons) of the total of 40 tons.

TECHNOLOGY

Despite the decline in use of magnesium, compared with wartime demand, 1947 witnessed steady progress in the development of new applications for the metal and its alloys. In fact, metallurgical research was far in advance of actual use, as magnesium had evidently reached an impasse where expanded consumption of the metal in its various forms awaited lower over-all costs, and lowered costs were contingent on increased use. Aside from high cost in cast- and wrought-product forms, comparatively low physical strength and chemical activity have retarded its acceptance for many common uses in the past. New developments have tended to overcome these objections.

Further work accomplished on magnesium-cerium-zirconium alloys promises castings usable in machinery at elevated temperatures, where a serious shortcoming of magnesium alloys in the past has been a tendency to creep under stress. Closer control of alloy content was found to be of considerable assistance in promoting consistency of behavior in sand-casting alloys, particularly AZ92 (Dowmetal C), the 9-percent-aluminum alloy.

Magnesium found increasing application in 1947 for the cathodic protection of pipe lines, water tanks, and marine parts, a use that takes advantage of chemical activity. Properly installed, the magnesium ribbon or anode bears the brunt of electrolytic corrosion, protecting steel in installations where its replacement may be inconvenient or difficult. With further research on chemical reactivity of magnesium, gratifying results were obtained in bringing the corrodibility of magnesium alloys under control by establishing closer tolerances in alloy content and by developing new paint coverings.

Additional technologic research conducted on problems of welding, drawing, forging, and rolling of magnesium have added greatly to the store of technical knowledge of the metal, which will be invaluable when broader industrial acceptance is gained.

WORLD REVIEW

Estimated world output of primary magnesium increased from less than 12,000 metric tons in 1946 to approximately 18,000 tons in 1947, most of the gain being accounted for by the increased production in the United States. It was evident that markets for the metal were limited, and expansion of production would be dependent upon broader industrial application. Official reports are not yet available from several of the countries believed to be producing magnesium, and information from alternate sources is not sufficient to add to the accuracy of the accompanying table.

World production of magnesium, 1940–47, by countries, in metric tons

[Compiled by B. B. Mitchell]

Country	1940	1941	1942	1943	1944	1945	1946	1947
Australia		112	484	497	54			
Canada		5	367	3,245	4,799	3,338	145	136
China:								
Formosa		35	261	376	432	21		
Manchuria [1]	5	27	8	251	450	200		
France	2,562	1,989	1,334	1,542	703	279	707	800
Germany	17,720	24,000	30,000	32,400	33,600	[2] 4,225		
Italy	438	1,857	2,379	[3] 2,000	[3] 3,000	[3] 400	[3] 1,000	[3] 600
Japan	2,720	2,575	2,020	2,777	2,904	1,020		
Korea	260	263	240	532	1,628	1,014		
Norway [3]		100	2,000	2,000	2,000			
Switzerland [3]	700	700	1,500	1,500	1,000	500	300	500
U. S. S. R. [3]	1,500	4,000	5,000	5,000	5,000	2,170	3,000	4,000
United Kingdom	[4] 6,200	9,380	14,865	19,096	13,094	[4] 6,900	[4] 1,700	[4] 660
United States	5,680	14,782	44,418	166,544	142,518	29,748	4,823	11,198
Total	37,785	59,825	104,876	237,760	211,182	49,815	11,675	17,894

[1] Revised figures.
[2] January-February only. Planned production for March, 2,830 tons.
[3] Estimated by author of the chapter.
[4] Includes secondary.

Canada.—Production was resumed at the Haley's Station, Ontario, plant of Dominion Magnesium Co., Ltd., in January. However, it had been noted that the Pidgeon process installed for the production of magnesium was adaptable to use for producing other base metals, such as calcium, barium, and strontium, and the company planned to concentrate on calcium and calcium hydride rather than magnesium.

In April, the new magnesium plant of the Aluminum Co. of Canada, at Arvida, Quebec, began operations with a rated capacity of 1,000 tons a year. This plant uses the electrolytic process, operating on magnesium chloride. The chloride is made from magnesium oxide produced at the company plant at Wakefield, Quebec, using brucite from the Gatineau Valley. Total production of magnesium in Canada totaled only 136 metric tons in 1947.

China.[2]—There has been no production of magnesium on a commercial scale in China since the close of the war. The Japanese are understood to have built two plants in Liaoning Province for production of the metal, with a combined annual capacity of 2,500 tons. However, actual production was much less than capacity, totaling not more than 700 tons during the 5 years ended in 1944. Both plants

[2] Kleinhans, Richard E., The Light-Metal Industries in China: Bureau of Mines, Mineral Trade Notes, vol. 26, No. 2, Spec. Suppl. 23, February 1948, 18 pp.

are believed to have been destroyed. Another plant was constructed by the Japanese at Takao, Formosa; but it was completely destroyed, and no reliable information regarding the plant is available. It is believed to have had a capacity of about 2,000 tons of metal a year, produced by electrolysis of magnesium chloride.

France.—The Société Generale du Magnesium holds a monopoly in France on the supply of raw materials for the production of magnesium, and furnishes users with technical advice on working and applying the metal. It also acts as a sales agent for the producing companies, the Compagnie de Produits Chimiques et Electro-Metallurgiques Alais, Froges et Camargue, and the Société d'Electro-Chimie, d'Electro-Metallurgie et des Acieries Electriques d'Ugine. The production capacity of these concerns is approximately 3,500 tons annually, but output in 1947 comprised only 800 tons of primary magnesium and approximately half that quantity of secondary. Of the total production, about half was for use in casting, and most of the remainder for use in alloying aluminum, with comparatively little being used for wrought products.

Germany.—Of the five magnesium reduction plants that operated in Germany during the war, four were I. G. Farbenindustrie establishments that were located in what is now the Russian occupation zone. It was reported [3] in September that all four plants (Lautawerk, Bitterfeld, Aken, and Stassfurt) had been dismantled. If the report is true, only the Heringen plant of Wintershall, A. G., in the American zone, would remain as a possible producer of magnesium in Germany.

Japan.[4]—At the beginning of World War II, Japan was fifth in rank of the countries producing magnesium; but as production in other countries increased rapidly to a peak in 1943, Japanese output sank to the seventh position, because of the failure of the industry to pace development elsewhere. However, the domestic industry, with assistance from plants in Formosa, Korea, and Manchuria, was able to meet requirements of the war program, as virtually no imports were received during the period of Japanese production. The total output of plants in the empire for the period 1933–45 was 18,654 metric tons and consumption for the same period 18,085 tons, of which almost 95 percent went to military uses.

The most satisfactory operation was obtained in plants producing magnesium from bittern, a brine left from the evaporation of sea water to obtain salt. However, some plants used a Farben-type process that employed magnesite, and one Japanese-operated plant in Korea used the Hansgirg carbothermic reduction process. Of the six plants operating in Japan proper in midyear 1945, three were using cell feed of magnesium chloride from bittern, and three were using magnesia from magnesite.

No magnesium has been produced in Japan since the close of the war and probably none in former subject countries. There is little present demand for the metal, and future production depends upon disposition of the plants as reparations and on the controls imposed

[3] Metal Bulletin (London), The Iron Curtain Rises: No. 3227, Sept. 26, 1947, p. 7.

[4] Many of the data contained herein were derived from Allen, Glenn L., Magnesium Metallurgy in the Japanese Empire: Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, Rept. 85, Aug. 6, 1947.

upon the nation's industry. It should be noted that only two of the former producers have indicated willingness to produce magnesium in a competitive peacetime economy.

United Kingdom.—Production of primary magnesium experienced a decline in Great Britain after the war comparable to that in the United States, as industrial demand was almost nonexistent, and wartime stocks of metal and scrap became available for fabrication. The sole producer in 1947 was Magnesium Elektron, Ltd., with an output of 660 metric tons for the year. The works of the Magnesium Metal Corp. at Port Tennant, Swansea, South Wales, were dismantled during the year, much of the equipment being sold for use in chemical plants. It was also announced that the Imperial Smelting Corp. had decided not to risk expenditure on development of the Magnesium Metal Corp. process for carbothermic reduction of magnesium, in view of the lack of demand for the metal.

On September 1, 1947, the British Ministry of Supply revoked the order controlling magnesium. Licensing and controls on price, acquisition, sale, and use of the metal were suspended, and the Ministry also discontinued its direct sales to consumers.

Magnesium Compounds and Miscellaneous Salines

By G. W. JOSEPHSON and F. M. BARSIGIAN [1]

GENERAL SUMMARY

PRODUCTION of magnesite in 1947 was much lower than the wartime peak; but, as the demand for refractory grades increased, output was greater than in 1946. Sales of caustic-calcined magnesia declined. A new record was established for sales of calcium chloride. Consumption of gasoline was very great in 1947; consequently, demand for bromine, used in antiknock compounds, increased sharply. Imports of iodine were very large. Natural sodium carbonate production capacity was being augmented, and output was 36 percent greater than in 1946. A new record was set in sales of natural sodium sulfate. Production of boron compounds (B_2O_3 basis) increased 12 percent to another record.

MAGNESIUM COMPOUNDS

RESERVES

A report by the Bureau of Mines and the Geological Survey [2] described reserves of magnesium minerals in the United States as follows:

Reserves of sea water and underground brines, the present commercial source of metallic magnesium, are virtually inexhaustible. Consequently the reserve position of the United States with respect to metal production is most favorable.

Reserves of all of the other magnesium minerals are also very large; but deposits of high-grade material, easily extracted and accessible to industrial areas, are

[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] Hearings before a Subcommittee of the Committee on Public Lands, United States Senate, Eightieth Congress, May 15, 16, and 20, 1947, pp. 259–260.

rather limited. Magnesite reserves are less plentiful than those of the other magnesium minerals (except brucite, which is commercially relatively scarce). About 8,000,000 tons of usable magnesite, occurring in Washington and Nevada, is available for open-pit mining and may be considered as measured ore. Probably 85,000,000 tons of impure magnesite, in the same States, may be considered inferred ore. In terms of 1941 consumption, these reserves would furnish magnesia refractories for about 250 years.

A number of dolomite deposits of commercial grade have been investigated recently and are inferred to contain 136,000,000 tons. This amount is regarded as representing but a small part of the total high-grade dolomite that may be available.

Deposits of olivine and serpentine on both the Atlantic and Pacific coasts contain almost astronomic amounts of magnesium, but technical difficulties have deterred commercial utilization. During the past few years a small Georgia plant has been recovering magnesium sulfate from serpentine, and recent research indicates that magnesium salts may be economically recovered from olivine also. Continued research may eventually classify these magnesium silicates as major magnesium raw materials.

SALIENT STATISTICS

Salient statistics of magnesite, magnesia, and dead-burned dolomite in the United States, 1943–47

	1943	1944	1945	1946	1947
Crude magnesite:					
Mined:					
Short tons	754,832	561,450	336,458	324,640	375,993
Value [1]	$6,071,596	$4,407,461	$2,324,957	$2,225,850	$2,596,747
Caustic-calcined magnesia:					
Sold or used by producers: [2]					
Short tons	191,792	139,243	43,270	45,178	33,049
Value	$11,497,505	$6,481,963	$2,503,544	$2,854,538	$2,870,636
Average per ton [3]	$59.95	$46.55	$57.86	$63.18	$86.86
Refractory magnesia:					
Sold or used by producers: [4]					
Short tons	301,382	278,490	254,994	244,824	314,921
Value	$9,341,183	$8,426,049	$7,414,218	$7,231,869	$9,466,132
Average per ton [3]	$30.99	$30.26	$29.08	$29.54	$30.06
Dead-burned dolomite:					
Sold by producers:					
Short tons	1,276,725	1,290,790	1,187,334	1,077,983	1,395,203
Value	$11,243,017	$11,441,612	$10,613,711	$10,101,707	$14,295,359

[1] Partly estimated; most of the crude is processed by the mining companies, and very little enters open market.

[2] 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.

[3] Average receipts f. o. b. mine shipping point.

[4] Includes dead-burned magnesite and refractory magnesia from brucite, dolomite, sea-water bitterns, well brines, and raw sea water; there was none from well brines in 1944.

DOMESTIC PRODUCTION

Magnesite.—Production of crude magnesite in 1947—375,993 short tons—was 16 percent greater than in 1946. This output was not as high as the record attained in 1943, but it was greater than in 1945, a wartime year. The principal reason for the upward trend in magnesia output is the growing acceptance of this material in the refractories industry. The output of refractory magnesia in 1947 was 29 percent greater than in 1946, whereas caustic calcined material declined.

Magnesia sold or used by producers in the United States, 1946–47, by kinds and sources

Magnesia	From magnesite, brucite, and dolomite [1]		From well brines, raw sea water, and sea-water bitterns [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1946						
Caustic-calcined	16,269	$1,310,584	28,909	$1,543,954	45,178	$2,854,538
Refractory	174,121	4,539,978	70,703	2,691,891	244,824	7,231,869
	190,390	5,850,562	99,612	4,235,845	290,002	10,086,407
1947						
Caustic-calcined	10,850	1,005,920	22,199	1,864,716	33,049	2,870,636
Refractory	209,581	5,794,636	105,340	3,671,496	314,921	9,466,132
	220,431	6,800,556	127,539	5,536,212	347,970	12,336,768

[1] Magnesia made from a combination of dolomite and sea water is included with that from sea water.

Dolomite.—As steel plants have been operating under forced draft during the past year, the demand for dead-burned dolomite has been extremely high. Output of dead-burned dolomite, as indicated by sales, attained a new record in 1947—8 percent greater than the previous high established in 1944.

Additional information on dolomite may be found in the Stone and Lime chapters of this volume.

Dead-burned dolomite sold in and imported into the United States, 1943–47

Year	Sales of domestic		Imports [1]		Year	Sales of domestic		Imports [1]	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1943	1,276,725	$11,243,017	739	$22,563	1946	1,077,983	$10,101,707		
1944	1,290,790	11,441,612	40	691	1947	1,395,203	14,295,359	53	$2,194
1945	1,187,334	10,613,711	(2)	7					

[1] Reported as "Dead-burned basic refractory material."
[2] Less than 1 ton.

Other Magnesium Compounds.—Increases were noted in the 1947 production of most of the high-cost magnesias (as distinguished from the low-cost refractory and caustic-calcined grades) and magnesium salts. The output of precipitated magnesium carbonate, which is used principally in 85-percent magnesia insulation, increased 23 percent over 1946. A substantial increase was noted in the production of magnesium chloride used in the manufacture of magnesium metal. The tonnage of "Specified magnesias and magnesium hydroxide" reported in 1947 was more than twice as great as in the previous year. The output of magnesium sulfate declined somewhat.

Specified magnesium compounds produced, sold, and used by producers in the United States, 1946–47

Product	Plants	Produced (short tons)	Sold [1] Short tons	Sold [1] Value	Used (short tons)
1946					
Specified magnesias (basis 100 percent MgO) and magnesium hydroxide, U. S. P. and technical:					
Extra-light and light magnesias	6	1,967	1,926	$808,240	-------
Heavy magnesia and magnesium hydroxide	4	1,874	1,620	416,775	(2)
Total	[3] 6	[4] 3,841	3,546	1,225,015	(2)
Precipitated magnesium carbonate	11	47,423	8,805	876,306	38,495
Magnesium chloride, 100-percent basis	3	32,137	(5)	(5)	(5)
Magnesium sulfate, 100-percent basis	2	(5)	(5)	(5)	-------
1947					
Specified magnesias (basis 100 percent MgO) and magnesium hydroxide, U. S. P. and technical:					
Extra-light and light magnesias	5	1,464	1,450	721,653	-------
Heavy magnesia and magnesium hydroxide	4	7,163	6,953	673,183	(2)
Total	[3] 5	[4] 8,627	8,403	1,394,836	(2)
Precipitated magnesium carbonate	12	58,142	10,239	1,047,953	47,645
Magnesium chloride, 100-percent basis	3	(5)	(5)	(5)	(5)
Magnesium sulfate, 100-percent basis	1	(5)	(5)	(5)	-------

1 Sales by a producer to an affiliated consumer for immediate use are not included under "Sold" but are under "Used."
2 Magnesia and magnesium hydroxide used by producing firms in making other magnesias are not shown.
3 A plant producing more than 1 grade or product is counted but once in arriving at total.
4 Exclusive of magnesia made from magnesium hydroxide, to avoid duplication.
5 Bureau of Mines not at liberty to publish figure.

REVIEW BY STATES

The following review outlines activities of firms producing magnesium compounds (except dolomite).

California.—Johns-Manville Products Corp., 22 East Fortieth Street, New York 16, N. Y., produced magnesium carbonate from purchased magnesium oxide and hydroxide at Redwood City, Calif., for use in 85-percent magnesia insulation. Marine Magnesium Products Corp., South San Francisco, recovered precipitated magnesium carbonate and specialty magnesias, using lime, dolomite, and water from San Francisco Bay as raw materials. The Permanente Metals Corp., Oakland, Calif., operated its magnesia-from-sea-water plant at Moss Landing, making refractory and caustic-calcined magnesias. Plant Rubber & Asbestos Works, 537 Brannan Street, San Francisco, Calif., made 85-percent magnesia at its Emeryville and Redwood City plants. However, the manufacture of 85-percent magnesia was discontinued at the Redwood City plant in the early part of 1947. The Emeryville plant has been operated as a division of the Paraffine Co., Inc., Emeryville 8, Calif., since June 30, 1947, Plant Rubber & Asbestos Works having been a wholly owned subsidiary that has been merged with the parent firm. Westvaco Chlorine Products Corp., Newark, Calif., recovered magnesite from its Western mine near Livermore and produced refractory and caustic grades of magnesia at Newark from sea-water bitterns, lime, and dolomite. The firm also recovered magnesium chloride from sea-water bitterns at Chula Vista.

Illinois.—Johns-Manville Corp., 22 East Fortieth Street, New York 16, N. Y., produced precipitated magnesium carbonate by the Pattinson process at its Waukegan, Ill., plant for use in 85-percent magnesia insulation.

Michigan.—The Dow Chemical Co., Midland, Mich., continued its production of magnesium chloride and sulfate from well brines, dolomite, and lime. Michigan Chemical Corp., St. Louis, Mich., produced magnesium carbonate and hydroxide and magnesia from dolomite and well brines. At its Manistee plant Morton Salt Co., 310 South Michigan Avenue, Chicago 4, Ill., produced precipitated magnesium carbonate from lime and well brines. Standard Lime & Stone Co. produced refractory magnesia at its Manistee plant from well brines and lime.

Nevada.—Basic Refractories, Inc., mined brucite at Gabbs, Nev., and shipped it to Narlo, Ohio, for calcining and manufacture into basic open-hearth refractories. Sierra Magnesite Co., Newark, Calif., an affiliate of Westvaco Chlorine Products Corp., and Henry J. Kaiser and associates continued to mine magnesite at Gabbs, all for caustic-calcined uses.

New Jersey.—At its Manville, N. J., plant, 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. Northwest Magnesite Co., 1800 Farmers Bank Building, Pittsburgh 22, Pa., recovered refractory magnesia from raw sea water at its Cape May, N. J., plant.

Pennsylvania.—Both the Philip Carey Manufacturing Co., 1935 Easton Boulevard, Lockland, Cincinnati 15, Ohio, plant at Plymouth Meeting, Pa., and Keasbey & Mattison Co., Butler Avenue and Maple Street, Ambler, Pa., produced precipitated magnesium carbonate and magnesium oxide. Ehret Magnesia Manufacturing Co., Valley Forge, Pa., produced precipitated magnesium carbonate. All three firms, used the Pattinson process in making magnesium carbonate for 85-percent magnesia insulation and other purposes.

Texas.—Dow Chemical Corp., Freeport, recovered magnesium chloride and oxide from sea water, the former for reduction to metal and the latter for fertilizer. Texas Industrial Minerals Co., Llano, organized late in 1947, mined magnesite.

Washington.—Northwest Magnesite Co., 1800 Farmers Bank Building, Pittsburgh 22, Pa., was the sole producer of refractory magnesite in Washington in 1947. This operation, the largest magnesite producer in the country, was described in a recent article.[3]

West Virginia.—The Standard Lime & Stone Co., continued its recovery of refractory magnesia by leaching calcined dolomite at its Millville, W. Va., plant, and produced magnesium carbonate from dolomite by the Pattinson process.

CONSUMPTION

At the National Open Hearth Conference of the American Institute of Mining and Metallurgical Engineers the status of basic refractories

[3] Huttl, John B., Unusual in Mine and Plant: Eng. and Min. Jour., vol. 149, No. 1, January 1948, pp. 56–59.

was the subject of a symposium.[4] A canvass of furnace operators conducted by the institute indicated that the total number of furnace bottoms installed with prepared ramming materials will be increased greatly, but the desirability of operating directly on a rammed bottom is questioned. Apparently, most operators now prefer to burn in a surface layer if for no other reason than as a safety measure. The variety of magnesia refractories preferred for furnace construction and maintenance was also discussed. The accompanying table showing the types of refractories preferred by operators for specified purposes has been compiled from data presented at this conference.

Refractories preferred for working hearths, bottom maintenance, bank maintenance, and tap-hole maintenance [1]

[Percentage of all furnaces]

	Working hearths		Bottom maintenance		Bank maintenance		Tap-hole maintenance
	1945	1947	Routine	Deep holes	Below slag line	Above slag line	
Magnesite (source unspecified)			4	24	6		
Regular Washington magnesite	63	34.8					
Sized Washington magnesite	14	32.4					
Michigan brine magnesite		9.3					
Sea-water magnesite		2.4					
Magnesite and dolomite				12	4		7
Dolomite-magnesia material	7	4.4		32			14
Magnesite and chrome ore							20
Magnesite and cement							7
Raw dolomite			17		5	30	
Clinkered dolomite		4.4	67	6	72	35	
Single burned dolomite			12		8	30	
Ramming material	16	12.3		7			43
Ramming material and magnesite				7			
Unspecified				12	5	5	9
Total	100	100.0	100	100	100	100	100

[1] Topping, John, and Robinson, A. W., Trends in Bottom Construction: Amer. Inst. Min. and Met. Eng. Proc., Open-Hearth Conference, 1947, pp. 214–217.

PRICES

According to E&MJ Metal and Mineral Markets, the price of maintenance-grade dead-burned magnesite rose from $22 per ton to $24 during the latter part of 1947. The Westvaco Chlorine Products Corp. quoted prices of its magnesias (carlots, f. o. b. California) as follows: 1946 prices for bulk and powdered caustic-calcined magnesite ($61.50 and $67.50 respectively) prevailed until December 1, 1947, when they were advanced to $64 and $70. Calcined (sea-water) magnesia, bulk—$54, powdered—$60 remained at the same levels as in 1946. Sea-water periclase, bulk, 90 percent, advanced from $40 to $43 on July 1, 1947, and on October 1 to $45.50 per short ton.

According to the Oil, Paint and Drug Reporter, magnesium hydroxide, medicinal grade, was quoted at 29 to 30 cents per pound in 1947, as in 1946; magnesium carbonate, technical grade, bags, carlots, Northern Atlantic States at 7¼ cents per pound, as in 1946; mag-

[4] American Institute of Mining and Metallurgical Engineers, Proceedings of the Thirtieth Conference, National Open-Hearth Committee, Iron and Steel Division: April 1947, pp. 202–221.

nesium carbonate, U. S. P. grade, increased from 8 to 9 cents per pound; magnesium chloride, flake, barrels, carlots, works, at $37 per ton, as in 1946. Epsom salts, technical, crystals, bags, carlots, increased from $2.05 to $2.30 per 100 pounds.

FOREIGN TRADE

Before the war substantial quantities of magnesium compounds—particularly magnesite from Austria and Manchuria—were imported into the United States. Difficulties in foreign countries and rapid development of the industry in this country in recent years have discouraged this trade; and, as shown in the accompanying tables, receipts in 1947 were very small.

Magnesite imported for consumption in the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
CRUDE MAGNESITE						
Malta, Gozo, and Cyprus			[1]	$6		
Mexico			1	50		
			1	56		
LUMP CAUSTIC-CALCINED MAGNESITE						
Canada	[1]	$9			[1]	$10
Greece					1	52
India	443	11,820	429	$11,318	498	19,479
Netherlands					15	1,198
	443	11,829	429	11,318	514	20,739
GROUND CAUSTIC-CALCINED MAGNESITE						
Netherlands			5	$475	2	$175
United Kingdom	2	$305	7	1,192	10	1,542
	2	305	12	,667	12	1,717
DEAD-BURNED AND GRAIN MAGNESITE AND PERICLASE						
Australia	33	$1,024				
Canada	746	72,788	1,873	$182,574	1,745	$170,216
U. S. S. R.	4,727	160,707				
United Kingdom					2	216
	5,506	234,519	1,873	182,574	1,747	170,432

[1] Less than 1 ton.

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Magnesium compounds imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Oxide or calcined magnesia		Magnesium carbonate, precipitated		Magnesium chloride (anhydrous and n. s. p. f.)		Magnesium sulfate (epsom salts)		Magnesium salts and compounds, n. s. p. f.[1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1943	(2)	$1	122	$17,730					21	$16,645
1944	30	9,485	151	26,703			22	$1,812	22	12,799
1945			66	15,836	2	$222	(3)	2	23	18,938
1946	50	16,205	145	23,428	38	1,539	(3)	2	11	8,991
1947	(4)	20	136	34,799	3	348	(5)	5	6	4,335

[1] Magnesium silicofluoride or fluosilicate and calcined magnesium sulfate included with "Magnesium salts and compounds, n. s. p. f."
[2] 50 pounds.
[3] 20 pounds.
[4] 198 pounds.
[5] 138 pounds.

WORLD REVIEW

World magnesite production statistics, so meager that they were not tabulated in issues of this chapter since that reviewing 1939, are now sufficiently representative to present in the accompanying table.

Austria.—Discovery of a deposit of magnesite at Fieberbrunn, Austria, has been reported.[5]

Germany.—Reports of Allied technical teams indicate that in Germany basic roofs for open-hearth steel furnaces have been successful. In the Mannesmann Werke, 8 or 9 suspended basic roofs were tried in two 75-ton furnaces, and roof life commonly was from 600 to 800 heats. One roof, however, built with magnesia brick containing 25 percent chromic oxide (from Turkish chromite) gave 2,923 heats and produced 220,000 tons of steel. In laying up the basic roofs, pieces of sheet steel were placed between the brick. This performance compares with 250 to 350 heats for silica-brick roofs. The investigators considered the furnace conditions to be less severe than those in this country.[6]

India.—Magnesite occurs in Mysore, Rajputana, Kashmir, Baluchistan, and Bihar, but the best deposits are said to be in the Salem district of Madras. The Salem deposits occur over an area of 300 acres and reserves have been estimated as sufficient to last 200 years on the basis of present-day requirements.[7]

Poland.—In 1947, about 1,112 tons of caustic-calcined magnesite, and 3,802 metric tons of raw magnesite were produced from mines at Sobotka, near Wroclaw.

[5] The Chemical Age, vol. 62, No. 1467, Aug. 23, 1947, p. 227.
[6] Brick and Clay Record, vol. 110, No. 1, January 1947, pp. 66, 68.
[7] Bureau of Mines, Mineral Trade Notes, vol. 25, No. 2, August 1947, p. 31.

World production of magnesite, 1937–47, by countries in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
Argentina	-----	-----	50	-----	-----	-----	-----	-----	-----	(2)	(2)
Australia:											
New South Wales	19,807	19,465	25,593	23,243	26,778	34,587	65,097	31,746	22,701	(2)	(2)
Queensland	-----	-----	-----	-----	373	(2)	-----	-----	(2)	-----	(2)
South Australia	71	231	382	1,660	804	876	804	467	752	657	1,003
Victoria	143	122	119	112	86	12	-----	-----	-----	(2)	(2)
Western Australia	-----	10	-----	261	102	25	-----	-----	-----	11	74
Austria	397,838	375,400	449,700	448,800	465,800	486,000	494,400	480,500	93,200	97,300	222,700
Canada [3]	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
China: Manchuria (exports)	331,000	171,708	247,784	[5] 223,262	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Cyprus (exports)	-----	-----	-----	-----	-----	-----	2	144	288	3	30
Czechoslovakia [6]	92,143	74,707	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Germany: Prussia	21,091	23,860	24,065	23,576	28,716	25,407	39,937	[7] [8] 20,000	(2)	-----	(2)
Greece	161,676	168,243	126,786	10,360	4,650	2,890	680	950	1,650	4,500	13,700
India	26,586	26,022	34,107	43,992	41,363	48,547	49,858	42,609	5,573	45,394	(2)
Italy	5,392	6,157	14,977	5,055	4,587	13,686	[8] 2,876	(2)	(2)	(2)	(2)
Kenya	(2)	(2)	(2)	-----	-----	-----	-----	45	14	61	41
Korea	36,720	31,937	65,226	73,540	67,414	107,354	108,469	157,745	22,581	(2)	(2)
New Zealand	-----	-----	-----	-----	-----	-----	174	105	113	380	368
Norway	2,096	2,098	2,767	1,512	1,838	2,466	2,057	1,554	1,744	1,174	(2)
Poland	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	3,802
Southern Rhodesia	-----	-----	-----	507	2,266	2,790	5,428	5,125	4,278	3,824	5,321
Spain	-----	-----	-----	-----	200	2,063	3,626	5,269	7,626	10,761	5,394
Turkey	1,365	864	493	845	1,900	115	137	205	441	100	860
Union of South Africa	1,752	2,615	3,824	7,951	14,289	16,685	12,694	5,433	7,079	7,003	8,415
U. S. S. R. (estimate)	550,000	600,000	650,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United States	184,554	87,996	180,511	302,242	340,010	451,202	684,768	509,336	305,228	294,507	341,093
Venezuela	-----	-----	-----	-----	-----	-----	589	[7] 700	5,600	2,750	2,980
Yugoslavia	41,966	40,779	32,887	42,552	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Total (estimate)	2,000,000	1,700,000	2,000,000	2,000,000	2,000,000	2,300,000	2,400,000	2,000,000	1,200,000	1,500,000	1,800,000

[1] Unless otherwise stated quantities in this table represent crude magnesite mined. In addition to countries listed negligible quantities of magnesite are also produced in Anglo-Egyptian Sudan, Brazil, Cuba, and Egypt.
[2] Data not available; estimate by senior author of chapter included in total.
[3] Magnesitic dolomite and brucite.
[4] Data for production not available; estimate by author of chapter included in total. Value reported as follows: 1937: C$677,207; 1938: C$420,261; 1939: C$474,418; 1940: C$897,016; 1941: C$831,041; 1942: C$1,059,374; 1943: C$1,260,056; 1944: C$1,139,281; 1945: C$1,278,596; 1946: C$1,225,593; 1947: C$1,201,457.
[5] January to September, inclusive.
[6] Exports less imports of crude and sintered magnesite, the sintered calculated as crude on the basis 1 ton of sinter to 2.1 tons of crude magnesite.
[7] Estimate.
[8] January to June, inclusive.

MISCELLANEOUS SALINES

CALCIUM CHLORIDE

Since 1943, sales of natural calcium (and calcium-magnesium) chloride have been increasing steadily, and a new record was established in 1947.

Exact statistics on the pattern of use of calcium chloride are not available. However, as calcium chloride is very hygroscopic, the principal use is in stabilizing soil road surfaces and suppressing dust. The coal industry is probably the second-largest consumer. Large tonnages of calcium chloride are used in dustproofing coal, and in heavy-media solutions used in coal washing. Experimental work is progressing in the use of the calcium chloride in conjunction with a wetting agent to control dust in coal mines. A surprisingly large tonnage of calcium chloride is used as an antifreeze in the weighting solutions with which tractor tires are filled. Another substantial market is in ice control—the calcium chloride being mixed with the sand or other abrasive material to prevent freezing in the stock pile, and to assist in the embedding of the abrasive grain into an icy surface. Refrigeration brines also consume a considerable quantity. Addition of calcium chloride to concrete (2 per cent) does not prevent freezing but it does assist in curing. Other uses include air drying, and a variety of freezeproofing applications—for example, 5 pounds of calcium chloride per gallon added to the water in a fire barrel is said to give protection down to 60° F. below zero and also reduce evaporation losses.

Calcium chloride and calcium-magnesium chloride from natural brines sold by producers in the United States, 1943–47

[In terms of 75 percent (Ca, Mg) Cl_2]

Year	Short tons	Value	Year	Short tons	Value
1943	199,796	$1,549,565	1946	262,147	$2,278,954
1944	200,964	1,621,227	1947	271,206	2,650,205
1945	218,320	1,818,219			

Calcium chloride imported for consumption in and exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Imports		Exports	
	Short tons	Value	Short tons	Value
1943	8,000	$102,080	12,725	$434,933
1944	2,761	35,125	8,535	234,329
1945	4,040	51,409	6,871	188,141
1946	1,313	14,587	10,073	367,993
1947	250	5,514	11,955	502,818

The following firms produced calcium chloride (and calcium-magnesium chloride) from natural brines in 1947: California Rock Salt Co., 2436 Hunter Street, Los Angeles 21, Calif., plant at Amboy, Calif.; Dow Chemical Co., Midland, Mich.; Hill Brothers Chemical Co., 2159 Bay Street, Los Angeles 21, Calif., plant at Amboy, Calif.; Michigan Chemical Corp., St. Louis, Mich.; National Chloride Co., Amboy, Calif.; Rademaker Chemical Corp., Eastlake, Mich.; Desert Properties Co., Frank Thomas, receiver, 374 Court Street, San Bernardino, Calif., plant at Amboy, Calif.; and Westvaco Chlorine Products Corp., South Charleston, W. Va.

BROMINE

The major use of bromine is in making ethylene dibromide, which is mixed with tetraethyl lead to form "ethyl" gasoline antiknock compound. Minor quantities of bromine are used in photographic emulsions and laboratory reagents. After hostilities ceased there was a sharp drop in sales of bromine owing to reduction in military requirements. In 1947, however, the civilian demand for gasoline reached unprecedented levels; consequently, bromine sales increased 83 percent over 1946 to 78,177,650 pounds. An automotive development that may strongly affect the demand for bromine is the trend toward higher-compression engines which require higher-octane gasolines than are now commonly used in passenger cars.

A paper on solution of the sulfur dioxide control problem in sea-water bromine plants was presented before the second national conference of the Instrument Society of America, Chicago, Ill., September 8–12, 1947.[8]

Bromine and bromine in compounds sold or used by producers in the United States, 1943–47

Year	Pounds	Value	Year	Pounds	Value
1943	94,085,937	$19,107,065	1946	[1] 42,780,925	$8,560,434
1944	102,112,462	19,712,819	1947	78,177,650	14,837,104
1945	79,709,857	14,796,229			

[1] Revised figure.

Bromine and bromides sold by primary producers in the United States, 1946–47

	1946			1947		
	Pounds		Value	Pounds		Value
	Gross weight	Bromine content [1 2]		Gross weight	Bromine content [1]	
Elemental bromine	2,657,355	2,657,355	$423,353	2,316,192	2,316,192	$358,374
Sodium bromide	1,796,557	1,395,027	339,579	1,225,213	951,377	235,091
Potassium bromide	2,596,680	1,743,671	512,056	3,015,145	2,024,670	608,577
Ammonium bromide	541,926	442,103	119,443	509,163	415,375	118,047
Other bromides, including ethylene dibromide	43,353,081	36,542,769	7,166,003	85,597,321	72,470,036	13,517,015
	50,945,599	42,780,925	8,560,434	92,663,034	78,177,650	14,837,104

[1] Calculated as theoretical bromine content present in compound.
[2] Revised figures.

[8] Chemical Engineering, vol. 54, No. 10, October 1947, p. 102.

Ethyl-Dow Chemical Co., Freeport, Tex., pioneer producer of bromine from sea water, was again the largest producer. The 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., producer of bromine from Searles Lake, has announced plans to market potassium bromide, a medicinal drug.[9] Westvaco Chlorine Products Corp., Newark, Calif., recovered bromine from seawater bitterns. The following produced 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.

Imports of bromine and bromine compounds are reported to have totaled 131 pounds, and exports of bromine, bromides, and bromates totaled 896 short tons valued at $586,845.

According to Oil, Paint and Drug Reporter, potassium and sodium bromides, U. S. P., granular, 500-pound barrels, works, were quoted at 33–34 cents a pound at the end of 1947. In 1946 the price quoted was 25 cents a pound.

IODINE

The United States obtains its supply of iodine in part from domestic sources and in part from Chile. Domestic production statistics may not be published, as there were only two producers in 1947. The most recent year for which figures may be published is 1937; in that year output totaled 299,286 pounds—substantially lower than the rates attained more recently. The two active operators—Dow Chemical Co., Midland, Mich. (plant at Seal Beach, Calif.), and Deepwater Chemical Co. Ltd., Victoria Avenue, Compton, Calif.—recovered iodine from oil-well brines.

Although substantial quantities of iodine are obtained from domestic sources, our principal supply comes from Chile. Iodine from Chile is imported by the Chilean Nitrate Sales Corp. As large stocks are held in the United States, import statistics do not reflect from year to year the variations in consumption. Imports in 1947 were at near record levels—over 10 times as great as in 1945.

Imports of iodine are shown in an accompanying table. Exports of iodine, iodates and iodides totaled 179 short tons valued at $718,278.

Crude iodine imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Pounds	Value	Year	Pounds	Value
1943	2,744,930	$3,041,609	1946	886,578	$976,190
1944	1,204,303	1,321,274	1947	2,260,506	2,756,888
1945	220,526	232,070			

According to the Oil, Paint and Drug Reporter, prices of iodine, crude, 150-pound kegs, ex-warehouse Staten Island, increased from

[9] Pit & Quarry, vol. 40, No. 3, September 1947, p. 83.

\$1.425 per pound in January 1947 to \$1.729 in December. Resublimed iodine, 5-pound bottles or jars, increased from \$2.10 per pound in January to \$2.35–\$2.65 in December.

SODIUM COMPOUNDS

Sodium Carbonate.—During 1947 the demand for sodium carbonate was extremely great and production capacity of both "natural" and "manufactured" soda ash was increased. Output of natural sodium carbonate reached a record total of 293,051 tons—36 percent more than in 1946.

Natural soda ash was produced in California by the following companies in 1947: American Potash & Chemical Corp., Trona, Calif.; Natural Soda Products Co., 506 Central Tower Building, San Francisco 3, Calif., plant at Keeler; Permanente Metals Corp., Kaiser Building, Oakland, Calif., plant at Lone Pine; Pittsburgh Plate Glass Co., Columbia Chemical Division, Bartlett, Calif.; and West End Chemical Co., 608 Latham Square Building, Oakland 12, Calif., plant at Westend.

Early in 1947 the American Potash & Chemical Corp., contracted for construction of a \$3,800,000 plant which will increase its output of soda ash approximately 70 percent.[10] Permanente Metals Corp. began producing at their recently completed soda plant at Owens Lake, Calif., in February 1947. Development of the deposit of trona by the Westvaco Chlorine Products Corp., at Green River, Wyo., was somewhat delayed. However, it was expected that production would begin early in 1948.

A report describing supply and demand for soda ash and other sodium compounds in Oregon and southern Washington was published in 1947.[11]

Natural sodium sulfates and sodium carbonates sold or used by producers in the United States, 1943–47

Year	Sodium sulfates [1]		Sodium carbonates [2]	
	Short tons	Value	Short tons	Value
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
1946	198,781	1,695,413	215,625	3,427,086
1947	257,294	3,329,094	293,051	5,862,178

[1] Tonnage figures for sulfates include Glauber's salt converted to 100 percent Na_2SO_4 basis.
[2] Soda ash and trona.

The large tonnage of natural sodium carbonate produced in the United States is an important factor in the supply, but the bulk comes from plants processing sodium chloride by the ammonia-soda process. Production statistics of sodium carbonate by the ammonia-soda proc-

[10] Ceramic Industry, vol. 48, No. 6, June 1947, p. 36.
[11] Ladoo, Raymond B., Sources of Soda Ash and Other Sodium Compounds for Columbia River Basin Industry: Raw Materials Survey (Portland, Oreg.), Rept. 2, September 1947, 28 pp.

ess for the last 5 years, according to the Bureau of the Census, are: 1943, 4,407,600 short tons; 1944, 4,538,398; 1945, 4,375,017; 1946, 4,284,231; and 1947, 4,519,144 tons.

The consumption pattern of sodium carbonate, as estimated by Chemical Engineering, is shown in the accompanying table.

The price of soda ash, light, calcined, bags, carlots, works, was quoted at $1.20 to $1.30 a hundredweight in 1947, according to Oil, Paint and Drug Reporter. The 1946 price was $1.20.

Estimated consumption of sodium carbonate in the United States, 1943–47, by industries, in short tons

[Chemical Engineering]

Industry	1943	1944	1945	1946	1947
Glass	1,200,000	1,290,000	1,320,000	1,400,000	1,440,000
Soap	150,000	162,000	150,000	120,000	135,000
Caustic and bicarbonate	1,010,000	1,033,000	1,114,000	1,128,000	1,130,000
Other chemicals	950,000	1,025,000	960,000	910,000	1,030,000
Cleansers and modified sodas	85,000	100,000	110,000	125,000	130,000
Pulp and paper	155,000	170,000	175,000	190,000	220,000
Water softeners	95,000	110,000	100,000	90,000	100,000
Petroleum refining	20,000	22,000	24,000	20,000	22,000
Textiles	58,000	61,000	68,000	77,000	71,000
Nonferrous metallurgy	450,000	320,000	200,000	140,000	190,000
Exports	370,000	79,000	70,000	67,000	92,000
Miscellaneous		320,000	290,000	223,000	240,000
	4,543,000	4,692,000	4,581,000	4,490,000	4,800,000

Sodium Sulfate.—Sales of natural sodium sulfate also established a new record in 1947, the total being 257,294 short tons, a 29-percent increase over 1946. This salt is used principally in the manufacture of kraft paper and glass, in stock feeds, as a flux in metallurgy, and in soapless detergents.

It has been reported that kraft pulps and paper took nearly four-fifths of the total salt cake consumed in 1946, whereas in the late twenties this market consumed less than one-third of the total. It was estimated that production increase of at least 200,000 tons per year will be necessary by the end of 1948 to satisfy the needs of the anticipated expansion in output of kraft pulp and detergents.[12]

The following firms reported production of natural sodium sulfates in 1947: American Potash & Chemical Corp., Trona, Calif.; Arizona Chemical Co., 30 Rockefeller Plaza, New York 20, N. Y., plant at Brownfield, Tex.; Dale Chemical Industries, Inc., 4031 Goodwin Avenue, Los Angeles 26, Calif., plant at Dale Lake, Calif.; Iowa Soda Products Co., Council Bluffs, Iowa, plant at Rawlins, Wyo.; Ozark-Mahoning Co., P. O. Box 449, Tulsa 1, Okla., plant at Monahans, Tex.; and Wm. E. Pratt, P. O. Box 738, Casper, Wyo.

[12] Chemical Industries, vol. 60, No. 6, June 1947, p. 967.

Production of sodium sulfate in the United States, 1941–47, in short tons

[U. S. Bureau of the Census]

Year	Glauber's salt (100 percent $Na_2SO_4 \cdot 10H_2O$)[1]	Salt cake (crude)[1]	Anhydrous refined (100 percent Na_2SO_4)	Total
1941	164,067	531,488	56,922	752,477
1942	199,962	570,869	71,784	842,615
1943	212,067	564,941	76,608	853,616
1944	231,200	564,889	69,997	866,086
1945	200,782	543,371	91,340	835,493
1946	167,153	527,746	122,573	817,472
1947	197,963	627,331	135,088	960,382

[1] Includes natural sodium sulfate as shown in table in sodium carbonate section of this chapter.

Domestic salt cake prices increased during 1947 from $15 to $20–$26 a short ton, bulk, works; anhydrous sodium sulfate from $1.70 to $2.10 per hundredweight, works; and Glauber's salt from $1.05–$1.45 to $1.25–$1.75 per hundredweight in 1947, according to Oil, Paint and Drug Reporter. Natural salt cake generally sells at prices somewhat lower than list quotations.

Sodium sulfate imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Crude (salt cake)		Crystallized (Glauber's salt)		Anhydrous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1943	32,790	$466,272			7	$477	32,797	$466,749
1944	31,305	466,935					31,305	466,935
1945	20,293	289,940					20,293	289,940
1946	22,446	352,407					22,446	352,407
1947	49,157	583,377	91	$1,760			49,248	585,137

Sodium Metal.—As sodium metal is produced by only two firms in the United States, statistics of output cannot be published. The Ethyl Dow Corp., 405 Lexington Avenue, New York, N. Y., produces sodium at Baton Rouge, La., for use in the manufacture of tetraethyl lead, the gasoline antiknock compound. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., produces sodium at Niagara Falls, N. Y., and sells it for a wide variety of uses, such as in the manufacture of sodium cyanide, sodium peroxide, drugs, pharmaceuticals, and metal refining.

The price of sodium metal in 1947 was 15 cents a pound in drums, carlots, works, the same as in 1946.

BORATES

Production of boron minerals again established a new record in 1947, exceeding the previous high set in 1946 by 12 percent (B_2O_3 basis).

Salient statistics of the boron-mineral industry in the United States, 1943–47

	1943	1944	1945	1946	1947
Sold or used by producers: [1]					
Short tons:					
Gross weight	256, 633	277, 586	325, 935	430, 689	501, 935
B_2O_3 content	87, 600	91, 700	104, 600	129, 800	145, 700
Value	$6, 401, 507	$6, 579, 587	$7, 635, 365	$9, 575, 866	$11, 844, 108
Imports for consumption (refined): [2]					
Pounds			1, 344	100, 567	2, 000
Value			$491	$4, 077	$747
Exports:					
Short tons	27, 118	32, 759	43, 475	53, 303	85, 736
Value	$1, 350, 834	$1, 601, 014	$2, 059, 510	$2, 644, 760	$4, 651, 642
Apparent consumption: [3]					
Short tons	229, 515	244, 827	[4] 282, 461	377, 436	416, 200

[1] 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.
[4] Revised figure.

In 1947 the following firms reported production of boron minerals: American Potash & Chemical Corp., Trona, Calif., on Searles Lake; Pacific Coast Borax Co., 510 West Sixth Street, Los Angeles 14, Calif., mine at Boron; Pittsburgh Plate Glass Co., Columbia Chemical Division, Bartlett, Calif.; United States Borax Co., 510 West Sixth Street, Los Angeles 14, Calif., mine near Shoshone; and West End Chemical Co., 608 Latham Square Building, Oakland 12, Calif., plant at Westend, on Searles Lake.

American boron compounds are in wide demand throughout the world. In 1947 about 17 percent of the output was exported.

The price of technical borax, 99½ percent, granular, bulk, carlots, freight allowed, was $44.50–$47.50 a short ton in 1947, the same as in 1946.

Manganese

By NORWOOD B. MELCHER

GENERAL SUMMARY

MANGANESE ore was generally available in adequate quantities during 1947. Considerable hesitancy on the part of buyers in signing new purchase contracts for manganese ore caused sellers of foreign ore to reduce prices substantially during the course of the year. Quoted prices for standard (48-percent Mn) ore, which approximated 70 cents per unit, eastern ports, at the beginning of the year, were quoted as low as 65 cents in the closing months. Nevertheless, industry stocks, which were low at the beginning of the year, increased only slightly and actually decreased about 20 percent relative to consumption.

The import duty on manganese ore continued at ½ cent per pound of contained manganese during 1947 (a rate that had been in effect since January 1, 1936, under the Brazilian Trade Agreement) but was reduced in October 1947 to ¼ cent per pound effective January 1, 1948, as a result of the Geneva conference of the International Trade Organization. Stocks of ore in bonded warehouses at the end of 1947 totaled 455,425 short tons, an increase of 28 percent over the previous year. Thus, approximately 100,000 tons of manganese ore received in 1947 were to be withdrawn for consumption at the lower duty.

Salient statistics of the manganese industry in the United States, 1943–47, gross weight in short tons

	1943	1944	1945	1946	1947
Manganese ore (35 percent or more Mn):					
Mine shipments:					
Metallurgical ore	195,096	241,170	174,295	134,381	125,428
Battery ore	9,973	6,224	8,042	[1] 8,295	6,189
Miscellaneous ore	104	222		[1] 959	10
Total mine shipments	205,173	247,616	182,337	143,635	131,627
General imports	1,429,599	1,157,932	1,461,945	1,749,223	1,541,818
Consumption	1,588,323	1,593,098	1,485,859	1,136,687	1,418,261
Ferromanganese:					
Domestic production	702,484	702,632	619,760	491,973	614,626
Imports for consumption	2,302	4,199	35,521	32,130	81,307
Exports	12,510	600	836	2,951	20,168
Consumption	736,288	730,491	641,622	501,260	732,619
Spiegeleisen:					
Domestic production	149,036	165,530	139,039	111,696	134,329
Imports for consumption	3,254	3,761	3,146	360	
Exports	314	202	2,393	7,513	305
Consumption	176,421	160,497	148,087	112,700	120,019

[1] A small quantity of miscellaneous ore is included with battery ore.

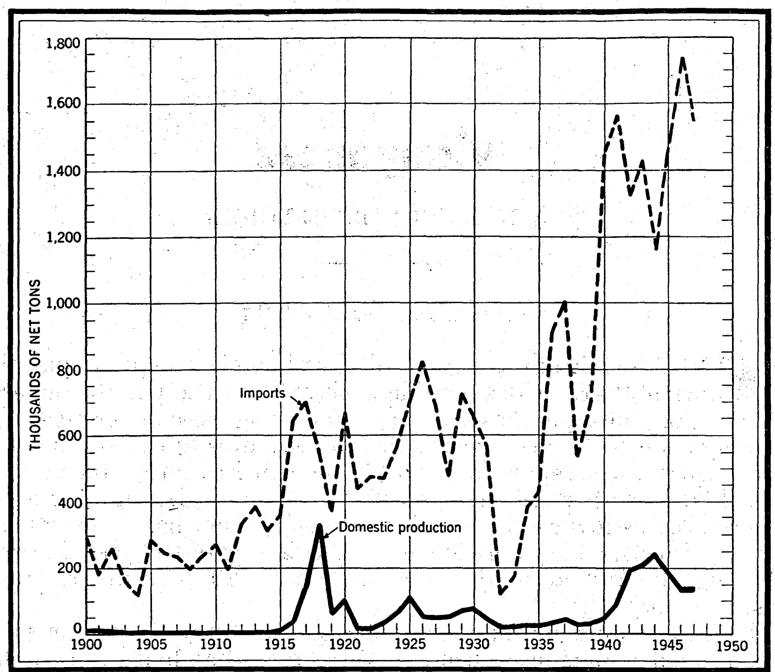

FIGURE 1.—Imports and domestic production (mine shipments) of manganese ore, 1900–47. Statistics on imports shown in the graph represent general imports for 1900–33, imports for consumption adjusted for changes in bonded warehouse stocks for 1934–39, and general imports for 1940–47.

Imports of manganese ore in 1947 decreased 12 percent from 1946 and totaled 1,541,818 short tons. Notable among countries that decreased shipments to the United States were Chile, Cuba, Gold Coast, and Union of South Africa. Chile shipped nearly 150,000 tons of ore in 1946, mainly from stock piles built up during the war, when shipping was not available; stocks were largely depleted in 1947, and much of the shipments was from current production. Cuba shipped in 1947 only about one-third the 1946 quantity because reserves had been largely exhausted. Most Gold Coast 1947 shipments went to supply increased requirements of the United Kingdom, and shipments to the United States were only about half of the 1946 total. Shortages of shipping equipment in the Union of South Africa resulted in 12 percent less ore being shipped to the United States in 1947 than in 1946. These deficiencies resulted in an increased reliance on ore from the Soviet Union and India during 1947. Improvements in rail facilities in India permitted a 13-percent increase in shipments to the United States, and offers for the sale of manganese ore from the U. S. S. R. resulted in a 37-percent increase in receipts of Russian material. The Soviet Union supplied 21 percent of United States receipts in 1947.

Production of manganese ore in 1947 in the United States and in Montana were virtually the same, as the State shipped nearly 99 percent of the total ore containing 35 percent or over of manganese. Small shipments came from Arizona, Arkansas, Nevada, New Mexico, and Tennessee in 1947. Ferruginous manganese ore (containing 10 to 35 percent Mn) was shipped from Arizona, Arkansas, Colorado, Montana, Nevada, New Mexico, Utah, and Virginia; and manganiferous iron ore was shipped from Minnesota during the year. The result of a 6-year program by the Bureau of Mines on the treatment of western manganese ores was made public during 1947;[1] nearly 300 samples of low-grade manganese ore from 12 Western States were examined during the period, of which approximately one-third proved to be amenable to concentrating to a high-grade manganese ore.

RESERVES

The following information on reserves of manganese in the United States was prepared by the Bureau of Mines and the Geological Survey and published in hearings before a subcommittee of the Committee on Public Lands, United States Senate, Eightieth Congress, first session, 1947, pages 260–262.

Manganese is widely distributed in nature. Mineralogical occurrences have been reported in numerous places and in virtually every State. However, no deposits comparable in size and grade to those found in the principal producing countries of the world have been discovered in the United States. Several small deposits of higher-grade material that could be used directly or converted to usable grade by simple concentration methods have been found; but as previously stated, most of them have been exhausted. The United States does possess several large deposits of low-grade material which in the aggregate contain very large quantities of manganese that could be recovered under improved technology, higher prices, or both. * * *

[The accompanying table] gives estimates of the reserves and probable rate of production of manganese in the United States under various economic and technologic assumptions. It is estimated that there are, in the United States, about 10,000,000 long tons of material of such nature, grade, and availability that it can be treated under the special arrangements and prices established by the Metals Reserve Company during the war. These included a base price of $1 per long-ton unit for ore containing 48 percent or more of manganese. Approximately 2,000,000 long tons of metallic manganese could be recovered from this reserve. Most of the ore is in four districts—Butte and Philipsburg, Mont; Three Kids, Nev; and Batesville, Ark. Other deposits are in the Cartersville district of Georgia, and in Virginia, California, New Mexico, Tennessee, Utah, Arizona, and Washington. The present outlook for technologic improvement indicates that this reserve might become available at 75 cents a unit or less within a decade. Were the price of manganese to drop from $1 a unit to the long-term average of less than 50 cents, the reserves of available material probably would not exceed 500,000 tons of metallic manganese.

Estimated reserves and probable rate of production of manganese in the United States

Assumed conditions: General	Assumed conditions: Price per unit	Reserves (tons of metallic manganese)	Possible annual production rate (tons of ferrograde)
Average peacetime conditions with technology as in 1944.	$0.50 and less	500,000	Maximum of 25,000.
Wartime conditions similar to 1944	$1	2,000,000 [1]	200,000 to 250,000.
Conditions of dire need, price no object.	$2±	50,000,000 to 75,000,000	To fill requirements.

[1] Under normal peacetime conditions, with the improvements that have been made and further improvements that will be made in the next decade in the technology for treating low-grade manganese ores it is not unreasonable to expect that this reserve might become available at a price range of 50 to 75 cents per unit.

[1] Shack, C. H., and Poole, H. G., Beneficiation of Western Ores: Bureau of Mines Rept. of Investigations 4117, 1947, 38 pp.

In addition to the limited amount of manganese recoverable at $1 a unit or less, several hundred million tons of low-grade material is available, containing 1 to 10 percent manganese, from which manganese could be obtained by known processes at high costs. The manganese content in these resources equals 50,000,000 to 75,000,000 tons, which would be adequate to supply domestic needs for many decades if it could be made available economically. The deposits included in this group are found in the Cuyuna range, Minn; eastern Aroostook County, Maine; Artillery Peak district, Arizona; Chamberlain, S. Dak; and the Three Kids district, Nevada. The Cuyuna reserves, consisting of manganiferous iron ore, which is now used in the production of manganiferous pig iron and spiegeleisen, probably will continue to be used for this important purpose.

DOMESTIC PRODUCTION

The following table shows the various types of manganiferous materials shipped by domestic producers from 1943 to 1947.

Manganiferous raw materials shipped by producers in the United States, 1943–47, in short tons

Year	Metallurgical ore				Battery ore (35 percent or more Mn)	Miscellaneous ore	
	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		35 percent or more Mn	10 to 35 percent Mn
1943	195,096	468,862	1,251,275	270,328	[1] 12,704	104	------
1944	241,170	296,981	1,190,476	247,402	6,224	222	155
1945	174,295	114,327	1,408,527	224,331	8,042	------	------
1946	134,381	[2] 100,402	1,070,694	205,786	[3] 8,295	[3] 959	87
1947	125,428	128,562	1,044,961	227,547	6,189	10	832

[1] Includes 2,731 tons containing 27 percent Mn.
[2] Revised figure.
[3] A small quantity of miscellaneous ore is included with battery ore.

Shipments of various grades of manganese-bearing ores during the last 5 years are given by States in the following tables. In addition, battery and miscellaneous ores were produced intermittently in California, Georgia, Montana, South Carolina, Tennessee, and Virginia, and manganiferous zinc residuum was produced from New Jersey zinc ores.

Metallurgical manganese ore shipped from mines in the United States, 1943–47, by States, in short tons

State	1943	1944	1945	1946	1947
Ala	------	49	32	------	------
Ariz	5,779	8,519	1,093	------	133
Ark	5,319	7,109	6,663	1,101	841
Calif	20,604	21,540	1,668	------	------
Colo	707	------	------	------	------
Ga	2,467	1,135	1,056	------	------
Idaho	36	------	------	------	------
Mo	180	------	------	------	------
Mont	130,789	153,665	143,888	129,227	123,490
Nev	10,451	21,799	960	1,064	67
N. Mex	469	273	3,334	1,166	858
N. C	140	------	------	------	------
Okla	265	------	------	------	------
Oreg	143	------	------	------	------
S. C	312	1,400	41	78	------
S. Dak	12	------	------	------	------
Tenn	2,501	418	------	------	39
Utah	91	30	------	------	------
Va	7,040	20,034	8,566	321	------
Wash	7,731	5,199	6,994	1,424	------
Wyo	60	------	------	------	------
	195,096	241,170	174,295	134,381	125,428

Ferruginous manganese ore shipped from mines in the United States, 1943–47, by States, in short tons

State	1943	1944	1945	1946	1947	State	1943	1944	1945	1946	1947
Ariz.	498	320	56	-------	62	N. Mex.	72, 967	100, 683	85, 744	72, 299	97, 007
Ark.	8, 207	14, 755	14, 806	1, 964	2, 094	N. C.	115	-------	-------	-------	-------
Calif.	8, 492	4, 598	12	-------	-------	S. C.	155	171	-------	-------	-------
Colo.	-------	-------	47	-------	37	Tenn.	803	6, 779	1, 000	-------	-------
Ga.	5, 835	2, 232	-------	-------	-------	Utah	18	32, 141	5, 001	7, 903	7, 198
Mich.	100, 092	-------	-------	1, 952	-------	Va.	12, 208	4, 419	392	87	6, 208
Minn.	253, 779	122, 765	-------	-------	-------						
Mont.	2, 041	781	5, 057	3, 816	3, 671		471, 593	297, 136	114, 327	100, 489	129, 394
Nev.	6, 383	7, 492	2, 212	12, 468	13, 117						

Manganiferous iron ore shipped from mines in the United States, 1943–47, by States, in short tons

State	1943	1944	1945	1946	1947
Michigan	-----------	45, 689	1, 680	-----------	-----------
Minnesota	1, 251, 275	1, 144, 787	1, 406, 847	1, 070, 694	1, 044, 961
	1, 251, 275	1, 190, 476	1, 408, 527	1, 070, 694	1, 044, 961

MINING BY STATES

Arizona.—The Walter H. Denison Manganese Co. shipped manganese ore containing (dry) 47.0 percent Mn, 4.3 percent Fe, 5.6 percent SiO_2, and 0.09 percent P from the Long Valley mine in Coconino County during 1947. A small shipment of ferruginous manganese ore was also made from this property.

Arkansas.—Most of the manganese-bearing ores shipped from Arkansas during 1947 came from various mines in Independence County operated by the Walter H. Denison Manganese Co. The high-grade ore from these mines averaged (natural) 51 percent manganese. C. C. Sims shipped some high-grade ore from a mine in the same county to blast furnaces in the Birmingham, Ala., district.

Colorado.—A small shipment of ore containing (natural) 23.06 percent Mn was made from a mine in Alamosa County by the Manganese Ore Products Co. of Almont, Colo. This ore was shipped to blast furnaces at Geneva, Utah, for consumption.

Minnesota.—Manganiferous iron ore shipped from Minnesota in 1947 came from the Cuyuna range in Crow Wing County and from the Missabe Mountain mine on the Mesabi range, St. Louis County. The ore was relatively low grade, averaging 6 percent Mn in the natural state.

Montana.—Montana supplied all of the battery and 98 percent of the metallurgical manganese ore shipped from domestic mines in 1947. The battery ore was produced and shipped from the Moorlight Group of mines by the Taylor-Knapp Co. and the Trout Mining Division of American Machine & Metals, Inc., both in the Philipsburg district. All of the metallurgical ore consisted of nodules shipped by the Anaconda Copper Mining Co. from its plant at Anaconda, Mont. These nodules averaged (natural) 59.6 percent Mn; most was shipped to consumers in the Lower Lake region, and much was transported by rail to Upper Lake ports and transferred to Great Lakes ore boats for delivery to Lower Lake ports. Ore from the Anaconda operation was

Manganese and manganiferous ores shipped from mines in the United States in 1947, by States

	Metallurgical				Battery				Miscellaneous				Total			
	Shippers	Short tons		Value	Shippers	Short tons		Value	Shippers	Short tons		Value	Shippers	Short tons		Value
		Gross weight	Manganese content			Gross weight	Manganese content			Gross weight	Manganese content			Gross weight	Manganese content	
Manganese ore: [1]																
Arizona	1	133	49	(2)									1	133	49	(2)
Arkansas	2	841	410	(2)									2	841	410	(2)
Montana	1	123,490	73,618	(2)	2	6,189	2,611	(2)	1	10	4	(2)	[3] 3	129,689	76,233	$4,153,045
Nevada	1	67	28	(2)									1	67	28	(2)
New Mexico	1	858	377	(2)									1	858	377	(2)
Tennessee	1	39	22	(2)									1	39	22	(2)
	7	125,428	74,504	(2)	2	6,189	2,611	(2)	1	10	4	(2)	[3] 9	131,627	77,119	4,200,947
Ferruginous manganese ore: [4]																
Arizona	1	62	18	(2)									1	62	18	(2)
Arkansas	1	2,094	628	(2)									1	2,094	628	(2)
Colorado	1	37	9	(2)									1	37	9	(2)
Montana	1	3,671	959	(2)									1	3,671	959	(2)
Nevada	3	13,117	3,373	(2)									3	13,117	3,373	(2)
New Mexico	1	97,007	11,641	(2)									1	97,007	11,641	(2)
Utah	4	7,198	1,674	(2)									4	7,198	1,674	(2)
Virginia	1	5,376	1,216	(2)					1	832	188	(2)	[5] 1	6,208	1,404	(2)
	13	128,562	19,518	(2)					1	832	188	(2)	[5] 13	129,394	19,706	707,809
Manganiferous iron ore: [6]																
Minnesota	4	1,044,961	62,721	$2,739,340									4	1,044,961	62,721	2,739,340

[1] Containing 35 percent or more manganese (natural).
[2] Value included in total.
[3] 1 company in Montana shipped metallurgical and miscellaneous grades.
[4] Containing 10 to 35 percent manganese (natural).
[5] 1 company in Virginia shipped metallurgical and miscellaneous grades.
[6] Containing 5 to 10 percent manganese (natural).

mined in the Emma, Travona, and Orphan Girl mines at Butte; the crude ore from these mines ranged from 15 percent to 20 percent manganese.

Nevada.—Ferruginous manganese ore was shipped from Pershing County by the Charleston Hill National Mines Co. and the Black Diamond Mining Co., both from Golconda, Nev.; Western Alloys, Inc., shipped ferruginous ore from the Black Rock mine in Lander County. A small shipment of manganese ore from a mine in White Pine County was made by the Manganese Mining Co. A study of the concentration of the manganese ore from Las Vegas wash was described [2] during the year.

New Mexico.—Ferruginous manganese ore averaging (natural) 12 percent Mn was shipped by the Luck Mining & Construction Co. from the Boston Hill mine in Grant County. This ore was shipped to the Colorado Fuel & Iron Corp., Pueblo, Colo. The United Mining & Milling Co. shipped manganese ore averaging (natural) 44 percent Mn from its mine near Socorro. A description of the Ellis manganese deposits was presented.[3]

Tennessee.—A small shipment of manganese ore averaging (natural) 57.73 percent Mn was made by the Cleveland Manganese Co. from Bradley County during 1947.

Utah.—The manganese-bearing ore shipped from Utah in 1947 contained 10 to 35 percent manganese and originated in mines in Grand, Juab, Millard, and Piute Counties. These ores were shipped to blast furnaces at Geneva and Provo. The Drum Mountain Manganese deposits [4] and the concentration of manganese ore from Tooele County were described in reports issued during the year.[5]

Virginia.—No production of manganese ore was reported from Virginia in 1947. Shipments consisting of tailings and low-grade material averaging (natural) 22.63 percent Mn were made from the Old Dominion mine in Augusta County. These shipments were made by the Dominion Manganese Corp.

CONSUMPTION AND STOCKS

The consumption of manganese ore in 1947 increased 25 percent from the 1,136,687 tons used in 1946. In 1947, 91 percent was of foreign origin compared with 92 percent in 1946. Industrial stocks of manganese ore on hand December 31, 1947, increased only 1 percent over the 1946 total of 870,547 tons.

The following table shows ores available for consumption in the United States in 1947, without adjustment for changes in consumer or Government stocks.

[2] Zimmerley, S. R., and Schack, C. R., Pilot-Mill Concentration of Las Vegas Wash Manganese Ore, Boulder City, Nev.: Bureau of Mines Rept. of Investigations 4123, 1947, 31 pp.

[3] Russell, Paul L., Ellis Manganese Deposits, Sierra County, N. Mex.: Bureau of Mines Rept. of Investigations 3997, 1947, 4 pp.

[4] King, W. H., Drum Mountain Manganese Project, Juab County, Utah: Bureau of Mines Rept. of Investigations 3993, 1947, 9 pp.

[5] Hussey, S. J., Mitchell, T. F., and McAllister, J. A., Concentration of Oxide Manganese Ore from the Ophir Hill Mine, Ophir, Tooele County, Utah: Bureau of Mines Rept. of Investigations 4130, 1947, 6 pp.

Indicated consumption of manganiferous raw materials in the United States in 1947

	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	131,627	58.6	356,941	15.7	1,044,961	6.0
Imports for consumption	1,297,992	48.1	10,730	29.0	[1] 45,785	(2)
Total available for consumption	1,429,619	49.1	367,671	16.1	1,090,746	(2)

[1] Estimated from consumption. [2] Exact manganese content unknown.

The following table shows the actual tonnage of manganese ore (containing 35 percent or more manganese natural) and manganese alloys consumed during 1946 and 1947, by type of consumer, and stocks at the end of the year.

Consumption of manganese ore and manganese alloys in the United States, 1946–47, and stocks Dec. 31, 1947, gross weight in short tons

	Consumed		In stock Dec. 31, 1947 [1]	
	1946	1947	At plant, including bonded warehouses	In bonded warehouses
Manufacturers of manganese alloys and manganese metal:				
Manganese ore:				
Domestic	80,503	116,217	68,579	
Foreign	972,767	1,216,807	748,368	440,657
Total manganese ore	1,053,270	1,333,024	816,947	440,657
Ferromanganese			40,933	24,546
Spiegeleisen			17,907	
Silicomanganese			(2)	(2)
Manganese briquets			(2)	(2)
Manufacturers of steel ingots and steel castings: [3]				
Manganese ore:				
Domestic	2,090	1,725	788	
Foreign	1,679	3,005	1,785	
Total manganese ore	3,769	4,730	2,573	
Ferromanganese:				
High-carbon	453,158	676,308	84,838	
Medium-carbon, Low-carbon	17,858	22,182	3,944	
Total ferromanganese	471,016	698,490	88,782	
Spiegeleisen	90,389	94,916	26,580	
Silicomanganese	47,155	61,273	9,905	
Manufacturers of steel castings: [4]				
Manganese ore:				
Domestic	274	355	643	
Foreign	431	507	437	
Total manganese ore	705	862	1,080	
Ferromanganese:				
High-carbon	21,780	24,095	6,659	
Medium-carbon, Low-carbon	918	1,155	578	
Total ferromanganese	22,698	25,250	7,237	
Spiegeleisen	7,751	9,135	2,716	
Silicomanganese	6,999	8,225	2,544	

See footnotes at end of table.

Consumption of manganese ore and manganese alloys in the United States, 1946–47, and stocks Dec. 31, 1947, gross weight in short tons—Continued

	Consumed 1946	Consumed 1947	In stock Dec. 31, 1947[1]: At plant, including bonded warehouses	In stock Dec. 31, 1947[1]: In bonded warehouses
Manufacturers of pig iron:				
Manganese ore:				
Domestic			521	
Foreign	10,059	14,997	10,677	
Total manganese ore	10,059	14,997	11,198	
Manufacturers of miscellaneous products:				
Ferromanganese:				
High-carbon	6,362	6,597	2,826	
Medium-carbon; Low-carbon	1,184	2,282	1,229	
Total ferromanganese	7,546	8,879	4,055	
Spiegeleisen	14,560	15,968	5,975	
Silicomanganese	747	1,035	5,331	2,108
Manganese briquets	4,834	9,398	3,498	290
Manufacturers of dry cells:				
Manganese ore:				
Domestic	8,497	6,727	919	
Foreign	39,104	39,629	28,507	14,768
Total manganese ore	47,601	46,356	29,426	14,768
Manufacturers of chemicals:				
Manganese ore:				
Domestic	5,096	70	814	
Foreign	16,187	19,092	18,509	
Total manganese ore	21,283	19,162	19,323	
Grand total:				
Manganese ore:				
Domestic	96,460	125,094	72,264	
Foreign	1,040,227	1,294,037	808,283	455,425
Total manganese ore	[5] 1,136,687	[5] 1,419,131	880,547	455,425
Ferromanganese:				
High-carbon	481,300	707,000	141,007	24,546
Medium-carbon; Low-carbon	19,960	25,619		
Total ferromanganese	501,260	732,619	141,007	24,546
Spiegeleisen	112,700	120,019	53,178	
Silicomanganese	54,901	70,533	17,780	2,108
Manganese briquets	4,834	9,398	3,498	290

[1] Excluding Government stocks.
[2] Included with "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.
[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 use of manganese in steel making increased from 12.7 pounds per short ton of steel ingots in 1946 to 14.5 pounds in 1947. This increase was due largely to increased production of manganese-bearing steels, particularly the low-manganese (less than 1.65 percent Mn) type. Such steel is not ordinarily classified as alloy steel. Of the manganese used in steel during 1947, 13.0 pounds was in the form of ferromanganese, 0.4 pound as spiegeleisen, 1.0 pound as silicomanganese, and 0.1 pound as manganese ore used directly. In 1946 the consumption of manganese contained in ferromanganese, spiegeleisen, silicomanganese, and manganese ore amounted to 11.1 pounds, 0.5 pound, 1.0 pound, and 0.1 pound, respectively, per ton of steel. These data apply to consumption of manganese in the manufacture of steel ingots and that part of steel castings manufactured by companies that also produce steel ingots.

Electrolytic Manganese.—The Electro-Manganese Corp., Knoxville, Tenn.—only producer of electrolytic manganese in 1947—made 3,499,181 pounds of this metal, all from foreign ores, during the year. Electrolytic manganese is used for a variety of purposes, ferrous and nonferrous. The Bureau of Mines did not produce any electrolytic manganese in 1947.

Ferromanganese.—The domestic output of ferromanganese increased 25 percent from 1946 and totaled 614,626 short tons. This alloy was produced at the following plants during the year: Bethlehem Steel Co., Johnstown, Pa.; Colorado Fuel & Iron Corp., Pueblo, Colo.; Electro-Metallurgical Co., Alloy, W. Va., Columbiana, Ohio, and Niagara Falls, N. Y.; E. J. Lavino & Co., Reusens, Va., and Sheridan, Pa.; Sloss-Sheffield Steel & Iron Co., North Birmingham, Ala.; Tennessee Products & Chemical Corp., Rockwood, Tenn.; Tennessee Coal, Iron & Railroad Co., Ensley, Ala.; and Carnegie-Illinois Steel Corp., Clairton and Etna, Pa. Of the 1,185,030 short tons of manganese ore used in the production of ferromanganese during 1947, 9 percent was of domestic origin compared with 8 percent in 1946. However, on a basis of the relative manganese content of foreign and domestic ore, 11 percent was made from domestic ore in 1947 compared with 10 percent in 1946. The recovery of manganese from ore in making ferromanganese was 84.75 percent in 1947 compared with 85.01 percent in 1946 and 85.62 percent in 1945.

Ferromanganese and spiegeleisen imported into and made from domestic and imported ores in the United States, 1946–47, in short tons

	1946		1947	
	Alloy	Manganese content	Alloy	Manganese content
Ferromanganese:				
Imported	32,130	25,908	81,307	65,181
Domestic production	491,973	387,112	614,626	483,509
From domestic ore (estimated)	50,956	40,095	70,534	55,487
From imported ore (estimated)	441,017	347,017	544,092	428,922
Total	524,103	413,020	695,933	548,690
Ratio (percent) of Mn in ferromanganese of domestic origin to total Mn in ferromanganese made and imported		9.71		10.11
Number of plants making ferromanganese	11		12	
Spiegeleisen:				
Imported	360	[1] 72		
Domestic production	111,696	22,597	134,329	29,484
From domestic ore	111,478	[1] 22,553	133,532	29,309
From imported ore	[1] 218	[1] 44	797	175
Total	112,056	22,669	134,329	29,484
Ratio (percent) of Mn in spiegeleisen of domestic origin to total Mn in spiegeleisen made and imported		99.50		99.41
Number of plants making spiegeleisen	3		5	
Total available supply of metallic manganese in ferromanganese and spiegeleisen		435,689		578,174
Percent of available supply of manganese in—				
Ferromanganese and spiegeleisen imported		5.96		11.27
Ferromanganese made from imported ore		79.65		74.03
Spiegeleisen made from imported ore		.01		.03
Ferromanganese made from domestic ore		9.20		9.60
Spiegeleisen made from domestic ore		5.18		5.07
Ferromanganese and spiegeleisen made from domestic ore		14.38		14.67
Spiegeleisen made and imported		5.20		5.10
Open-hearth, bessemer, and electric steel produced	66,602,724		84,894,071	

[1] Estimated.

Ferromanganese produced in the United States and metalliferous materials consumed in its manufacture, 1943–47

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	
		Percent	Short tons	Foreign	Domestic		
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
1946	491,973	78.69	387,112	883,383	80,377	4,829	1.959
1947	614,626	78.67	483,509	1,075,043	109,987	1,340	1.928

Manganese ore used in manufacture of ferromanganese in the United States, 1943–47, by source of ore

Source of ore	1943		1944		1945		1946		1947	
	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	199,567	57.86	130,886	59.06	120,420	57.05	80,377	58.66	109,987	59.53
Foreign:										
Africa	340,985	45.21	290,684	46.19	280,264	46.15	323,225	47.18	313,027	47.35
Brazil	254,215	39.72	227,410	41.02	275,117	41.19	161,456	40.98	139,300	40.49
Canada	44	45.00								
Chile	5,837	48.95	464	45.47	5,498	45.42	2,194	47.45	8,298	47.23
Cuba	194,780	45.91	241,582	47.45	257,521	45.37	165,951	46.53	74,102	44.00
India	345,270	49.13	409,563	49.05	258,432	48.77	207,769	48.33	369,101	49.94
Mexico	10,436	41.03	46,495	41.15	21,791	43.86	22,492	47.23	33,382	41.16
New Zealand			536	44.35						
Philippines, Republic of	27,233	46.04	8,144	52.00					2,196	51.64
U. S. S. R.	3,129	45.19			12,452	44.49	296	44.59	135,637	47.71
	1,381,496	47.11	1,355,764	46.28	1,231,495	46.43	963,760	47.23	1,185,030	48.14

Shipments of ferromanganese from producing furnaces in 1947 increased 24 percent in quantity and 30 percent in value over 1946. The record of shipments for the past 5 years follows.

Ferromanganese shipped from furnaces in the United States, 1943–47

Year	Short tons	Value	Year	Short tons	Value
1943	722,658	$93,481,580	1946	493,808	$61,355,778
1944	715,059	91,406,229	1947	614,647	79,972,673
1945	610,376	78,907,189			

Spiegeleisen.—Production of spiegeleisen in 1947 increased 20 percent from 1946; shipments increased 8 percent in quantity and 31 percent in value. Spiegeleisen was manufactured at the following plants during 1946: New Jersey Zinc Co., Palmerton, Pa.; Tennessee Coal, Iron & Railroad Co., Ensley, Ala.; Carnegie-Illinois Steel Corp., Gary, Ind., and Etna, Pa.; and Inland Steel Co., East Chicago, Ind.

Virtually all of the spiegeleisen manufactured in 1947 was made from domestic materials. However, a small quantity of ore (356 short tons) from Portuguese East Africa and 55 tons from India were also used.

Spiegeleisen produced and shipped in the United States, 1943–47

Year	Produced (short tons)	Shipped from furnaces		Year	Produced (short tons)	Shipped from furnaces	
		Short tons	Value			Short tons	Value
1943	149, 036	150, 136	$4, 827, 954	1946	111, 696	114, 982	$3, 793, 673
1944	165, 530	155, 325	4, 851, 490	1947	134, 329	124, 517	4, 980, 030
1945	139, 039	157, 774	5, 108, 144				

Manganiferous Pig Iron.—Pig-iron blast furnaces used 25,658 tons of manganiferous zinc residuum and 979,700 tons of domestic ore containing (natural) over 5 percent manganese in 1947. Of this ore, none contained 35 percent or more manganese, 59,323 tons contained (natural) 10 to 35 percent manganese, and 820,377 tons contained (natural) 5 to 10 percent manganese. In addition 60,782 tons of foreign ore—of which 14,997 tons contained more than 35 percent manganese and 45,785 tons contained 5 to 10 percent manganese—were used during the year.

Foreign ferruginous manganese ore and manganiferous iron ore consumed in the United States, 1944–47, in short tons

Source of ore	Ferruginous manganese ore				Manganiferous iron ore			
	1944	1945	1946	1947	1944	1945	1946	1947
Africa								44, 227
Australia								1, 558
Cuba	1, 844							
Mexico		800	257				5, 854	
	1, 844	800	257				5, 854	45, 785

Battery and Miscellaneous Industries.—During 1947 manufacturers of dry cells in the United States used 46,356 tons of manganese ore, of which 6,727 tons were of domestic origin and 39,629 tons were imported. Chemical plants used 70 tons of domestic ore and 19,092 tons of foreign ore containing (natural) more than 35 percent manganese. Most of this ore was used in the manufacture of manganese sulphate for fertilizer and in the manufacture of hydroquinone.

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, and cobalt, which are electronegative to zinc. Chemical ore has a wide range of analyses.

PRICES

Manganese Ore.—Prices of manganese ore containing 48 percent Mn, as quoted by E&MJ Metal and Mineral Markets, at the beginning of 1947 ranged from 70 to 71 cents per long-ton unit, including

Manganese ore (35 percent or more Mn) imported into the United States, 1946–47, by countries

[U. S. Department of Commerce]

Country	General imports [1] (short tons)				Imports for consumption [2]					
					Short tons				Value	
	Gross weight		Mn content		Gross weight		Mn content			
	1946	1947	1946	1947	1946	1947	1946	1947	1946	1947
Belgian Congo	----------	2,854	----------	1,484	----------	2,903	----------	1,608	----------	$42,257
Brazil	160,171	184,050	66,386	74,971	86,015	157,804	38,985	70,234	$1,122,840	1,957,910
British East Africa	----------	530	----------	267	----------	----------	----------	----------	----------	----------
Canada	17	257	8	138	17	257	8	138	770	7,425
Chile	149,564	43,450	68,066	20,523	143,498	42,078	65,222	19,930	4,491,443	1,341,484
Cuba	158,734	57,089	77,469	26,893	158,734	57,089	77,469	26,893	3,868,372	1,224,880
French Morocco	1	----------	(3)	----------	1	----------	(3)	----------	44	----------
French West Africa	2,868	----------	1,434	----------	----------	----------	----------	----------	----------	----------
Gold Coast	351,633	192,277	177,942	99,563	279,653	217,317	144,275	112,102	3,091,369	3,316,990
India	371,753	421,121	185,548	206,705	321,280	284,535	160,958	140,007	3,847,384	3,497,822
Mexico	30,701	56,642	13,980	25,558	39,760	50,890	18,570	22,805	1,004,014	737,724
Mozambique	----------	567	----------	283	----------	----------	----------	----------	----------	----------
Peru	----------	448	----------	215	----------	448	----------	215	----------	14,739
Philippines, Republic of	----------	2,376	----------	1,141	----------	2,376	----------	1,141	----------	37,800
Portuguese Guinea and Angola	----------	448	----------	229	----------	448	----------	229	----------	8,052
Union of South Africa	281,861	248,703	133,580	109,838	243,666	192,871	113,037	87,154	3,988,310	2,205,279
U. S. S. R.	241,920	331,006	121,753	162,297	241,920	288,976	121,753	141,975	8,243,077	6,898,819
	1,749,223	1,541,818	846,166	730,105	1,514,544	1,297,992	740,277	624,431	29,657,623	21,291,181

[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.

duty, f. o. b. eastern and southern ports. At the end of the year comparable prices ranged from 65 to 70 cents per long-ton unit.

The long-ton unit upon which the price of manganese ore is based is 1 percent of a long ton, or 22.4 pounds, of contained manganese. Prices of chemical ore are given on a per-ton basis, with a minimum requirement of manganese dioxide. A duty of one-half cent per pound of contained manganese was imposed on all ores imported in 1947, except those from Cuba and the Republic of the Philippines, which enter duty-free.

Manganese Alloys.—The average value, f. o. b. producers' furnaces, for ferromanganese shipped during 1947 was $130.11 compared with $124.25 per short ton in 1946. The quoted price of ferromanganese rose from $135 per gross ton to $150 per ton early in September 1947. The value of spiegeleisen, f. o. b. domestic furnaces, was $39.99 per short ton compared with $32.99 in 1946.

FOREIGN TRADE [6]

Imports of all grades of manganese ore are shown by countries in the accompanying table. These data include imports of battery-grade ore totaling 65,756 short tons in 1947. Of this quantity 45,257 tons came from Gold Coast, 17,913 from U. S. S. R., 1,075 from India, 574 from Chile, 448 from Peru, 448 from Portuguese Guinea and Angola, and 41 from Mexico. The ore averaged 55.23 percent Mn or 87.36 percent MnO_2. Imports for consumption of battery ore totaled 67,563 short tons, of which 49,169 tons came from Gold Coast, 15,808 from U. S. S. R., 1,075 from India, 574 from Chile, 448 from Peru, 448 from Portuguese Guinea and Angola, and 41 from Mexico. The value of these withdrawals amounted to $2,025,553 or $29.98 per short ton f. o. b. foreign ports.

Imports for consumption of ferromanganese in 1947 more than doubled the 1946 total; exports increased nearly sevenfold.

Ferromanganese imported into and exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Imports for consumption [1]			Exports	
	Gross weight (short tons)	Mn content (short tons)	Value	Gross weight (short tons)	Value
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
1946	32,130	25,908	4,493,056	2,951	381,194
1947	81,307	65,181	10,847,036	20,168	2,811,653

[1] All from India in 1943; all from Canada in 1944–47 except—1944: 1,408 tons (1,076 content), $98,282 from India; 1946: 9,357 tons (7,595 content), $1,585,803 from Norway; 1947: 12,607 tons (10,372 content), $2,149,139 from Norway.

Spiegeleisen imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1943	3,254	$140,247	1946	360	$17,512
1944	3,761	153,032	1947	----------	----------
1945	3,146	142,883			

[6] 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 REVIEW

The accompanying table shows, insofar as statistics are available, the world production of manganese ores, 1941 to 1947, 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, 1941–47, in metric tons [1]

[Compiled by B. B. Mitchell]

Country [1]	Percent Mn	1941	1942	1943	1944	1945	1946	1947
North America:								
Canada (shipments)	-----	-----	395	44	-----	-----	-----	-----
Cuba	36–50+	251,385	249,255	[2] 311,214	[2] 257,864	198,243	130,764	50,397
Mexico	41–45	7,500	40,000	70,503	80,671	51,959	25,000	31,400
United States (shipments)	35+	79,646	173,043	186,129	224,632	165,412	130,303	119,409
South America:								
Argentina [3]	35–38	1,476	1,424	1,645	3,155	4,272	([4])	([4])
Bolivia (exports)	50	([4])	600	17	-----	-----	-----	-----
Brazil (exports)	38–50	437,402	306,241	275,552	146,983	244,649	149,149	142,092
Chile	40–50	47,200	71,292	114,074	43,989	7,445	20,538	19,352
Europe:								
Germany [5]	30+	2,319	2,100	985	([4])	19,000	35,000	89,000
Greece	60–62	180	430	290	([4])	([4])	([4])	-----
Hungary	35–48	26,380	31,880	33,580	[6] 21,050	[7] 6,600	14,780	33,470
Italy	34–37	59,773	60,163	([4])	([4])	15,389	[8] 30,000	[8] 50,000
Portugal	35–45	1,815	6,820	12,611	9,210	8,114	5,932	([4])
Rumania	30–36	15,032	29,021	37,417	([4])	([4])	18,807	([4])
Spain	40+	9,968	21,268	26,150	30,426	24,889	29,589	22,429
Sweden	30+	13,928	24,242	26,703	24,276	18,036	12,594	[8] 8,000
Switzerland	-----	1,755	5,772	8,138	5,778	2,757	([4])	-----
U. S. S. R. (estimate)	41–48	2,393,000	[9] 1,823,000	1,000,000	461,000	2,251,000	1,700,000	1,800,000
United Kingdom	-----	1,205	10,599	20,558	17,890	11,480	-----	-----
Yugoslavia	32–38	[10] 4,724	([4])	([4])	([4])	([4])	([4])	([4])
Asia:								
Burma (estimate)	35	([4])	762	762	762	([4])	([4])	([4])
China	41	500	500	4,364	([4])	16,400	[11] 9,600	20,000
India	47–52	798,555	769,423	604,922	376,251	213,602	256,975	350,000
Indochina, French	47–50	1,040	1,440	1,400	7,700	([4])	([4])	([4])
Iran [12]	45–55	1,800	([4])	([4])	([4])	([4])	([4])	([4])
Japan [8]	32–40	[13] 195,546	[13] 254,254	[13] 342,884	[13] 400,679	[13] 85,700	29,394	33,194
Korea	-----	([4])	([4])	([4])	32,377	([4])	([4])	([4])
Malayan Union	30	[14] 3,693	2,540	2,540	2,540	([4])	([4])	([4])
Netherlands Indies	50–55	13,880	39,600	39,600	39,600	([4])	([4])	([4])
Philippines, Republic of	35–48	[14] 50,570	([4])	([4])	([4])	([4])	-----	3,375
Portuguese India	42–50+	8,111	680	-----	-----	-----	([4])	([4])
Turkey	30–50	1,360	3,418	2,684	3,200	3,552	1,185	4,633
Africa:								
Belgian Congo	50+	30,532	28,984	17,411	2,983	-----	[15] 14,714	[15] 16,912
Egypt	30+	2,175	8,169	7,079	30	47	25	29
Gold Coast	50+	498,881	691,016	[2] 534,362	[2] 479,499	[2] [15] 713,013	[2] [15] 777,583	[2] [15] 598,655
Morocco, French	32–50	50,722	44,273	49,010	27,550	45,292	57,080	109,452
Northern Rhodesia	30–48	4,775	6,211	4,787	5,127	1,965	1,420	-----
Portuguese West Africa	50	([4])	([4])	4,000	2,000	-----	1,900	700
Tunisia	35–40	106	102	-----	313	-----	-----	25
Union of South Africa	30–51	445,893	394,445	219,122	106,883	114,546	237,897	288,213
Oceania:								
Australia:								
New South Wales	-----	1,485	793	614	782	1,000	([4])	([4])
Queensland	-----	201	152	57	209	([4])	([4])	([4])
South Australia	-----	12,138	9,477	5,680	1,219	-----	-----	192
New Zealand	-----	964	326	518	-----	-----	408	-----
Papua [16]	-----	408	352	365	176	173	44	([4])
	-----	5,491,000	5,167,000	4,040,000	2,900,000	4,260,000	3,700,000	3,800,000

[1] In addition to countries listed, Belgium, Bulgaria, Costa Rica, Eritrea, and Spanish Morocco produce manganese ore, but data of output are not available. Czechoslovakia reports 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] Dry weight. [3] Shipments by rail and river.

[4] Data not available; estimate by author of chapter included in total.

[5] Figures for 1945–47 represent French zone only; no output in American-British zone or Saar.

[6] January to June, inclusive. [7] June to December, inclusive. [8] Preliminary figures.

[9] Estimate excludes Ukraine. [10] Croatia only. [11] Incomplete data.

[12] Fiscal year ended Mar. 20 of year following that stated.

[13] Fiscal year ended Mar. 31 of year following that stated.

[14] January to September, inclusive. [15] Exports. [16] Fiscal year ended June 30 of year stated.

European Economic Cooperation.—The 16 countries participating in the European Economic Cooperation program plus Western Germany, consumed 807,000 metric tons of manganese ore in 1947 compared with 669,000 in 1946 and 1,205,000 in 1938. Production of manganese in those countries (including colonial output shipped to participating countries) was 61 percent of consumption in 1947 and 27 percent in 1938.

Consumption of manganese ore by countries[1] participating in the European Economic Cooperation program and by Western Germany, 1938 and 1945–47 (actual) and 1948–51 (predicted), in thousands of metric tons

[Committee of European Economic Cooperation]

	Actual consumption				Predicted consumption			
	1938	1945	1946	1947	1948	1949	1950	1951
Belgium	80	3	21	33	53	53	60	60
Denmark	1	1	1	1	2	2	2	2
France	295	20	98	136	357	369	381	393
Greece	------	------	------	------	------	------	3	3
Italy	122	([2])	49	80	113	134	154	176
Luxembourg	40	3	27	43	81	81	81	81
Netherlands	15	------	2	6	17	19	24	24
Norway	124	11	48	58	74	89	105	125
Sweden	15	18	20	20	20	22	22	23
Switzerland	5	------	------	------	5	5	5	5
Turkey	------	3	3	5	5	6	6	6
United Kingdom	222	299	343	330	390	410	410	430
Total participating countries	919	([2])	612	712	1,117	1,190	1,253	1,328
Western Germany:								
British-American zone	233	------	25	28	41	55	75	100
Saar	53	------	32	67	126	200	200	200
Grand total	1,205	([2])	669	807	1,284	1,445	1,528	1,628

[1] No consumption in Austria, Eire, Iceland, Portugal, and the French zone of Germany.
[2] Data not available.

Gold Coast.—Manganese ore is known to exist in numerous small deposits in the Gold Coast but only the important Nsuta mine is being worked at the present time. This mine is located approximately one-half mile east of the Takoradi-Kumasi Railway, a distance of 39 miles from the port of Takoradi. Manganese was first discovered at the location of the present Nsuta mine in 1914 by the Gold Coast Geographical Survey on land that had been leased in 1910 to Fanti Consolidated, Ltd. After the discovery, a subsidiary, the Wassaw Exploring Syndicate, was formed to prospect and exploit the deposits. The concession was taken over by the African Manganese Co. in 1923. There is no information available on reserves of manganese ore in the Gold Coast, but it was stated in 1942 by the acting mine manager that there was no question of early exhaustion of reserves at the Nsuta mine at the current rate of production. It is known that high-grade ore does not exist by itself in large quantities but is found in small streaks and lenses in predominantly low-grade ore. The company classifies its output into 13 grades but does not reveal the production of each. The spotty occurrence of high-grade ore may account partly for the company's lack of interest in a sampling project initiated by the United States Army Signal Corps to discover the reasons for variations in the quality of Gold Coast battery ore.

A crude ore from the Nsuta mine is grizzlied, jaw-crushed, scrubbed to break up clay clods, and trommeled into three sizes: Minus ¼-inch, plus 1-inch, and the intermediate grade. The large size is passed through a secondary crusher, grizzlied to 2 inches, and undersize returned to the trommel. The minus ¼-inch is run to waste, the intermediate is sent to the sintering plant, and the coarse is then handpicked of siliceous pieces, the balance being lump, a finished product.[7].

Haiti.—Investigations of undeveloped manganese deposits in Haiti were reported.[8]

India.—India was the leading supplier of manganese ore for United States consumption in 1947 and has been one of the two leading nations with respect to manganese ore production since 1900. Improvement in rail facilities permitted a substantial increase in exports during 1947. Manganese is mined principally in Balaghat, Nagpur, and Bandara districts in the Central Provinces, Sandur State; Vizagapatam district in Madras; the Panch Mahals district in Bombay; Singhbhum district in Bihar; and the adjoining States of Keonjhar and Bonai. The ores are mixtures of psilomelane, braunite, and pyrolusite and occur on the surface, often in the form of hills, so that mining may be done efficiently by unskilled labor.[9] The following companies were active in the production of manganese in India during 1947: W. Futehally & Co., Bank Street., Fort, Bombay; James Finlay & Co., Ltd., Esplanade Road, Fort, Bombay; Killick Wixon & Co., Killick Bldg., Home Street, Fort, Bombay; Jagmohandas Bhagwandas Boda & Co., 49 Churchgate Street, Fort, Bombay; Goa Express Commercial Agency, P. O. Box 4, Nova Goa, Portuguese India; and Rai Bahadur Seth Shreeram Durgaprasad, Tumsar, Central Provinces.[10]

Iran.—Manganese production in Iran was begun in 1940 and continued for approximately 3 years but has stopped since. A total of 7,390 metric tons had been produced at the time operations ceased. The Government-owned Robat Karim manganese mines 6 miles northwest of Shahryar were the only producers, and reserves are now estimated to contain 60,000 tons of metal. The ore produced was of two grades: Grade 1, containing 79.02 percent MnO_2, and Grade 2, containing 42.80 percent MnO_2.[11] The equivalent Mn contents are 49.96 and 27.06 percent, respectively.

Malayan Union.—Production of manganese ore from Malaya was substantial in prewar years and reached a maximum in 1936, when 36,776 gross tons were produced and exported. This ore was mined by Japanese companies and shipped to Japan. The deposits are in the States of Kelantan and Trengganu.[12]

Spain.—Production of manganese ore in Spain during 1946 totaled 29,589 metric tons and during 1947, 22,429 tons, most of which came from the Province of Huelva. These deposits are situated in south-

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[7] Bureau of Mines, Mineral Trade Notes, vol. 25, No. 2, August 1947, pp. 11–13.

[8] Goddard, E. N., Gardner, L. S., and Burbank, W. S., Manganese Deposits of Republic of Haiti: U. S. Geol. Surv. Bull. 953-B, 1947, pp. 27–52.

[9] South African Mining and Engineering Journal, vol. 48, part 1, No. 28–40, July 19, 1947, p. 629.

[10] Bureau of Mines, Mineral Trade Notes, vol. 25, No. 4, October 1947, pp. 12–13.

[11] Bureau of Mines, Mineral Trade Notes, vol. 25, No. 4, October 1947, p. 13.

[12] Bureau of Mines, Mineral Trade Notes, vol. 25, No. 4, October 1947, pp. 13–14.

western Spain on the northern slopes of the Sierra Morena in the same region as the Rio Tinto pyrites deposits. More than a hundred massive lenticular deposits have been recorded in the district but many of these have become exhausted. The ores are pyrolusite and psilomelane formed by the oxidation of carbonate and silicate ores. Carbonate ores contain from 28 to 48 percent manganese, and the silicate ores 39 to 45 percent manganese and 20 to 22 percent silicon.[13]

United Kingdom.—The Benallt mine, Caernarvonshire, Wales, yielded about 40,000 tons of manganese ore in the 2 years ended in the summer of 1944, some in 1945, and none in 1946–47. A magnetometric survey indicated reserves of about 10,000 tons of ore in three orebodies.[14]

Imports of manganese ore by the United Kingdom were 273,400 metric tons in 1947 compared with 196,700 tons in 1946. Consumption of imported manganese ore in 1947 totaled 327,700 metric tons, of which 315,900 were from West Africa, 11,600 from India, and 200 from other countries. Production of manganese ferroalloys declined in 1947 compared with 1946 but not seriously enough to hamper an increase in consumption, as shown in the accompanying table.

Production and consumption of manganese ferroalloys in the United Kingdom, 1945–47, in metric tons

[British Iron and Steel Federation]

	Production			Consumption		
	1945	1946	1947	1945	1946	1947
Ferromanganese, high-carbon	106,400	116,600	104,700	102,700	100,500	104,300
Ferromanganese, low-carbon	3,700	4,200	3,900	4,100	3,700	3,900
Spiegeleisen	27,000	35,900	29,200	19,400	21,200	27,200
Silicomanganese	(1)	(1)	(1)	9,900	8,400	9,100
Silicospiegel	(1)	(1)	(1)	70	400	400

1 Data not available.

13 Groves, A. W., Manganese: Imperial Institute, London, 1938, pp. 93–94.

14 Groves, A. W., Results of Magnetometric Survey at Benallt Manganese Mine, Rhiw, Caernarvonshire: Bull. Inst. Min. and Met., No. 484, March 1947, pp. 1–24; discussion, No. 486, May 1947, pp. 37–47, and No 490, September 1947, pp. 29–32.

Mercury

By HELENA M. MEYER AND ALETHEA W. MITCHELL

GENERAL SUMMARY

THE downtrending mercury price, contrasted with the upward movement of commodity prices in general, was an outstanding feature of the mercury industry in 1947. United States production dropped 8 percent and general imports 56 percent from 1946, and together were slightly less than consumption. The weakness in prices, therefore, was not because immediate supplies exceeded requirements in the domestic market, but because current world supplies continued to be larger than world needs, and the excess threatened the United States market. The fact that the Idria mine was no longer under control of the Spanish-Italian Cartel—the Mercurio Europeo—was an additional competitive factor, and, consequently, metal from this property aided in depressing prices. The quoted price for mercury at New York was $83.74 a flask, the lowest annual average since 1938, when it was $75.47. Meanwhile, the Bureau of Labor Statistics index price for all commodities nearly doubled, indicating that the 1947 price for mercury was equivalent to not much more than half the indicated level in terms of 1938 dollars.

Considering the fact that costs of production were rising while the price was dropping, the decrease of only 8 percent in output from domestic mines is unusual. Production came from only 37 mines in 1947, compared with 102 in 1944; of the 1947 total, 99 percent was furnished by 16 mines, whereas of the 1944 total, 97 percent was produced by 31 mines, an increasing concentration of production in the hands of the strongest companies. Nonetheless, under the price-cost relationships prevailing at the end of the year, an almost complete shutdown of the mining industry was considered possible.

Despite the large quantities of metal in the world seeking a market and the fact that two of the chief consuming nations in the world prior to World War II—Germany and Japan—no longer demanded large supplies, and Japan, at least, had metal of its own for disposal, the drop in general imports into the United States from 23,062 flasks in 1946 to 10,228 in 1947 indicated that a saturation point had been reached in the ability of the domestic market to absorb metal.

Consumption of mercury in 1947, spurred by gains in use for the new battery and by increased agricultural consumption, rose 13 percent in 1947 and was 32 percent above the prewar annual average for 1935–39. The quality and performance of the new dry cell are reported to have made good progress in 1947, and consumption for this use is expected to make further advances in 1948. The low price for mercury is a favorable factor in the development of the new dry cell. A low price and assured large supplies are said to be two outstanding requirements for expansion in the dry cell's use.

Figure 1 shows trends in production, consumption, and price of mercury from 1915 to 1947.

Industrial stocks of mercury showed little change in 1947 as compared with 1946, and Office of Metals Reserve inventories were absorbed into the Government strategic stock pile. The quantity of mercury in the strategic stock pile may not be divulged.

World production in 1947 was probably not very different from 1946, when the output was only about half of the all-time record for 1941. Of the important mercury-producing countries, Spain, the

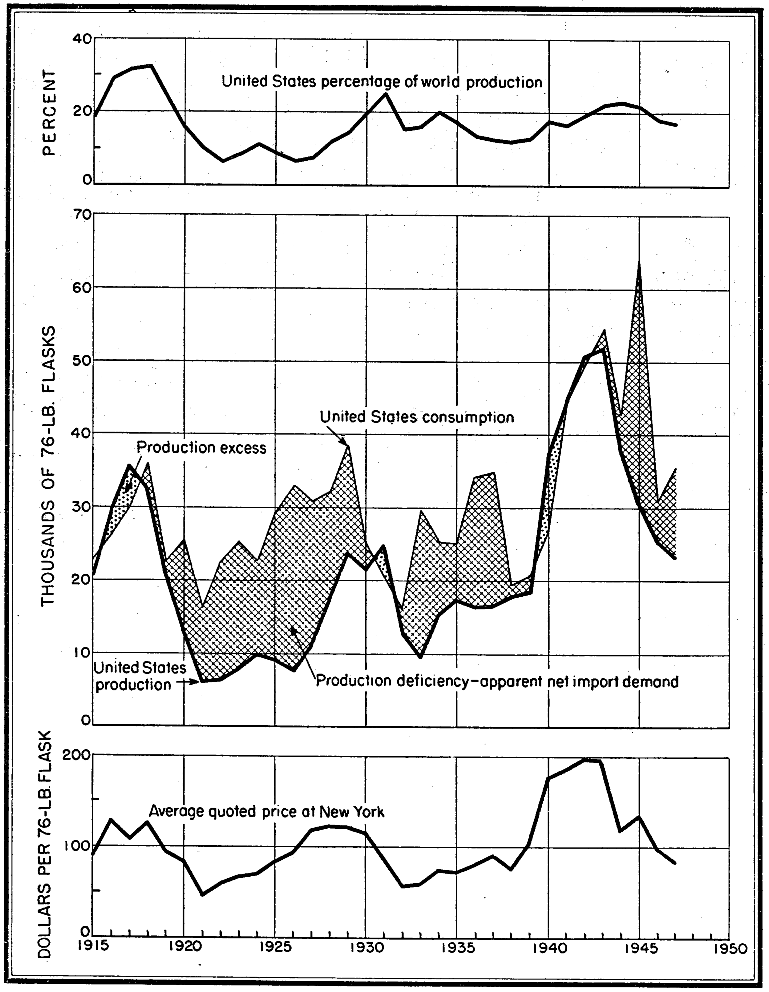

FIGURE 1.—Trends in production, consumption, and price of mercury in the United States, 1915–47.

United States, and Mexico had smaller outputs, and Italy had a slightly larger one. Data on Yugoslavia are not available, but it is reasonable to believe that output rose in that country.

Salient statistics of the mercury industry in the United States, 1943–47

[Flasks of 76 pounds]

	1943	1944	1945	1946	1947
Production .... flasks..	51, 929	37, 688	30, 763	25, 348	23, 244
Number of producing mines	146	102	68	51	37
Average price per flask:					
New York	$195. 21	$118. 36	$134. 89	$98. 24	$83. 74
London	$281. 44	$281. 44	$242. 45	$120. 39	$73. 02
Imports for consumption:					
Pounds	[1] 3, 633, 216	1, 486, 025	5, 214, 890	1, 055, 956	984, 814
Equivalent flasks	[1] 47, 805	19, 553	68, 617	13, 894	12, 958
Exports:					
Pounds	[1] 29, 236	57, 007	78, 877	68, 932	67, 148
Equivalent flasks	[1] 385	750	1, 038	907	884
Consumption .... flasks..	54, 500	42, 900	62, 429	[2] 31, 552	35, 581

[1] Large quantities reexported in 1943 are included in imports but not exports.
[2] Revised.

DOMESTIC PRODUCTION

Mercury production in the United States in 1947 continued at relatively high levels in view of steadily falling prices and rising costs of production. The 1947 output was 8 percent less than in 1946 but was one-third above the annual rate for the prewar (1935–39) period. The fact that production was concentrated more closely in stronger hands in 1947 was largely responsible for the showing made; of output in the fourth quarter of the year, 96 percent came from seven mines, and some of the seven mines were on the borderline of joining nonproducing properties.

Idaho's gain of 2 percent was the only increase noted in 1947. Of the areas producing in 1947, Alaska had the sharpest decline—82 percent—owing to the idleness throughout the year of the chief property—the Red Devil (New Idria-Alaska). Nevada decreased 15 percent, Oregon 11 percent, and California 3 percent. Arizona and Arkansas dropped from the list of producing areas in 1947.

The principal producing mines in 1947 were as follows:

Alaska—Decoursey Mountain mine.

California—Fresno County, Archer mine; Lake County, Sulphur Bank mine; Napa County, Knoxville mine; San Benito County, Juniper and New Idria mines; San Luis Obispo County, Buena Vista (Mahoney) mine; Santa Clara County, Guadalupe mine and Almaden dumps; Sonoma County, Culver-Baer and Mount Jackson mines; Yolo County, Reed mine.

Idaho—Valley County, Hermes mine.

Nevada—Humboldt County, Cordero mine; Pershing County, Red Bird mine.

Oregon—Douglas County, Bonanza mine.

In 1947, those 16 mines produced 99 percent of the total for the United States; in 1946, 18 mines produced 98 percent, but in 1942, 34 mines produced only 89 percent. The leading producers accounted for at least 100 flasks each. The seven leading mines, which produced 96 percent of the total for the fourth quarter of 1947, mentioned in the foregoing discussion were as follows: Sulphur Bank, New Idria, Mount Jackson, and Reed mines in California; Hermes mine in Idaho; Cordero mine in Nevada; and Bonanza mine in Oregon.

Mercury produced in the United States, 1944–47, by States

Year and State	Producing mines	Flasks of 76 pounds	Value [1]	Year and State	Producing mines	Flasks of 76 pounds	Value [1]
1944:				1946:			
Arizona	3	548	$64,861	Alaska	2	699	$68,670
Arkansas	8	191	22,607	Arizona	1	95	9,333
California	58	28,052	3,320,235	Arkansas	2	11	1,081
Nevada	17	2,460	291,166	California	32	17,782	1,746,904
Oregon	8	3,159	373,899	Idaho	1	868	85,272
Texas	4	1,095	129,604	Nevada	7	4,567	448,662
Alaska and Idaho	4	2,183	258,380	Oregon	6	1,326	130,266
	102	37,688	4,460,752		51	25,348	2,490,188
1945:				1947:			
California	39	21,199	2,859,533	Alaska	1	127	10,635
Idaho	1	627	84,576	California	26	17,165	1,437,397
Nevada	12	4,338	585,153	Idaho	1	886	74,194
Oregon	6	2,500	337,225	Nevada	6	3,881	324,995
Alaska, Arizona, Arkansas, and Texas	10	2,099	283,134	Oregon	3	1,185	99,232
	68	30,763	4,149,621		37	23,244	1,946,453

[1] Value calculated at average price at New York.

Mercury produced in the United States, 1940–45, by months, and 1946–47, by quarters, in flasks of 76 pounds

Month	1940	1941	1942	1943	1944	1945	1946	1947
January	1,800	3,100	3,700	4,200	4,400	2,500		
February	2,200	2,900	3,400	3,900	3,800	2,700	5,550	6,100
March	2,500	3,500	4,100	4,600	3,800	3,000		
April	2,700	3,500	4,200	4,600	3,700	3,000		
May	3,100	3,600	4,800	4,200	3,400	3,300	7,000	5,700
June	3,000	4,000	4,900	4,100	3,000	3,000		
July	3,200	3,400	4,700	4,300	2,700	3,600		
August	3,500	4,100	4,500	4,500	2,500	3,300	6,500	5,850
September	3,600	4,200	4,200	4,500	2,500	2,050		
October	3,600	4,000	4,100	5,200	2,700	1,200		
November	3,400	3,800	4,100	5,000	2,300	1,350	6,150	5,550
December	3,700	3,900	4,400	4,200	2,500	1,600		
Total: Preliminary	36,300	44,000	51,100	53,300	37,300	30,600	25,200	23,200
Final	37,777	44,921	50,846	51,929	37,688	30,763	25,348	23,244

In recent years the trend in grade of mercury ore treated in the United States has been upward, against the long-time trend. In 1947 there was a slight extension of this upward movement. In 1947, 12.5 pounds of metal was recovered for each ton of ore treated, compared with 12.0 pounds in 1946 and 5.1 pounds in 1942.

In addition to mercury produced at the mines in 1947, at least 3,500 flasks were reported as produced from battery scrap and calomel. Additional unreported quantities are believed to have been recovered.

Mercury ore treated and mercury produced therefrom in the United States, 1927–47 [1]

[That material from old dumps which is not separable is included with ore]

Year	Ore treated (short tons)	Mercury produced: Flasks of 76 pounds	Mercury produced: Pounds per ton of ore	Year	Ore treated (short tons)	Mercury produced: Flasks of 76 pounds	Mercury produced: Pounds per ton of ore
1927	99,969	10,711	8.1	1938	199,954	17,816	6.8
1928	142,131	14,841	7.9	1939	191,892	18,505	7.3
1929	248,314	19,461	6.0	1940	449,940	37,264	6.3
1930	288,503	18,719	4.9	1941	652,141	43,873	5.1
1931	260,471	22,625	6.6	1942	733,360	49,066	5.1
1932	108,118	11,770	8.3	1943	613,111	50,761	6.3
1933	78,089	8,381	8.2	1944	300,385	37,333	9.4
1934	126,931	13,778	8.2	1945	209,009	29,754	10.8
1935	135,100	15,280	8.6	1946	157,469	24,929	12.0
1936	141,962	14,007	7.5	1947	139,211	22,823	12.5
1937	186,578	16,316	6.6				

[1] Excludes mercury produced from placer operations and from clean-up activity at furnaces and other plants.

REVIEW BY STATES

Alaska.—The Decoursey Mountain mine produced 127 flasks of mercury from 25 tons of ore treated in retorts in 1947 and was the only property in the Territory for which production was reported. Considerable low-grade ore was said to have been blocked out, but no estimate of the tonnage was reported. The Red Devil mine will not resume operations under conditions prevailing in 1947. Efforts were being made to complete installation of a small retort at the Red Top mine, 15 miles from Dillingham.

Results of Bureau of Mines exploration work on 10 projects in Alaska were described recently.[1]

California.—Despite a drop in output of 3 percent in 1947, California mines accounted for 74 percent of the total for the United States, compared with 70 percent in 1946, 69 percent in 1945, and 74 in 1944. Eight Counties contributed to the total, as follows: Fresno, Lake, Napa, San Benito, San Luis Obispo, Santa Clara, Sonoma, and Yolo. The recent peak for mercury-producing Counties in California was 17 in 1943. The New Idria mine led among domestic mercury-producing properties again in 1947 and recovered 93 percent as much as the three next largest contributors combined.

Mercury ore totaling 626 tons from the Archer mine, Fresno County, was trucked to a nearby furnace for treatment and yielded 135 flasks of metal. Mining was selective. Another property in the County had a small output.

The Bureau of Mines recently issued [2] a report on the Coso mercury mine. Of particular interest in the Bureau's work on the project was the adaptation and use of the bucket drill as a tool for sampling shallow, soft ore deposits.

[1] Webber, Burr S., Bjorklund, Stuart C., and others, Mercury Deposits of Southwestern Alaska: Bureau of Mines Rept. of Investigations 4065, May 1947, 57 pp.
[2] Dupuy, Leon W., Bucket-Drilling the Coso Mercury Deposit, Inyo County, Calif.: Bureau of Mines Rep. of Investigations 4201, March 1948, 45 pp.

Mercury production in Lake County was from the Sulphur Bank, Helen, Baker, and one other mine. The total for the County was 364 flasks. All properties are believed to have been idle at the year end.

The Knoxville and one other mine produced mercury in Napa County in 1947.

Six properties in San Benito County made some production in 1947, but the New Idria was by far the largest producer, despite far below-capacity operations. The total output for the County, 9,228 flasks, was more than double that of Sonoma County, the second-largest mercury-producing County in the United States in 1947. San Benito County's increase of 12 percent over 1946 was against the trend in most areas. Second in importance among mines producing mercury in this County was the Juniper mine, where approximately 68 pounds of metal were recovered per ton of ore treated. Other producers included the Stayton and Valley View properties, at both of which retorts were used, as was the case at the Juniper mine. At the El Rey mine, 300 feet of development work were done in an effort to reach a new ore body, but there was no production.

The Buena Vista (Mahoney) and two much smaller producers accounted for San Luis Obispo County's total of 449 flasks in 1947, more than ten times the output in 1946, when the Buena Vista was unproductive. A 50-ton rotary furnace is used at the Buena Vista.

Four properties accounted for Santa Clara County's output of 586 flasks in 1947, compared with 1,203 flasks in 1946, the Almaden dumps contributing the largest part of the 1947 total, followed by the Guadalupe mine. The Guadalupe mine and 80-ton Gould rotary furnace were closed during the third quarter of the year.

The Mount Jackson mine, as usual, was by far the largest mercury-producing mine in Sonoma County and moved from third to second place among producers in the United States. In the latter half of the year, however, Cordero had supplanted Mount Jackson as the second largest producer. In Sonoma County, 4,247 flasks of mercury were recovered from 43,145 tons of ore in 1947, compared with 3,222 flasks and 37,519 tons in 1946. Producers other than Mount Jackson were the Culver-Baer, Esperanza, and one other. The Sonoma Quicksilver Mines, Inc., acquired the Great Eastern mine adjoining the Mount Jackson in 1947 and was operating the two mines at the end of the year. Ore is treated in a Gould rotary furnace. The Culver-Baer mine, where a 20-ton rotary was in use, was closed in December.

The Reed mine, Yolo County, was the fourth largest mercury producer in 1947, furnacing its ore. This mine was closed in November and December, production during those months coming from clean-up activity.

Idaho.—The Hermes mine, Yellow Pine district, Valley County, was the only mercury-producing property in Idaho in 1947 and was the sixth largest in the United States. Production was 886 flasks of mercury from 6,340 tons of ore, or far below capacity operations.

The mine is equipped with two rotary furnaces with a reported capacity of 80 tons each. In 1946, 868 flasks were produced, indicating an almost unchanged production rate.

Nevada.—Output of Nevada mines, chiefly Cordero, was second only to that for California for the third successive year. Production was from six mines and totaled 3,881 flasks from 20,362 tons of ore, compared with 4,567 flasks and 23,342 tons from seven mines in 1946. Elko, Esmeralda, Humboldt, and Pershing Counties each contributed some production, but that from Humboldt by far exceeded the others.

A little metal was produced by L. V. Pangburn in a retort at the Silver Fox property, Ivanhoe district, Elko County.

W. F. Dunnigan treated ore in a 30-ton Gould rotary furnace and produced some metal.

In the last quarter of 1947 the Cordero mine, Opalite district, Humboldt County, was the second largest mercury-producing mine in the United States, although ranking third for the year as a whole. Only San Benito and Sonoma Counties in California surpassed Humboldt County in mercury production in 1947. One other property in Humboldt County produced some mercury in 1947.

The Red Bird in the Antelope Springs district, Pershing County, was the second largest mercury-producing mine in Nevada in 1947. The Goldbanks mine, Goldbanks district, had a small output from ore treated in a retort.

Oregon.—Three properties in Oregon, by far the largest of which was the Bonanza mine, made up the State's output of 1,185 flasks in 1947 from 7,238 tons of ore, compared with double the number of mines and 1,326 flasks of mercury in 1946. The Bonanza mine contributed most of the output in both years; in 1947 it produced 1,182 flasks of mercury from 7,233 tons of ore treated in a rotary furnace. The Bonanza mine was the fifth largest mercury producer in the United States in 1947, as in 1946, despite the fact that output declined for the seventh successive year. The other two operations, in Crook and Harney Counties, produced very small quantities in 1947.

CONSUMPTION AND USES

Mercury consumption continued in 1947 well below wartime peaks but gained 13 percent over 1946 and was almost one-third above the prewar (1935–39) annual average. Expansion in use in the new mercury dry cell was the chief factor in the higher consumption rate in 1947, and continuing expansion is expected to require larger quantities in 1948. The quality and performance of the new cell were reported to have made good progress in 1947. A continued low price for the metal and assured supplies are said to be requirements for further gains in consumption for this purpose. Agricultural use of mercury likewise gained notably in 1947 over 1946. Research in connection with new mercury boiler installations may bring about greater use of the metal, and continued low prices are a stimulant to that end.

Mercury consumed in the United States, 1946–47, in flasks of 76 pounds

Use	1946 [1]	1947	Use	1946 [1]	1947
Pharmaceuticals	4,095	3,047	Catalysts	3,310	5,078
Dental preparations	1,133	785	Electrical apparatus	[2] 3,889	[2] 6,763
Fulminate:			Industrial and control instruments	[2] 4,609	[2] 5,394
Munitions Blasting caps	682	523	Amalgamation	99	138
Agriculture	3,134	5,617	General laboratory	269	333
Antifouling paint	994	760	Redistilled	[2] 5,574	[2] 4,689
Electrolytic preparation of—			Other	3,214	1,761
Chlorine Caustic soda	550	693		31,552	35,581

[1] Revised.
[2] A partial break-down of the "redistilled" classification showed 47 percent was for instruments, 22 percent for dental preparations, and 10 percent for electrical apparatus in 1946 and 52, 10, and 22 percent, respectively, in 1947.

Mercury consumed in the United States, 1940–45, by months, and 1946–47, by quarters, in flasks of 76 pounds

Month	1940	1941	1942	1943	1944	1945	1946	1947
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	6,800	9,000
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	8,100	8,500
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	7,400	7,700
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	8,900	9,900
December	2,100	3,900	4,500	3,200	3,900	2,000		
Total: Preliminary	26,800	44,800	49,700	54,500	42,900	63,900	31,200	35,100
Final						62,429	[1] 31,552	35,581

[1] Revised.

The use of mercury and other compounds for mildewproofing was described [3] in a recent report. Among other things the report states:

> The phenylmercurics render important service in a great many industries. They are used in tanning, in paints, in paper mills, in sap stain prevention of lumber, and wood impregnation.
>
> Similar to the phenylmercurics are the newly developed pyridylmercurics—the stearate, chloride, and acetate. These compounds are suggested for use in fabrics, rubber, paper, cork, lacquer, and wax fungus-proofing. The high water-solubility of pyridylmercuric acetate is unique in this group and the phenylmercurics. Under the trade name "Pyridose" (Mallinckrodt), it is sold as a slime-control agent for paper mills.

Consumption of an important quantity of mercury in the form of phenylmercuric acetate as a crabgrass killer appears promising.

A comparison of chlorine and caustic soda production by two types of manufacture was made [4] recently. A new mercury cell, claimed to have certain advantages over the German cells, recently was described.[5] An installation of the new-type cell in Canada has been announced.[6]

[3] Block, S. S., Mildewproofing Compounds—New Chemicals, New Knowledge, Can Curb Fungus Ravages: Chemical Industries, vol. 62, No. 2, February 1948, pp. 226–231.
[4] MacMullin, Robt. B., Diaphragm vs. Amalgam Cells for Chloride-Caustic Production: Chemical Industries, vol. 61, No. 1, July 1947, pp. 41–50.
[5] Gardiner, W. C., New Mercury Cell Makes Its Bow: Chemical Engineering, vol. 54, No. 11, November 1947, pp. 108–112.
[6] Canadian Chemistry and Process Industries: Vol. 33, No. 2, February 1948, p. 161

STOCKS

Industrial inventories of mercury changed little in 1947. From the accompanying table it will be noted that no mercury was held by the Office of Metals Reserve at the end of 1947, such metal having moved into the Government strategic stock pile.

Stocks of mercury in hands of consumers and dealers, producers, and Office of Metals Reserve, 1943–47, in flasks of 76 pounds

End of year	Consumers and dealers	Producers [1]	Office of Metals Reserve	Total
1943	13,200	3,457	[2] 69,852	86,500
1944	10,400	2,714	67,812	80,900
1945	17,000	3,243	63,638	83,900
1946	16,400	2,599	20,884	39,900
1947	16,200	3,084	------------	19,284

[1] Operators that account for roughly 95 percent of output.
[2] Total Government inventory.

PRICES

Quotations for mercury declined throughout the year, continuing the downtrend generally in progress since March 1945; the average price for the year of $83.74 a flask at New York was the lowest annual average since 1938, when it was $75.47 a flask. The 1947 price was only 43 percent of the all-time peak annual price of $196.35 for 1942. The movement in mercury prices was against the trend in most commodities, including items affecting costs of production of mercury, with a resultant adverse effect upon the mercury-producing industry. Bureau of Labor Statistics index prices for nonferrous metals and for all commodities in 1947 were 93 percent in each case above those for 1938. The low level of mercury prices compared with other metals since the reestablishment of free markets may be explained in part by the fact that mercury ceiling limitations during the war were at proportionately much higher levels than were those for other metals. At the beginning of 1947 quotations for mercury ranged from $88 to $92 a flask and at the end of the year from $79 to $81 a flask.

Because of the domestic tariff of $19 a flask on mercury, the differential between New York and London prices normally favors the New York price, although seldom by as much as the tariff. Following the outbreak of the war in Europe in 1939 until December 1946, however, the London price was almost always in excess of the New York average. Throughout 1947 the normal relationship existed.

In May, Mercurio Europeo reduced its export price by $14.50 to the basis of $65 a flask at Spanish or Italian ports, and the British price was reduced an equivalent amount in the same month. The Cartel price was reduced another $5 in August, with a corresponding drop in the London quotation. The British quotation was reported as £20 15s. 0d. in January and £16 0s. 0d. in December.

Average monthly prices per flask (76 pounds) of mercury at New York and London, and excess of London price over New York price, 1945–47

Month	1945			1946			1947		
	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	$156.85	$281.44	$124.59	$104.81	$126.06	$21.25	$88.00	$83.61	[3] $4.39
February	165.55	281.44	115.89	102.73	126.06	23.33	86.86	83.57	[3] 3.29
March	162.00	281.44	119.44	103.92	126.06	22.14	86.85	83.57	[3] 3.28
April	156.84	281.44	124.60	102.46	126.05	23.59	85.77	83.57	[3] 2.20
May	153.69	281.44	127.75	101.00	126.04	25.04	84.46	77.81	[3] 6.65
June	147.73	281.44	133.71	99.40	126.05	26.65	84.00	69.17	[3] 14.83
July	140.72	281.06	140.34	98.31	126.05	27.74	84.00	69.17	[3] 14.83
August	123.20	280.88	157.68	97.56	126.05	28.49	84.00	67.28	[3] 16.72
September	95.84	280.74	184.90	96.00	126.04	30.04	81.64	64.48	[3] 17.16
October	101.39	126.01	24.62	95.19	126.00	30.81	80.69	64.50	[3] 16.19
November	106.87	126.06	19.19	89.39	100.57	11.18	79.64	64.49	[3] 15.15
December	108.00	126.05	18.05	88.12	83.61	[3] 4.51	79.00	64.50	[3] 14.50
Average	134.89	242.45	107.56	98.24	120.39	22.15	83.74	73.02	[3] 10.72

[1] Engineering and Mining Journal, New York.
[2] Mining Journal (London) prices in terms of pounds sterling are converted to American dollars by using average rates of exchange 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; maximum prices were revoked in August 1946.
[3] New York excess. (The resumption of a New York excess is a return to a normal relationship.)

FOREIGN TRADE [7]

Imports of mercury for consumption in the United States in 1947 continued the decline, in progress in 1946, from the all-time peak established in 1945; the 1947 total amounted to only 19 percent of the abnormal quantity for 1945. Actual receipts of mercury from abroad during 1947 (general imports) fell 56 percent from 1946 and were only 14 percent of the 1945 total. General import data give a more accurate record of materials actually entering the country during a given period than do imports for consumption.

Of general imports of 10,228 flasks in 1947 (comparisons with 1946 in parentheses), 3,107 (none) came from Japan, 2,161 (5,559) from Spain, 1,824 (6,669) from Mexico, 1,516 (10,284) from Italy, 1,500 (none) from Yugoslavia, and 120 (550) from Chile. The metal from Japan was imported under arrangements entered into between the U. S. Commercial Company, the Department of State, the War Department, and the Supreme Commander of the Allied Powers (SCAP) for the handling of Japanese exports. In the announcement of the U. S. Commercial Company regarding this purchase, the quantity was said to be 2,900 flasks, of which 1,800 were Italian mercury and 1,100 Japanese metal. The Government metal was for sale in the domestic market, and the entire quantity was reported disposed of by the end of October. The mine that produced the Yugoslavian metal was under Italian control after the end of World War I and before the end of World War II.

The long-time record covers "imports for consumption," which include imports for immediate consumption plus withdrawals from warehouse for consumption. Imports for consumption totaled 12,958 flasks in 1947, compared with 13,894 flasks in 1946. Of the 1947

[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.

total (comparisons with 1946 in parentheses), 3,498 (3,127) flasks came from Spain, 3,107 (none) from Japan, 2,900 (5,038) from Italy, 1,783 (5,360) from Mexico, 1,400 (none) from Yugoslavia, and 270 (369) from Chile.

Mercury imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Country	1943		1944		1945	
	Pounds	Value	Pounds	Value	Pounds	Value
Canada	1, 184, 211	$3, 009, 271	118, 906	$337, 177	130, 720	$237, 175
Chile	202, 148	506, 710	74, 627	152, 309	36, 285	55, 995
Honduras					1, 748	3, 621
Italy						
Japan						
Mexico	2, 238, 725	5, 010, 038	1, 288, 548	2, 012, 873	824, 789	1, 307, 402
Peru	8, 132	19, 934	3, 944	9, 397	11, 628	19, 570
Spain					4, 209, 720	7, 386, 167
Yugoslavia						
Total: Pounds	[1] 3, 633, 216	8, 545, 953	1, 486, 025	2, 511, 756	5, 214, 890	9, 009, 930
Flasks	[1] 47, 805		19, 553		68, 617	

Country	1946		1947	
	Pounds	Value	Pounds	Value
Canada	2	$6	1	$1
Chile	28, 064	27, 978	20, 536	17, 504
Honduras				
Italy	382, 880	325, 274	220, 352	180, 336
Japan			236, 161	251, 899
Mexico	407, 334	378, 235	135, 521	103, 015
Peru				
Spain	237, 676	201, 783	265, 843	201, 766
Yugoslavia			106, 400	71, 400
Total: Pounds	1, 055, 956	933, 276	984, 814	825, 921
Flasks	13, 894		12, 958	

[1] Includes 1,128,727 pounds (14,852 flasks) reexported and not separately classifiable by countries.

Imports of mercury compounds are insignificant, no mercuric chloride nor vermilion red being entered in 1947, and the total for mercury preparations being 2,240 pounds.

Of the exports of 884 flasks of mercury in 1947 (comparisons with 1946 in parentheses), 11 countries received 17 flasks or more, as follows: Czechoslovakia 140 (21), Union of South Africa 119 (36), Canada 92 (124), Netherlands 73 (48), Finland 58 (none) Argentina, 55 (6), Brazil 53 (258), China 51 (14), Nicaragua 20 (none), Saudi Arabia 19 (14), and the Philippine Republic 17 (7).

The larger total of 3,095 flasks of mercury reexported in 1947 went to 10 countries in quantities of 22 flasks or more, as follows: Canada 1,405 (502), United Kingdom 1,202 (none), Sweden 85 (367), Hong Kong 72 (50), Brazil 71 (493), Belgium 51 (105), Argentina 50 (193), Colombia 31 (22), Switzerland 29 (353), and Curacao 22 (29).

Mercury exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Pounds	Flasks of 76 pounds	Value	Year	Pounds	Flasks of 76 pounds	Value
1943	29,236	385	$88,842	1946	68,932	907	$113,817
1944	57,007	750	123,481	1947	67,148	884	90,659
1945	78,877	1,038	121,713				

WORLD REVIEW

World output in 1947 was close to the rate maintained in 1946, at little more than half of the all-time record established in 1941. The shrunken world markets, mainly because Germany and Japan no longer were among the chief consuming nations, were unable to use all of the new metal produced and the stocks on hand. Of the larger producing countries, only Italy is known to have had a larger output in 1947 as compared with 1946, Spain, the United States, and Mexico showing decreases. Yugoslavian production probably rose in 1947.

World production of mercury, 1941–47, by countries, in flasks of 34.5 kilograms (76 pounds) [1]

[Compiled by B. B. Mitchell]

Country [1]	1941	1942	1943	1944	1945	1946	1947
Algeria	147	121	146	165	326	340	348
Australia:							
New South Wales	1	(2)			(3)	(3)	(3)
Queensland	34	15	15	12	3		(3)
Austria	(3)	(3)	(4)	(4)	(3)	(3)	(3)
Bolivia (exports)			51	2	3		(3)
Canada	7,057	13,630	22,240	9,682			
Chile	1,305	2,256	2,563	1,181	862	827	(3)
China	2,756	4,293	3,133	3,510	1,828	1,189	290
Czechoslovakia	(3)	(3)	(3)	(3)	(3)	(3)	[5] 768
Germany	899	493	[4 6] 3,480	[4 6] 3,480	(3)		(3)
Italy	94,161	75,885	61,945	22,997	25,527	50,822	53,984
Japan [7]	4,323	5,197	6,706	7,096	3,139	1,361	1,619
Mexico	23,137	32,443	28,321	26,063	16,443	11,661	9,700
New Zealand	73	150	93	90	30		(3)
Peru		145	326	152	209	5	
Rumania		21	176	(3)	(3)	(3)	(3)
Southern Rhodesia	2	3	(2)		(2)		
Spain	86,473	72,288	47,756	34,349	40,694	41,801	35,420
Sweden	59	11		21	1		(3)
Tunisia	88	3	(2)				(3)
Turkey	242	176	271	143	158	75	(3)
Union of South Africa	204	579	1,189	1,192	852	764	
United States	44,921	50,846	51,929	37,688	30,763	25,348	23,244
Yugoslavia [8]						(3)	(3)
Total [7]	275,000	265,000	240,000	157,000	131,000	144,000	144,000

[1] Mercury is also produced in Korea and U. S. S. R. but production data are not available; estimates by senior author of chapter are included in total.
[2] Production less than 1 flask.
[3] Data not yet available; estimates by senior author of the chapter included in total.
[4] Austria included with Germany.
[5] By-product of pyrite production in Slovakia only.
[6] Estimate.
[7] Preliminary.
[8] Output of Idria mine included with Italy until ceded to Yugoslavia after World War II.

REVIEW BY COUNTRIES

Algeria.—In 1947, 348 flasks of mercury were produced and 464 flasks were exported; exports went entirely to France.

Italy.—Italy was the leading world mercury-producing country again in 1947, despite the absence of Idria's output from the Italian total. The total for 1947 was far below the peak rates sustained during the early part of the war period, and a considerably greater current output is waiting only for a sufficient outlet. The geology and other aspects of the mercury industry were described by Eckel,[8] whose report is abstracted in part as follows:

The Monte Amiata district is characterized geologically by a thick series of sedimentary rocks that range from Triassic to Eocene in age and are surmounted on Monte Amiata itself by a thick cap of extrusive trachyte. Bodies of travertine and of landslide detritus, younger than the trachyte, are rather widespread. The structure is complex and little known but most of the ore deposits seem to lie along or near a major, north-trending fault or on associated cross-fractures. Cinnabar is the only important ore mineral and clay minerals are by far the most abundant products of hydrothermal alteration. A southward increase in the amount of stibnite, relative to cinnabar, suggests horizontal zoning. The grade of ore ranges from 0.60 to 3.0 pct and the reserves, as compared with those in American mines, are enormous. Even in the face of wartime scarcities, the mines are remarkably self-sufficient and labor is plentiful, but the costs of production are estimated to be not greatly below those of the better American mines. Notes on the principal mines, on the mining and metallurgical methods, and on the manufacture of synthetic cinnabar are included in the paper.

A report describing the Monte Amiata district[9] was published recently. Another report,[10] among other things, discussed efforts of Italian producers to reestablish their industry in the postwar period.

Japan.—A comprehensive report covering mercury resources of Japan was released[11] in 1947. The report was summarized as follows:

1. Mercury production of 20 mines in Japan totaled 1,167 tons from 1925–45. Of this amount, 70 percent was from the Itomuka mine in Hokkaido. This mine operated from 1939–45, produced 817 tons of mercury, and attained a peak production of 196 tons in 1944. The only important mines operating in 1946, the Itomuka and Oketo, produced about 6.5 tons of mercury monthly. Proved and probable reserves were sufficient in 1946 to maintain that rate of production for 10 years, if the low rate of recovery during 1940–45 was maintained. With efficient mining, milling, and distillation practices, the reserve would last about 7 years longer.
2. Future requirements of Japan are estimated to be 200–300 tons of mercury per year. This estimate is based on the 1925–33 average of new available supplies. It assumes no new important uses of mercury and decreased buying power for essential mercury products. Domestic production probably can supply one-half the demand after consumer stocks are depleted. Consumer stocks at the end of 1946 were reported by Economic and Scientific Section, SCAP, to be 470 tons.
3. Mercury deposits are irregular in size, shape, and grade. For this reason, possible and prospective reserves are of greater concern than with other metal deposits. In Japan this is especially true, because of less intensive prospecting than in the United States and European countries and because of relatively heavy soil and vegetative cover. Modern practices in geologic surface and subsurface mapping and chance discoveries may lead to a material change in the 1945–46 reserve and production potential of mercury in Japan.

[8] Eckel, Edwin E., Mercury Industry in Italy: American Inst. of Min. & Met. Eng., Tech. Pub. No. 2292, January 1948, 21 pp.
[9] Mine and Quarry Engineering (London), The Mercury Mines of Tuscany: Vol. 13, No. 11, November 1947, pp. 325–330.
[10] The Mining Journal (London), Italian Mercury: Vol. 228, No. 5824, Apr. 5, 1947, pp. 171–172.
[11] Mercury Resources of Japan: Supreme Commander for the Allied Powers (Natural Resources Section) Rept. 91, Sept. 10, 1947, 62 pp.

Mexico.—The falling world price for mercury has affected output in Mexico adversely. Production of 9,700 flasks in 1947, compared with 11,661 in 1946, was only 30 percent of the all-time peak of 32,443 flasks established in 1942. Production of 1,300 flasks in the final quarter of 1947 contrasted with 3,700 flasks for the first quarter of the year. Virtually the entire 1947 output was exported.

Netherlands Indies.—A shipment in 1947 of slightly over 20 tons of mercury ore from Tandjong Priok to the United States for treatment yielded 65 flasks of metal, indicating an average mercury content of 12 to 13 percent.

Spain.—Production of mercury dropped 15 percent in 1947 and was equal to only 41 percent of the all-time peak established in 1941. As in Italy, output was affected adversely by inability of world markets to absorb potential world supplies. Exports were almost double the low total for 1946 but were well below production, and the already large stocks increased during the year. Notes on the Almaden mine were published [12] in 1947.

United Kingdom.—Foreign-trade figures for the United Kingdom indicate that use of mercury in this country may be approaching prewar levels. Imports in three selected years were as follows: 44,317 flasks in 1938, 2,023 in 1946, and 25,665 in 1947. Reexports during the 3 years were 15,498, 330, and 2,238 flasks, respectively, indicating that 28,819, 1,693, and 23,427 flasks, respectively, remained within the country for use.

At the beginning of the year the British Ministry of Supply price for mercury was £20 15s. 0d. per flask. It was reduced to £17 3s. 6d. in May and to £16 0s. 0d. in August, continuing at this level for the remainder of the year (a reduction of more than $19 a flask for the year).

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[12] The Mining Journal (London), Almaden: Past, Present, and Future: Vol. 229, No. 5837, July 5, 1947, pp. 400–401.

Mica

By G. RICHARDS GWINN AND E. M. TUCKER

GENERAL SUMMARY

THE production of sheet, punch, and scrap mica in 1947 decreased sharply from the total reported in 1946, but the output of ground mica again reached a new high. The consumption of sheet and punch mica also decreased from that reported in the previous year. The production of mica in India—the world's major source of block and splitting mica—in 1947 was again hampered by the fluctuating political situation and by strikes. The output of phlogopite mica from Madagascar in 1947 exceeded the 1946 total.

Certain sizes and qualities of muscovite sheet and film mica and some grades and sizes of muscovite and phlogopite splittings remained on the list of strategic minerals that must be stock-piled for national defense.

Reports on the exploration of mica deposits in Georgia,[1] North Carolina,[2] and New Meixco [3] and a review of methods of recovering scrap mica [4] were recently released by the Bureau of Mines.

There is an ever-increasing number of ceramic and plastic products that have reached the position of alternate materials (rather than substitutes) for some of the uses for which mica has previously been specified, and the programs for developing synthetic mica have advanced to the pilot-plant stage. Efforts were made during 1947 to reduce the tariff on block mica imported into the United States. Twenty-three nations signed a General Agreement on Tariffs and Trade at Geneva, Switzerland, effective January 1, 1948, and running for 3 years reducing the tariff on many mineral commodities. However, because India and Brazil failed to concur on the proposed reduction for mica, this mineral was not included in the final agreement.

The accompanying table of salient statistics summarizes domestic production and total supply of mica available in the United States for the 1943–47 period.

[1] Beck, W. A., Georgia Mica Spots: Bureau of Mines Rept. of Investigations 4239, 1948, 29 pp.
[2] Dahners, L. A., and McIntosh, F. K., North Carolina Mica Spots: Bureau of Mines Rept. of Investigations 4241, 1948, 16 pp.
[3] Holmquist, R. J., Apache Mica Mine, Rio Arriba County, N. Mex.: Bureau of Mines Rept. of Investigations 4037, 1947, 5 pp.
[4] Munson, G., and Clark, F. F., Studies on Methods for Recovering Scrap Mica from the Pegmatites of the Black Hills, South Dakota: Bureau of Mines Rept. of Investigations 4190, 1948, 26 pp.

Salient statistics of the mica industry in the United States, 1943–47

	1943	1944	1945	1946	1947
Domestic mica sold or used by producers:					
Total uncut sheet and punch:					
Pounds	3, 448, 199	1, 523, 313	1, 298, 587	1, 078, 867	415, 589
Value	$3, 228, 742	$3, 262, 711	$737, 342	$217, 955	$116, 110
Average per pound	$0. 94	$2. 14	$0. 57	$0. 20	$0. 28
Scrap: [1]					
Short tons	46, 138	51, 727	41, 060	53, 602	49, 797
Value	$738, 025	$1, 089, 072	$812, 322	$1, 041, 423	$1, 095, 578
Average per ton	$16. 00	$21. 05	$19. 78	$19. 43	$22. 00
Total sheet and scrap: [1]					
Short tons	47, 862	52, 489	41, 709	54, 141	50, 005
Value	$3, 966, 767	$4, 351, 783	$1, 549, 664	$1, 259, 378	$1, 211, 688
Total ground: [1]					
Short tons	51, 582	52, 713	51, 806	62, 113	64, 540
Value	$1, 990, 144	$1, 914, 709	$1, 995, 969	$2, 516, 018	$2, 967, 713
Consumption of splittings:					
Pounds	8, 413, 362	8, 816, 965	7, 897, 402	7, 815, 989	9, 309, 981
Value	$3, 518, 822	$4, 657, 730	$3, 415, 696	$4, 259, 478	$6, 680, 753
Imports for consumption:					
Total uncut sheet and punch:					
Pounds	5, 501, 745	5, 032, 983	4, 208, 130	4, 499, 562	1, 754, 419
Value	$6, 313, 900	$3, 921, 078	$4, 148, 737	$2, 288, 448	$1, 150, 958
Scrap:					
Short tons	2, 048	2, 412	3, 612	6, 207	5, 109
Value	$27, 102	$32, 688	$41, 950	$75, 846	$66, 408
Total sheet and scrap:					
Short tons	4, 799	4, 929	5, 716	8, 457	5, 986
Value	$6, 341, 002	$3, 953, 766	$4, 190, 687	$2, 364, 294	$1, 217, 366
Manufactured:					
Short tons	8, 960	2, 314	3, 695	5, 487	5, 699
Value	$9, 513, 064	$3, 707, 718	$2, 173, 133	$4, 754, 583	$6, 251, 613
Total imports:					
Short tons	13, 759	7, 243	9, 411	13, 944	11, 685
Value	$14, 854, 066	$7, 661, 484	$6, 363, 820	$7, 118, 877	$7, 468, 979
Exports (all classes of mica):					
Short tons	693	619	981	1, 542	1, 493
Value	$653, 889	$526, 824	$377, 473	$709, 109	$970, 326

[1] Includes mica recovered from kaolin and mica schists as follows: 1943, 24,113 tons, $314,851; 1944, 22,107 tons, $485,567; 1945, 15,046 tons, $324,515; 1946, 15,197 tons, $290,540; and 1947, 14,598 tons, $385,833.

DOMESTIC PRODUCTION

Sheet Mica.—The output of sheet and punch mica in 1947 reached 415,589 pounds valued at $116,110, a figure 61 percent below the 1,078,867 pounds valued at $217,955 reported in 1946. Punch mica in 1947 represented 83 percent of the total sheet produced, or 343,832 pounds valued at $47,099. As shown in the accompanying table, North Carolina in 1947 supplied 49 percent of the punch, 57 percent of the sheet, and 78 percent of the scrap mica produced in the United States. South Dakota in 1947, as in the previous year, was the second-largest mica-producing State. Many producers in 1947 as in 1946 failed to report production, and the Bureau of Mines was again obliged to depend largely on reports by purchasers to obtain complete totals of the domestic output of mica. The continued poor preparation of domestic sheet mica (half trim) is responsible in part for the decline in demand for domestic material.

Mica sold or used by producers in the United States, 1935–39 (average) and 1941–47

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
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	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	1,166,858	166,116	131,729	571,226	1,298,587	737,342	41,060	812,322	41,709	1,549,664
1946:										
North Carolina	339,997	54,684	84,794	80,821	424,791	135,505	39,100	887,901	39,312	1,023,406
South Dakota	13,884	2,148	3,516	6,284	17,400	8,432	2,806	63,692	2,815	72,124
Other States [2]	633,010	69,207	3,666	4,811	636,676	74,018	11,696	89,830	12,014	163,848
	986,891	126,039	91,976	91,916	1,078,867	217,955	53,602	1,041,423	54,141	1,259,378
1947:										
North Carolina	169,647	22,601	41,169	61,674	210,816	84,275	38,655	844,086	38,761	928,361
South Dakota	162,380	22,464	26,000	6,240	188,380	28,704	1,499	37,225	1,593	65,929
Other States [3]	11,805	2,034	4,588	1,097	16,393	3,131	9,643	214,267	9,651	217,398
	343,832	47,099	71,757	69,011	415,589	116,110	49,797	1,095,578	50,005	1,211,688

[1] Includes small quantities of splittings in certain years.
[2] Includes Alabama, California, Colorado, Connecticut, Georgia, Maine, New Hampshire, New York, South Carolina, and Virginia.
[3] Includes Alabama, Arizona, California, Colorado, Georgia, Maine, New Hampshire, and Virginia.

Scrap Mica.—Production of scrap mica in 1947 reached 49,797 short tons valued at $1,095,578, a figure 7 percent below the 53,602 tons valued at $1,041,423 reported in 1946. In addition to mine scrap, these figures include 14,598 short tons valued at $385,833 of mica reclaimed as a byproduct of kaolin washing and by milling mica schist. The shortage of scrap mica which developed in 1946 continued through 1947, and mica grinders imported large quantities of scrap from India, Africa, Canada, and Mexico.

The production of scrap and reclaimed mica for the 1942–47 period and the 1935–39 average are given in an accompanying table.

Scrap and reclaimed mica sold or used by producers in the United States, 1935–39 (average) and 1942–47

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
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	26,014	487,807	15,046	324,515	41,060	812,322
1946	38,405	750,883	15,197	290,540	53,602	1,041,423
1947	35,199	709,745	14,598	385,833	49,797	1,095,578

Ground Mica.—The production of ground mica in 1947 reached an all-time high of 64,540 short tons valued at $2,967,713, an increase of 4 percent over the previous record of 62,113 tons valued at $2,516,018 reported in 1946. Production figures for ground mica are broken down to show the quantities manufactured by wet and dry processes. A review of the methods of mica grinding has recently been released.[5]

Ground mica (including mica from kaolin and schists) sold by producers in the United States, 1943–47, by methods of grinding

Year	Dry-ground		Wet-ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
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	43,686	1,243,075	8,120	752,894	51,806	1,995,969
1946	53,908	1,582,974	8,205	933,044	62,113	2,516,018
1947	55,731	1,852,768	8,809	1,114,945	64,540	2,967,713

Because of the sharp decline in output of all kinds of mica and the small number of producers reporting, data on the production of sheet, punch, and scrap mica by districts are not available for publication in 1947. New Hampshire, which for many years has been the second largest mica-producing State, did not produce sheet or punch mica in 1947. Only scrap mica was reported in the Southwestern district, and no mica was produced in the Northwestern district.

[5] Rock Products, Fine Grinding of Mica: Vol. 50, No. 7, July 1947, pp. 92–93.

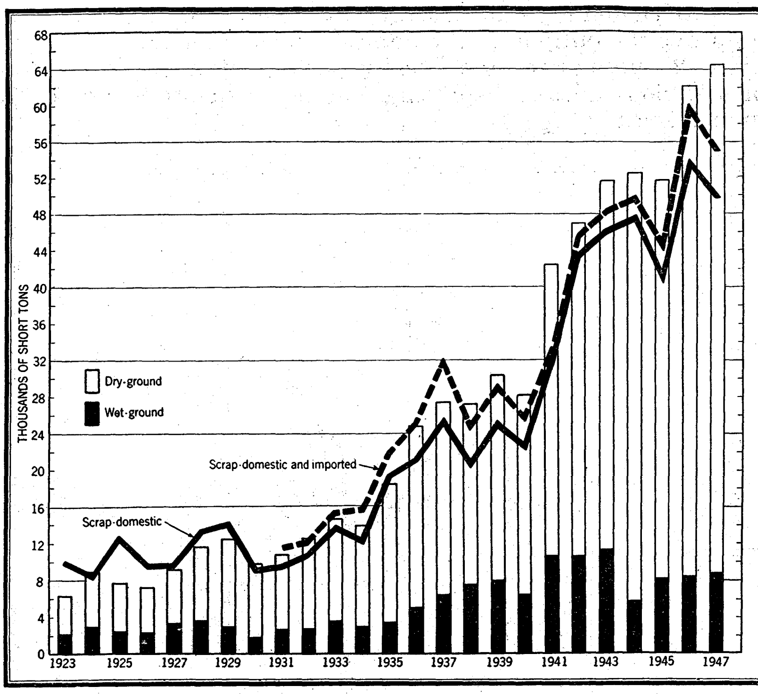

Figure 1.—Scrap and ground mica sold in the United States, 1923–47.

CONSUMPTION

The downward trend in the over-all consumption of block, splittings, and film mica which started in 1944 continued through 1947. As consumption of splittings reached a new high in 1947, the decrease is attributed to smaller demands for block and film mica.

Shortages of components other than mica, used by the electrical industry, accounted for some of the reduced demand; but, for the most part, the use of alternative materials was the major cause for the decline in consumption of block- and film-mica products. Eugene Munsell & Co. of New York, N. Y., formerly one of the large mica fabricators in the United States, discontinued the manufacture of mica products in January 1947 and is now only a wholesaler and importer of raw mica. It has also stopped purchasing domestic mica.

As demands have decreased, preparation requirements have increased. Mica fabricators require, and are obtaining, almost entirely from imported sources, three-quarter and full-trim block and film mica. Thus domestic material, which for the most part is offered as half-trim material, is not in great demand. It is reported that some fabricators of electric toasters, irons, and heaters which utilize large quantities of low-grade and low-price sheet mica are using domestic clear and slightly stained mica which, because of its poor preparation (half trim), is obtained at the same or essentially the same price as low-grade stained material. Although mining and preparation costs of mica in the United States are higher than those in other countries, it is believed that improved mining and preparation practices would reduce costs and improve the outlook of the domestic mica industry.

Figure 2 summarizes graphically the situation with respect to imports of block mica and splittings and domestic production of sheet and punch mica.

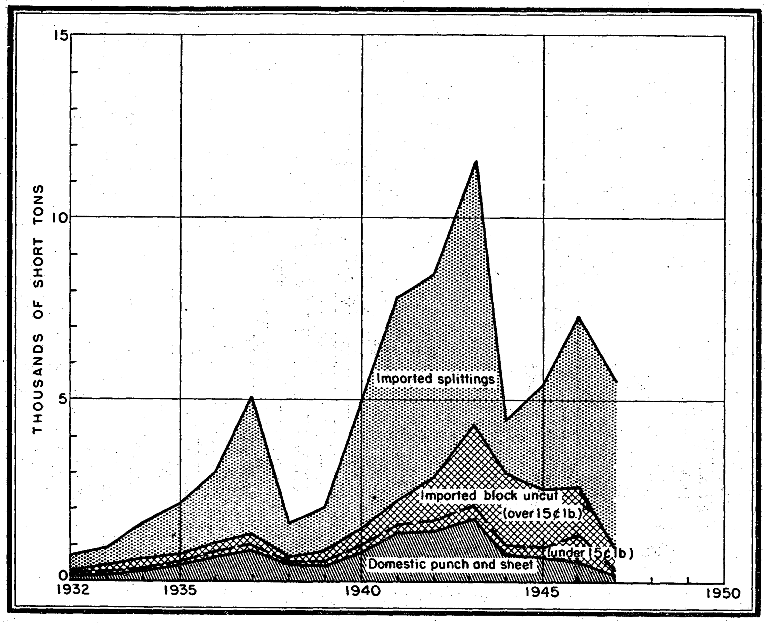

FIGURE 2.—Block mica splittings imported for consumption in the United States and sales of domestic sheet and punch mica, 1932–47.

Sheet, Punch, and Film Mica.—A summary of domestic production of sheet and punch mica and the apparent consumption of sheet, punch, and splittings for the 1936–47 period are given in an accompanying table. Domestic production in 1947 supplied only 4 percent of total consumption compared to 8 percent in 1946. The consumption of splittings in 1947 was 9,309,981 pounds, and the quantity of block- and film-mica products consumed was apparently 1,992,663 pounds. In 1946 the Bureau of Mines started to collect statistics on the consumption of block and film mica; but the returns obtained were not complete, and figures were not released. A more complete coverage was obtained in 1947, and what is believed to be a reasonably accurate account of the consumption of muscovite block and film and phlogopite block mica is shown in an accompanying table. The difference of 382,274 pounds between the two figures reported as block- and film-mica consumption is attributed to stocks held by mica fabricators and the inadequate classification of block-mica imports. As the United States at present depends almost entirely on imported sources for the better grades of block mica, some grades and sizes of which are essential for national security, it is important that accurate figures be obtained on mica consumption. Such data can continue to be compiled by the Bureau of Mines only with the full cooperation of industry.

Production of sheet and punch mica and apparent consumption of sheet and punch mica and mica splittings in the United States, 1936–47, in pounds

Year	Production	Apparent consumption	Year	Production	Apparent consumption
1936	1,319,233	5,721,685	1942	2,761,844	12,888,273
1937	1,694,538	7,160,616	1943	3,448,199	17,296,196
1938	939,507	3,029,447	1944	1,523,313	15,185,998
1939	813,708	5,147,448	1945	1,298,587	13,310,700
1940	1,625,437	8,093,174	1946	1,078,867	13,282,337
1941	2,666,453	12,040,476	1947	415,589	11,302,644

Consumption of block and film muscovite and phlogopite mica in the United States in 1947, in pounds

Type	Block	Film	Total block and film
Muscovite:			
Clear and slightly stained	19,698	90	19,788
Fair stained	4,445	35,450	39,895
Good stained	41,902	83,101	125,003
Stained	947,237		947,237
Heavy stained	390,791		390,791
Other	72,516	6,028	78,544
Total muscovite	1,476,589	124,669	1,601,258
Phlogopite (all qualities)	9,131		9,131
Grand total	1,485,720	124,669	1,610,389

Mica Splittings.—Consumption of mica splittings in the United States in 1947 reached an all-time high of 9,309,981 pounds valued at $6,680,753, an increase of 19 percent over the 7,815,989 pounds valued at $4,259,478 in 1946. Stocks of splittings on December 31, 1947, totaled 6,346,845 pounds valued at $4,783,643, a quantity 4 percent below the 6,588,932 pounds valued at $3,615,731 reported in 1946. The increase in consumption is attributed to the continued large demand for electrical products that utilize splittings in their manufacture. Consumption and stocks of mica splittings for the 1943–47 period are shown in the accompanying table.

Muscovite splittings in 1947, as in previous years, represented the bulk of the consumption and stocks of splittings, comprising respectively 90 and 92 percent of the totals reported. The better grades of phlogopite splittings, which are imported entirely from Madagascar, comprised, respectively, 6 and 5 percent of total consumption and stocks. The remaining 4 percent of the splittings consumed and 3 percent of stocks were made up of low-grade Canadian, Mexican, and domestic splittings.

Consumption and stocks of mica splittings in the United States, 1943–47, by sources, as reported by consumers

Source	1943		1944		1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Consumption:										
Domestic	26, 510	$11, 308	58, 350	$23, 862	94, 716	$46, 731	7, 220	$1, 651	81, 800	$66, 020
Canadian	344, 966	172, 674	601, 661	324, 631	321, 216	163, 658	292, 212	152, 969	[1] 254, 135	[1] 139, 504
Indian	7, 649, 596	3, 054, 995	7, 708, 253	4, 002, 010	7, 085, 316	2, 970, 013	7, 243, 835	3, 939, 595	8, 424, 625	6, 074, 465
Madagascar	337, 099	233, 788	371, 972	251, 945	324, 383	188, 530	217, 309	130, 040	549, 421	400, 764
Mexican	55, 191	46, 057	76, 729	55, 282	71, 771	46, 764	55, 413	35, 223	(1)	(1)
Total	8, 413, 362	3, 518, 822	8, 816, 965	4, 657, 730	7, 897, 402	3, 415, 696	7, 815, 989	4, 259, 478	9, 309, 981	6, 680, 753
Stocks in consumers' hands Dec. 31:										
Domestic	2, 200	1, 009	3, 694	1, 365	7, 000	3, 430	4, 541	1, 390	50, 700	23, 818
Canadian	138, 564	85, 893	141, 427	95, 850	143, 102	91, 115	275, 685	166, 786	[1] 110, 162	[1] 64, 561
Indian	4, 031, 849	1, 708, 096	3, 578, 885	1, 749, 011	2, 684, 848	1, 145, 176	5, 727, 615	3, 039, 429	5, 846, 763	4, 470, 649
Madagascar	215, 639	139, 797	184, 970	121, 307	193, 763	130, 661	535, 185	378, 174	339, 220	224, 615
Mexican	128, 959	97, 963	86, 001	57, 632	35, 876	21, 235	45, 906	29, 952	(1)	(1)
Total	4, 517, 211	2, 032, 758	3, 994, 977	2, 025, 165	3, 064, 589	1, 391, 617	6, 588, 932	3, 615, 731	6, 346, 845	4, 783, 643

[1] Mexican included with Canadian.

Built-Up Mica.—Consumption of built-up mica products in 1947 reached 6,896,114 pounds valued at $11,413,045 compared with 6,486,555 pounds valued at $10,285,862 in 1946. Thus the downward trend in consumption of built-up mica products which started in 1945 was stopped in 1947. Segment plate, heater plate, and flexible cold products increased in 1947 over the previous year's totals. Only molding plate and "all other" declined. The decline in "all other," which includes mica tape and slot insulation, is attributed to the increased use of plastic and glass insulating products.

Built-up mica produced in the United States, 1945–47, by kinds of product

Product	1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value
Molding plate	2,015,993	$2,096,267	1,742,835	$2,061,588	1,660,883	$1,832,779
Segment plate	2,441,076	3,074,435	1,860,173	2,460,860	1,920,875	2,513,205
Heater plate	390,598	716,903	685,580	1,283,908	1,248,461	2,351,901
Flexible (cold)	775,342	955,126	553,274	746,600	677,801	973,247
All other (tape, etc.)	1,571,900	3,003,988	1,644,693	3,732,906	1,388,094	3,741,913
Total	7,194,909	9,846,719	6,486,555	10,285,862	6,896,114	11,413,045

Ground Mica.—Dry ground mica is the major product accounting, respectively, for 86 percent of the tonnage and 62 percent of the value of the ground mica manufactured in 1947. The roofing, paint, and rubber industries, in the order named, were the largest individual consumers of ground mica in 1947. The roofing industry, which utilizes for the most part dry ground material, was by far the largest consumer, taking 62 percent of the total output of ground mica and 70 percent of the dry ground mica produced. Although the paint industry was the second largest user in 1947, the quantity consumed was less than that reported in 1946. The decline in consumption, however, is attributed to a shortage of raw material rather than a decrease in demand. The rubber industry also reported a smaller consumption in 1947 than in 1946.

Ground mica (including mica from kaolin and schists) sold by producers in the United States to various industries, 1946–47

Industry	1946			1947		
	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total	
Roofing	30,102	48	$791,639	40,012	62	$1,228,972
Wallpaper	2,827	5	240,786	1,724	3	205,454
Rubber	4,951	8	381,231	3,900	6	429,570
Paint	14,452	23	638,598	8,151	13	560,336
Plastics	321	1	33,066	1,374	2	72,836
Miscellaneous [1]	9,460	15	430,698	9,379	14	470,545
	62,113	100	2,516,018	64,540	100	2,967,713

[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.

A review of the manufacture of glass-bonded mica products (mycalex) which includes data on power factor, dielectric constant, and mechanical and physical properties of these materials was recently released.[6]

PRICES

Prices for domestic sheet and punch mica in 1947, as in the previous year, were based largely on negotiations between buyer and seller. Thus the following quotations from E&MJ Metal and Mineral Markets are nominal: Punch, 6 to 15 cents per pound, according to size and quality; sheet 1½ by 2 inches, 60 to 65 cents per pound; 2 by 2 inches, $1; 2 by 3 inches, $1.35; 3 by 3 inches, $1.80; 3 by 4 inches, $2.25; 3 by 5 inches, $3; 4 by 6 inches, $4; and 6 by 8 inches, $6 per pound.

Prices for scrap mica in 1947 ranged from $17.50 to $20 per short ton in the Western States to $18 to $35 per ton in the East. Prices on imported scrap, as reported by mica grinders, ranged from $24.50 to $40 per ton. Prices for ground mica as quoted in the Oil, Paint and Drug Reporter were as follows: Dry-ground, per short ton 100-mesh f. o. b. mill in carlots $47.50, less than carlots $51, roofing grade 20- to 80-mesh $50; wet-ground, freight allowed, $100 to $130 in carlots and $110 to $140 per ton less than carlots, depending on mesh size.

MICA SUBSTITUTES

Ceramic materials having exceptionally high dielectric constants have been produced at the National Bureau of Standards[7] and Massachusetts Institute of Technology.[8] These products are manufactured from titanium minerals and alkaline earths, and for some of the products a resin binder is added. A satisfactory method has been developed for the preparation of thin-disk dielectrics (not greater than 0.001 inch) and for stabilization of the highest dielectric constants over a wide temperature range for specimens prepared from mixtures of barium and strontium titanates with constants of 10,000 and 18,000. Condensers made from the thin ceramic sheets manufactured by the Massachusetts Institute of Technology are lighter in weight and give promise of standing higher temperatures than the usual paper and mica types.

A synthetic mica known as fluorine phlogopite mica, having the desirable characteristics of the natural mica now being stock-piled, has been successfully produced on a pilot-plant scale. Further research may reveal methods for direct fabrication of mica components, thus eliminating the task of sorting, grading, and splitting that is necessary with natural mica. The research on mica synthesis was started in June 1946 at the Colorado School of Mines under a Signal Corps contract. The Bureau of Mines Electrotechnical Laboratory at Norris, Tenn., started pilot-plant work on the problem September 1, 1947, under an Office of Naval Research contract. The Owens-Corning Fiberglas Corp. has also assisted and has made available

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[6] Monack, A. J., Rapid Insulator Production With Glass-Bonded Mica: Ceram. Ind., vol. 48, No. 2, February 1947, pp. 60–64.

[7] National Bureau of Standards, High-Dielectric Ceramics: Technical News Bull., vol. 31, No. 4, April 1947, pp. 39–40.

[8] Howatt, G. N., Breckenridge R. G., and Brownlow, J. M., Fabrication of Thin Ceramic Sheets for Capacitors: Jour. Am. Ceram. Soc., vol. 30, No. 8, August 1947, pp. 237–42.

data and patents acquired during its investigations in 1945 and 1946. It is believed that, as a result of these projects the engineering problems involved in producing synthetic mica on an industrial scale will be solved.

FOREIGN TRADE [9]

Imports.—In 1947 imports of all kinds of mica totaled 11,685 short tons valued at $7,468,979 compared with 13,944 tons valued at $7,118,877 in 1946, a decrease of 16 percent in quantity but an increase of 5 percent in value. The higher value is attributed to a general increase in the costs of all types of nica imported and to larger imports of "films" and "all mica manufactures." The decline in imports of the better grades of block mica which started in 1945 continued through 1947. In 1947, as in the previous year, Brazil was the United States' major source of block mica. Of the various types of mica imported in 1947 only ground mica showed a large increase. This is attributed to the continued large demand by the roofing and paint industries for ground mica and to the shortage in the United States of scrap mica—the raw material used in the preparation of the ground product.

Further details on imports, by kinds and sources, may be found in the accompanying table.

Mica imported for consumption in the United States in 1947,[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
Argentina							33,069	$4,177	212,674	$100,761
Brazil							28,466	3,234	835,554	765,231
British East Africa									3,405	14,929
Canada	2,560,600	$21,716			305,688	$57,066	124,200	13,620	4,501	7,491
Colombia									4,421	2,699
India			2,981,155	$19,673			896	118	179,941	109,381
Madagascar									551	1,688
Mexico	669,091	1,639							2,766	1,160
Peru									1,700	1,024
Portuguese Guinea and Angola			128,342	717					8,990	21,526
Southern Rhodesia									7,062	44,979
Switzerland									220	40
Union of South Africa			3,878,403	22,663						
United Kingdom									315	1,834
Total: 1947	3,229,691	23,355	6,987,900	43,053	305,688	57,066	186,631	21,149	1,262,100	1,072,743
1946	4,081,171	31,929	8,333,916	43,917	341,866	56,951	1,504,877	183,917	2,652,819	2,047,580

See footnote at end of table.

[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.

Mica imported for consumption in the United States in 1947,[1] 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
Brazil	10,323	$5,989	92,796	$46,626	21	$484	103,140	$53,099
Canada	3,360	2,184					3,360	2,184
India	8,426,147	5,137,435	360,140	525,778	8,686	21,028	8,794,973	5,684,241
Madagascar	623,496	301,659					623,496	301,659
Mexico	10,492	7,330	14,612	39,591	2,421	18,202	27,525	65,123
United Kingdom	2,000	5,646					2,000	5,646
Total: 1947	9,075,818	5,460,243	467,548	611,995	11,128	39,714	9,554,494	6,111,952
1946	9,377,847	3,907,324	404,066	566,571	10,662	51,951	9,792,575	4,525,846

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
Brazil	34,338	$18,804						
Canada	3	16					1,710,090	$33,415
Denmark	2	1						
India	97,000	79,319			40	$66		
Mexico	342	497			1,936	3,062		
Sweden	15	98						
United Kingdom	76	4,383						
Total: 1947	131,776	103,118			1,976	3,128	1,710,090	33,415
1946	372,052	203,491	1,000	$430	830	1,288	806,791	23,528

[1] Changes for table in Minerals Yearbook, 1945, p. 1508, are as follows: Phlogopite: Canada, 4,415,608 pounds, $27,191; total: 5,288,343 pounds, $29,618. Untrimmed phlogopite: Canada, 399,391 pounds, $56,432; total: 399,391 pounds, $56,432. Other: Valued above 15 cents per pound: Mozambique, 6,849 pounds, $39,470; Brazil, 1,536,944 pounds, $1,416,130; Southern Rhodesia, 761 pounds, $5,988; total: 3,224,168 pounds, $4,035,636. Not cut or stamped to dimensions: Over 12 ten-thousandths of an inch in thickness: India, 1,211,524 pounds, $408,444; total: 1,276,426 pounds, $496,464. Total: Films and splittings: India, 6,737,705 pounds, $1,919,148; total: 6,999,827 pounds, $2,152,042.

Exports.—The quantity of mica and mica products exported from the United States in 1947 reached 1,493 short tons valued at $970,326, compared to 1,542 tons valued at $709,109 in 1946. The decline is attributed to a decrease in quantity of manufactured sheet and built-up mica products exported in 1947. Unmanufactured- and ground-mica exports increased over the 1946 figures. Canada, Belgium and Luxembourg, Brazil, and Mexico were the chief foreign destinations. Details of exports appear in the following table.

Mica and manufactures of mica exported from the United States in 1947, by countries

Country	Unmanufactured		Manufactured			
			Ground or pulverized		Other	
	Pounds	Value	Pounds	Value	Pounds	Value
North America:						
Canada	137,297	$4,027	1,139,855	$56,270	97,250	$269,105
Cuba	720	205	15,792	1,689	2,129	5,905
Mexico	97,650	47,982	35,646	2,427	11,591	27,807
Other North America	4,690	940	1,300	343	1,048	3,158
South America:						
Argentina	8,800	572	96,800	4,126	321	2,095
Brazil	6,700	405	145,783	6,598	10,224	18,888
Chile			1,000	66	4,608	14,466
Colombia			10,000	628	1,858	2,731
Peru					1,700	1,920
Uruguay	1,145	4,114	21,000	1,323	2,455	907
Venezuela	4,400	275	35,200	2,294	4,504	5,587
Other South America	42	212			1,101	1,868
Europe:						
Austria					1,540	3,253
Belgium and Luxembourg			439,640	29,840	14,506	53,732
France			11,000	825	14,584	41,676
Hungary	100	1,121			2,271	9,207
Italy			32,000	2,480	45,498	163,536
Netherlands			31,141	2,535	6,364	34,720
Norway					660	1,524
Portugal			5,000	312	1,098	1,917
Spain			20,400	842		
Sweden			23,200	2,155	46,118	16,188
Switzerland			15,900	1,167	3,149	5,028
U. S. S. R					8,585	13,373
United Kingdom			120,000	7,208	1,348	6,553
Other Europe					1,996	4,474
Asia:						
China	1,200	3,650			10,683	21,480
Formosa					1,472	2,666
Hong Kong			4,000	126	49	173
India	52,796	11,791	50,000	2,012	658	1,689
Netherlands Indies			3,100	212	157	379
Philippines, Republic of	60	358			897	4,016
Other Asia	1,800	164			1,423	4,086
Africa:						
Algeria					562	738
Belgian Congo					330	1,092
Madagascar			2,000	160		
Southern Rhodesia					893	3,097
Union of South Africa	9,500	546	83,900	3,453	4,648	8,143
Other Africa					908	2,091
Oceania:						
Australia					1,545	3,971
Other Oceania	4,000	333			366	1,301
Total: 1947	330,900	76,695	2,343,657	129,091	311,097	764,540
1946	295,081	16,793	2,303,385	101,820	485,963	590,496

WORLD PRODUCTION

Information on world production of mica continues to increase, and it is believed that a break-down showing block and scrap mica will be available for all the major mica-producing countries for Minerals Yearbook, 1948. Such a break-down is given for United States production in the present table. Available figures on most of the mica-producing countries are shown in the accompanying table.

World production of mica, 1942–47, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1942	1943	1944	1945	1946	1947
North America:						
Canada (sales)	2,731	3,651	3,032	3,195	3,956	2,366
Guatemala	[2] 3	5	1	[3] 1	[3] 4	(4)
Mexico	44	104	[2] 111	[2] 409	[2] 81	[2] 231
United States (sold or used by producers): [5]						
Block	1,253	1,564	691	589	489	189
Scrap	39,246	41,855	46,926	37,249	48,627	45,175
South America:						
Argentina	625	402	594	719	430	(4)
Bolivia (exports)	3	2	2	---	---	(4)
Brazil (exports)	866	796	941	984	1,148	866
Peru	5	9	113	491	207	(4)
Uruguay	---	---	3	---	6	14
Europe:						
Italy	256	---	(4)	(4)	(4)	(4)
Norway	1,391	981	[2] 724	[2] 564	[2] 224	[2] 69
Portugal	(4)	219	[6] 1,200	(4)	(4)	(4)
Rumania	116	628	(4)	(4)	(4)	(4)
Spain	334	387	239	18	4	12
Sweden	494	327	335	126	69	(4)
Asia:						
Ceylon	---	2	2	1	(7)	(7)
India (exports)	8,729	10,242	3,670	4,859	10,671	10,009
Korea	111	146	422	95	(4)	(4)
Africa:						
British East Africa:						
Kenya	} 12	} 41	(7)	(4)	---	---
Tanganyika			[2] 128	[2] 250	[2] 342	[2] 71
Uganda			12	5	(7)	---
Eritrea	---	---	(4)	---	(4)	3
Madagascar	320	343	493	620	468	[2] 536
Portuguese East Africa	1	---	4	2	2	(4)
Portuguese West Africa	(7)	1	4	20	31	89
Rhodesia:						
Northern	4	10	16	7	(7)	---
Southern	14	54	250	196	335	296
Union of South Africa	1,265	1,274	1,127	1,131	1,785	3,386
Oceania:						
Australia	206	88	146	134	230	326
New Zealand	(4)	(7)	(7)	(7)	---	---
Total (estimate) [1]	58,100	63,100	61,700	52,200	70,000	65,100

[1] In addition to countries listed mica is also produced in Austria, China, Colombia, Ethiopia, and U. S. S. R., but data on production are not available; no estimates for these countries are included in the total.
[2] Exports.
[3] Imports into United States.
[4] Data not available; estimate by author of the chapter included in total.
[5] Includes following quantities recovered from kaolin and schists—1942: 18,580 tons; 1943: 21,875 tons; 1944: 20,055 tons; 1945: 13,649 tons; 1946: 13,786 tons; 1947: 13,243 tons.
[6] Estimate.
[7] Less than 1 ton.

Molybdenum

By HUBERT W. DAVIS

GENERAL SUMMARY

REVERSING a downward trend that had persisted for three consecutive years, the output of molybdenum concentrates turned upward in 1947 and was 48 percent greater than in 1946. Likewise, shipments, which had declined progressively for 4 years, exceeded those in 1946. Colorado had been the largest molybdenum-producing State for 23 consecutive years but surrendered the lead to Utah in 1947. New Mexico regained third place in 1947.

The greatly accelerated activity in the steel industry, which employs about 70 percent of the total molybdenum consumed in the United States, was reflected in gains of 38 and 23 percent, respectively, in production and shipments of molybdic oxide, calcium molybdate, and ferromolybdenum in 1947 over 1946. Output and shipments of other molybdenum products (chiefly ammonium molybdate, sodium molybdate, and metal) were also higher. As a consequence of the greater demand for molybdenum products in 1947, the quantity of molybdenum concentrates converted to oxide was 35 percent more than in 1946.

No molybdenum concentrates were imported into the United States in 1947. Exports in 1947, however, were five times those in 1946.

Industry stocks of molybdenum concentrates were 23 percent larger at the end of 1947 than at the close of 1946, but stocks of molybdenum products were virtually unchanged.

Salient statistics of molybdenum concentrates in the United States, 1943–47

	Molybdenum contained, thousands of pounds				
	1943	1944	1945	1946	1947
Production	61,667	38,679	30,802	18,218	27,047
Shipments (including exports)	53,955	39,423	[1] 33,683	[1] 16,787	22,190
Exports	10,071	5,985	2,863	565	2,989
Imports for consumption [2]	1,572	2,354	204	(3)	----------
Consumption	49,891	31,520	32,696	14,994	20,221
Stocks (industry), Dec. 31	17,993	19,335	16,899	[1] 19,294	23,682

[1] Revised figure.
[2] Excludes imports for conversion and reexport as follows: 1943, 216,398 pounds; 1944, 1,145,440 pounds; 1945, 460,416 pounds; 1946, 276,465 pounds; 1947, none.
[3] 10 pounds.

DOMESTIC PRODUCTION

The total production of molybdenum concentrates was 27,047,000 pounds (contained molybdenum) in 1947, an increase of 48 percent over 1946. The chief mineral of molybdenum is molybdenite (MoS_2); which accounted for virtually the entire output in 1947; powellite [$Ca(Mo,W)O_4$] contributed a relatively small quantity. Wulfenite ($PbMoO_4$), once mined from several deposits in southwestern United States, has not been produced since 1944.

Molybdenum was produced in six States in 1947; Utah led, followed in order by Colorado, New Mexico, Arizona, Nevada, and California. In 1947 Utah displaced Colorado as the chief producing State. Output of concentrates at mines operated solely for molybdenum was 11,670,300 pounds in 1947, an increase of 5.5 percent over 1946, whereas byproduct concentrates from copper and tungsten operations totaled 15,376,700 pounds, a gain of 115 percent. Byproduct molybdenum represented 57 percent of the total concentrates produced in 1947 as compared with 39 percent in 1946.

Shipments of molybdenum concentrates were 22,189,800 pounds (contained molybdenum) in 1947, an increase of 32 percent over 1946.

Molybdenum in ore and concentrates produced and shipped from mines in the United States, 1938–47 [1]

Year	Production (pounds)	Shipments from mines		Year	Production (pounds)	Shipments from mines	
		Pounds [2]	Value [3]			Pounds [2]	Value [3]
1938	33,297,000	25,727,000	$17,977,000	1943	61,667,000	53,955,000	$38,500,000
1939	30,324,000	32,415,000	22,157,000	1944	38,679,000	39,423,000	27,999,000
1940	34,313,000	25,329,000	17,189,000	1945	30,802,000	[4]33,683,000	23,976,000
1941	40,363,000	38,377,000	25,996,000	1946	18,218,000	[4]16,786,600	11,529,000
1942	56,942,000	66,437,000	47,275,000	1947	27,047,000	22,189,800	15,178,000

[1] For shipments by years, 1914–37, see Minerals Yearbook, 1941, p. 629.
[2] Figures for 1938–44 represent shipments from mines, plus concentrates converted to oxide by producer at Miami, Ariz.; those for 1945–47 represent shipments to domestic and foreign customers, plus concentrates converted to oxide at Miami, Ariz., and Langeloth, Pa.
[3] Largely estimated by Bureau of Mines.
[4] Revised figure.

REVIEW BY STATES

Arizona.—The Miami Copper Co. was the sole producer of molybdenum in Arizona in 1947. Since 1938 it has been a regular producer of molybdenite which is recovered as a byproduct of its copper operations at Miami, Ariz. Output of molybdenite concentrates, which are converted to molybdic oxide at Miami, was 23 percent less in 1947 than in 1946.

The Squaw Peak Copper Mining Co. at Camp Verde, which had a small output of molybdenite in 1946, was nonproductive in 1947.

California.—The only producer of molybdenum in California is the United States Vanadium Corp. at Bishop, where the metal is recovered as a byproduct of tungsten production. The treatment plant of the company was operated at a greatly reduced rate in 1947; as a consequence, recovery of molybdenum concentrates was 43 percent less than in 1946. Molybdenum occurs as molybdenite and powellite, which comprised about 29 and 71 percent, respectively, of the output in 1947.

Colorado.—Colorado, which had been the premier molybdenum-producing State for 23 consecutive years, surrendered the lead to Utah in 1947. Nevertheless, output in 1947 was 5.5 percent greater than in 1946. The ore deposits of Colorado are exploited only for their molybdenum content; and, in general, production is geared to demand, whereas in Utah output of molybdenum is a byproduct of copper operations and, consequently, is governed largely by the rate of copper mining.

The Climax Molybdenum Co., operating the world-famous deposit at Climax, Colo., was the sole producer of molybdenite concentrates in Colorado in 1947; its output was 6.4 percent greater in 1947 than in 1946. Most of its 1947 output of concentrates was shipped to its processing plant at Langeloth, Pa., where the company produces ferromolybdenum, calcium molybdate, molybdic oxide, and other molybdenum products.

The Urad mine of the Molybdenum Corp. of America at Empire, Colo., a comparatively small producer in 1946, had no output in 1947.

Nevada.—Since 1941 the Nevada Mines Division of the Kennecott Copper Corp. has been the lone producer of molybdenite concentrates in Nevada. The concentrates are recovered as a byproduct of the McGill concentrator, where copper ores from the company Ruth and Copper Flat operations and from the Emma Nevada group of Consolidated Coppermines Corp. are milled. Output of concentrates was 6.5 percent more in 1947 than in 1946.

New Mexico.—The Chino Mines Division of the Kennecott Copper Corp., Hurley, and the Molybdenum Corp. of America, Questa, continued to be the only producers of molybdenite in New Mexico in 1947. A small gain in production at the Questa mine in 1947 was more than offset by a loss at Chino mines; as a consequence, output of both operations was 2.5 percent less than in 1946. At Hurley molybdenite has been recovered as a byproduct of copper operations since 1937. The Questa mine, which is operated for molybdenum only, was opened in 1919 and since 1923 has been a regular producer. A larger flotation plant to serve the Questa mine was completed in 1947; it will treat accumulated mill tailings as well as ore. A log-type dryer, replacing a manual-drying operation, has also been installed at the Questa mine to dry the concentrates. The concentrates produced at Questa are shipped to the processing plant of the Molybdenum Corp. of America at Washington, Pa., where the company produces ferromolybdenum, calcium molybdate, molybdic oxide, and other molybdenum products.

Utah.—Utah ascended to first place as a producer of molybdenum in 1947, displacing Colorado, which had ranked first for 23 consecutive years. The sole producer in Utah is the Utah Copper Division of the Kennecott Copper Corp., which since 1936 has been recovering molybdenite as a byproduct of copper at its Arthur and Magna concentrators. Output of molybdenite concentrates in Utah was 154 percent more in 1947 than in 1946. Some output was lost in 1947 as a result of a 15-day strike by employees of the railroad serving the mine and concentrators, which were closed during this period.

RESERVES

The following information on reserves of molybdenum in the United States was prepared by the Bureau of Mines and Geological Survey and published in hearings before a Subcommittee of the Committee on Public Lands, United States Senate, Eightieth Congress, first session, 1947, pages 267–269.

The molybdenum resources of the United States comprise a larger proportion of known world resources than that of any other metal in common use. Domestic reserves have been segregated into three groups: (1) Deposits valuable principally for molybdenum and those containing molybdenum recoverable as a byproduct under economic and technologic conditions similar to those of 1943; (2) potentially productive deposits that might become available at present or slightly increased prices, or with improvements in technology; and (3) deposits that, because of physical features, grade, or other factors, cannot now be considered commercial and are unlikely to become so in the near future. All of group 1 and an appreciable proportion of group 2 can be considered reserves available now, or in the near future, for normal demands and as supplementary sources in times of national emergency. The accompanying table shows the known measured, indicated, and inferred reserves of molybdenum. Recoverable molybdenum has not been estimated because recovery differs greatly from plant to plant, particularly from byproduct sources where technology is continually improving.

Estimated molybdenum reserves of the United States as of 1943, by commercial availability

Availability:	Molybdenum (metal) content (in pounds)
1. Commercial under conditions similar to those of 1943	2,600,000,000
2. Potentially commercial and marginal	900,000,000
3. Submarginal	more than 3,500,000,000

In group 1 shown in the table, the grades of ore generally exceed 0.5 percent of molybdenite (molybdenum sulfide, MoS_2), except for the byproduct molybdenum in copper mining, in which the grades range from 0.02 to 0.2 percent of MoS_2. Although the grade of some ores included in group 2 exceeds 0.5 percent of MoS_2, most of the ore is below this grade, but none with a cut-off less than 0.25 percent of MoS_2 is included, except in the byproduct class. In groups 1 and 2 the reserves are considered measured and indicated except insofar as the byproduct reserves of the larger copper deposits may be classed as inferred.

The reserves in group 3, which are largely inferred, include large deposits in several Western States and Alaska containing 0.05 to 0.25 percent of molybdenite, vanadiferous shales, and partly explored areas adjacent to the principal known molydenum deposits.

The commercial, potentially commercial, and marginal reserves of molybdenum in the United States are equivalent to over 400 years supply at the average rate of domestic consumption from 1935 to 1939 and nearly 100 years supply at the wartime rate. They are equivalent to the output of about 140 years at the prewar rate of production.

Up to the present the United States has dominated world production and consumption of molybdenum, and its production facilities are flexible enough to meet any anticipated demands. However, in future some competition in world markets may arise, chiefly from South American copper deposits and from recently discovered molybdenum deposits in Manchuria, reportedly of great extent.

CONSUMPTION AND USES

Consumption (as measured by shipments to domestic consumers) of molybdenum products in the United States was 20 percent greater in 1947 than in 1946. The largest single use for molybdenum is as an alloying element in the manufacture of steels, to which it is added as molybdic oxide, calcium molybdate, or ferromolybdenum. In general, when an entire open-hearth heat is to be alloyed to a degree not exceeding 0.8 percent molybdenum, the addition is in the form of molybdic oxide or calcium molybdate; ferromolybdenum is used when higher percentages of molybdenum are desired. Of the total molybdenum used in the United States, it is estimated that about 70 percent is in steels. The addition of molybdenum to various grades of stainless steel increases resistance to most chemical attacks. Molybdenum is finding an expanding market in the high-temperature alloys developed for various components of gas turbines, as well as in jet aircraft engines and turbosuperchargers.

According to Knight,[1] at least 40 high-temperature alloys, of which about 35 were designed to stand temperatures of 1,200° to 1,600° F., have been developed. Of these high-temperature alloys, 19 contain molybdenum ranging from 0.4 to 25 percent.

Much smaller quantities (about 20 percent of the total) of molybdenum, chiefly in the form of ferromolybdenum and molybdic oxide, are employed in gray iron and malleable castings. Molybdenum in various forms finds limited employment in the chemical, electrical, and ceramic industries, which account for about 10 percent of the total. A relatively small quantity of concentrates (53,300 pounds of contained molybdenum in 1947) is used by a few steel companies as an addition to the molten metal in the ladle to raise the sulfur content to improve machinability, in addition to gaining the benefit of the contained molybdenum. Experiments with molybdenum as a fertilizer for deficient soils have been described.[2]

Production and shipments of molybdenum products[1] in the United States, 1943–47, in pounds of contained molybdenum

Year	Production	Shipments		
		To domestic consumers	Exported[2]	Total
1943	47,982,700	38,865,500	4,571,700	43,437,200
1944	30,579,800	31,138,500	1,577,500	32,716,000
1945	32,406,300	26,977,200	1,327,000	28,304,200
1946	15,039,100	16,501,700	442,400	16,944,100
1947	20,659,700	19,878,500	866,400	20,744,900

[1] Comprises ferromolybdenum, molybdic oxide, and molybdenum salts and metal.
[2] Reported by producers to the Bureau of Mines.

[1] Knight, H. A., Super Alloys for High-Temperature Service: Materials and Methods, vol. 23, No. 6, June 1946, pp. 1557–1563.
[2] Chemical Engineering and Mining Review (Melbourne), vol. 39, No. 7, Apr. 10, 1947, p. 257.

STOCKS

The accompanying table shows industry stocks of molybdenum concentrates and products, 1943–47.

Industry stocks of molybdenum concentrates and products, Dec. 31, 1943–47

[Thousands of pounds]

Year	Molybdenum content			Year	Molybdenum content		
	Concentrates	Products [1]	Total		Concentrates	Products [1]	Total
1943	17,993	12,176	30,169	1946	[2] 19,294	10,793	[2] 30,087
1944	19,335	8,740	28,075	1947	23,682	10,821	34,503
1945	16,899	12,829	29,728				

[1] Comprises ferromolybdenum, molybdic oxide, and molybdenum salts and metal.
[2] Revised figure.

PRICES

Since 1938 the published price, f. o. b. mines, of molybdenite in concentrates containing 90 percent MoS_2 has been 45 cents a pound (equivalent to 75 cents a pound of molybdenum contained). Molybdenite concentrates are shipped largely to processing plants for conversion to molybdic oxide, the form in which most molybdenum is employed in iron and steel plants. Some oxide, however, is employed in making ferromolybdenum and calcium molybdate, which are also used in the manufacture of iron and steel. The prices of the principal molybdenum products are based on a pound of contained molybdenum, f. o. b. producer's plant. Throughout 1947 molybdic oxide and calcium molybdate were quoted at 80 cents a pound and ferromolybdenum at 95 cents.

FOREIGN TRADE [3]

Imports of molybdenum ore and concentrates into the United States for consumption are normally small, and in 1947 none was received compared with only 10 pounds (contained molybdenum) in 1946. Some molybdenum ore and concentrates are imported for conversion to molybdenum products, which are exported; no ore or concentrates were so imported in 1947 compared with 276,465 pounds (contained molybdenum) from Chile in 1946.

Exports of molybdenum concentrates were 2,989,251 pounds (contained molybdenum) in 1947 compared with 564,924 pounds in 1946. Taking 60 and 19 percent, respectively, of the total, the United Kingdom and France were the chief foreign markets in 1947.

Exports of ferromolybdenum were 953,034 pounds (gross weight) in 1947 compared with 740,523 pounds in 1946, and those of molybdenum metal and alloys were 133,106 pounds compared with 220,532 pounds in 1946.

The duty on molybdenum ores and concentrates continued to be 17½ cents a pound on the metallic molybdenum contained; and on

[3] 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.

ferromolybdenum, molybdenum metal and powder, calcium molybdate, and other compounds and alloys of molybdenum it was 50 cents a pound of molybdenum contained plus 15 percent ad valorem.

Molybdenum ore and concentrates exported from the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Molybdenum content (pounds)	Value	Molybdenum content (pounds)	Value	Molybdenum content (pounds)	Value
Argentina	----------	----------	----------	----------	2,050	$1,808
Austria	----------	----------	----------	----------	6,589	5,502
Canada	705,633	$468,400	30,000	$24,000	101,650	81,320
Cuba	----------	----------	1,940	815	----------	----------
Czechoslovakia	----------	----------	----------	----------	21,820	15,422
Italy	----------	----------	----------	----------	392,378	294,433
France	354,142	231,959	----------	----------	555,840	418,509
Netherlands	12,544	10,097	----------	----------	----------	----------
Sweden	115,364	91,954	301,031	172,109	105,915	84,895
U. S. S. R.	1,674,834	1,126,777	----------	----------	----------	----------
United Kingdom	----------	----------	231,153	173,365	1,803,009	1,330,296
Venezuela	----------	----------	800	735	----------	----------
	2,862,517	1,929,187	564,924	371,024	2,989,251	2,232,185

WORLD REVIEW

Despite the fact that molybdenum is produced in many parts of the world, the combined output of all countries other than the United States is less than 15 percent of the world total, and most of that comes from a few countries.

World production of molybdenum in ores and concentrates, 1940–47, by countries, in metric tons [1]

[Compiled by B. B. Mitchell]

Country [1]	1940	1941	1942	1943	1944	1945	1946	1947
Australia	20	24	7	15	9	(2)	4	(3)
Austria	--------	--------	4	5	7	(2)	20	(3)
Canada	5	47	43	178	509	220	184	183
Chile	267	229	580	680	1,051	841	560	402
China:								
Manchuria [4]	(3)	75	384	516	516	30	(3)	(3)
Other Provinces [5]	7	5	3	(3)	(3)	(3)	(3)	(3)
Finland	47	148	126	108	110	92	(3)	(3)
France	--------	--------	2	11	7	(3)	(3)	(3)
Indochina, French	--------	--------	2	2	(2)	(3)	(3)	(3)
Italy	21	26	17	9	(3)	(3)	(3)	(3)
Japan	[6] 13	[6] 41	[6] 56	[6] 87	[6] 189	[6] 108	47	[7] 17
Korea, South	83	122	217	291	394	54	(3)	(3)
Mexico	310	522	855	1,138	717	468	818	94
Morocco, French	35	31	6	7	--------	--------	(3)	(3)
Norway	287	229	368	227	248	76	(3)	(3)
Peru	166	146	154	85	62	29	4	4
Sweden	--------	--------	--------	12	20	3	--------	(3)
United States	15,564	18,309	25,829	27,972	17,545	13,972	8,264	12,268
Total (estimate)	17,200	20,300	29,000	31,400	21,400	15,900	10,800	13,900

1 Molybdenum is also produced in Greece, Rumania, Turkey, U. S. S. R., and Yugoslavia, but production data are not available. Estimates by author of chapter are included in total.
2 Less than 1 ton.
3 Data not yet available; estimate by author of chapter included in total.
4 Exports to Japan proper.
5 Data represent areas designated as Free China during the period of Japanese occupation.
6 Preliminary data for fiscal year ended Mar. 31 of year following that stated.
7 Estimate.

Canada.—According to the Dominion Bureau of Statistics, production of molybdenite concentrates in Canada was 729,609 pounds in 1947 compared with 736,400 pounds in 1946. The output in both years came from Quebec. Shipments of concentrates were 629,600 pounds in 1947, compared with 636,400 pounds in 1946. The production and cleaning of molybdenite concentrate at the La Corne mine were described.[4]

Chile.—Since 1939 Chile has been a regular producer of molybdenite concentrate. Output of molybdenite in Chile was 669 metric tons in 1947 compared with 933 tons in 1946.

Czechoslovakia.—It was reported that work has begun on opening a molybdenum mine near Krupka, in the Teplitz area.[5]

Greece.—The Mavrodendra mine, 50 miles northwest of Salonika, remained in State custody. It is well-equipped but is not being worked.

Mexico.—The recovery of molybdenite concentrate from copper operations of Greene Cananea Copper Co., Cananea, Sonora, was inaugurated in 1933; since that year it has been a regular producer. Output of molybdenite was 344,668 pounds in 1947, compared with 1,474,252 pounds in 1946.

U. S. S. R.[6]—Although no figures are available, growth of the Soviet molybdenum industry is reported to have been phenomenal, with output more than quadrupling between 1940 and 1945. Present plans call for doubling the 1945 output by 1950. The anticipated increase is expected to result from intensive development of the large deposits discovered shortly before the war in the desert east of Kounrad, near Lake Balkhash. Two new flotation mills are now recovering molybdenum concentrate from ore from these deposits. The second-largest molybdenum center is the Tyrny-Auz tungsten-molybdenum combine in the North Caucasus. Both mine and mill of this operation were blown up by the Germans; the mine has been reopened and the mill rebuilt. Molybdenum has been discovered and development is under way in at least five other localities in the U. S. S. R.

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[4] McKean, F. K., A Process for Cleaning Molybdenite Concentrate: Trans. Canadian Inst. Min. and Met., vol. 50, 1947, pp. 36–48; The Production of Molybdenite and Bismuth at La Corne, Quebec: Trans. Canadian Inst. Min. and Met., vol. 50, 1947, pp. 375–388.

[5] Mining Journal (London), vol. 228, No. 5826, Apr. 19, 1947, p. 214.

[6] Engineering and Mining Journal, vol. 148, No. 8, August 1947, pp. 150–151.

Natural Gas

By H. BACKUS AND F. S. LOTT

GENERAL SUMMARY

WITH increased facilities for distribution, marketed production of natural gas in 1947 expanded 10 percent to 4,445 billion cubic feet from 4,031 billion in 1946.

All the major types of consumption increased over 1946. The proportion of gas used by domestic consumers gained 2 percent to 18 percent at the expense of industrial consumers. Domestic consumption accounted for 802,150 million cubic feet in 1947 compared with 660,820 million in 1946, a 21-percent gain. Commercial consumption increased 18 percent and miscellaneous industrial consumption 11 percent. Gas used as fuel at petroleum refineries gained 10 percent over the 1946 volume, reflecting increased production by that industry.

There were 12,203,700 domestic and 1,039,080 commercial consumers in 1947, compared with 11,471,640 domestic and 964,990 commercial consumers in 1946.

The estimated value of natural gas at the wells increased generally throughout the producing fields in 1947, except in a few States. The average for the total output was 6 cents compared with 5.3 cents in 1946 and 4.9 cents in 1945.

Salient statistics of natural gas in the United States, 1943–47

	1943	1944	1945	1946	1947 [1]
Marketed production:					
California millions of cubic feet	457,757	502,017	502,442	487,904	544,950
Louisiana do	505,294	534,688	542,789	525,178	573,151
Oklahoma do	285,045	310,888	357,530	380,938	393,216
Texas do	1,323,885	1,525,515	1,711,401	1,776,148	1,932,857
West Virginia do	223,787	181,452	160,225	178,958	182,072
Other States do	618,921	656,479	644,299	681,479	818,447
Total production do	3,414,689	3,711,039	3,918,686	4,030,605	4,444,693
Exports to—					
Canada do	131	143	191	200	207
Mexico do	11,079	14,433	18,016	17,475	17,942
Consumption:					
Domestic do	529,444	562,183	607,400	660,820	802,150
Commercial do	204,793	220,747	230,099	241,802	285,213
Industrial:					
Field do	780,986	855,180	916,952	897,809	933,761
Carbon-black plants do	315,562	355,770	431,830	478,349	484,882
Petroleum refineries do	243,584	[2] 315,311	338,458	331,520	363,892
Portland-cement plants do	51,748	35,588	38,349	58,004	60,499
Other industrial do	1,277,362	[2] 1,351,684	1,337,391	1,344,626	1,496,147
Total consumption do	3,403,479	3,696,463	3,900,479	4,012,930	4,426,544
Electric public-utility power plants [3] millions of cubic feet	305,576	359,745	326,190	306,924	373,037
Domestic percent of total	16	15	16	16	18
Commercial do	6	6	6	6	6
Industrial do	78	79	78	78	76
Number of consumers:					
Domestic thousands	10,354	10,669	10,959	11,472	12,204
Commercial do	811	845	889	965	1,039
Industrial [4] do	42	43	46	50	50
Number of producing gas wells	57,200	58,780	60,660	62,740	63,670
Value (at wells) of gas produced:					
Total thousands of dollars	176,893	189,809	191,006	212,251	267,212
Average per M cubic feet cents	5.2	5.1	4.9	5.3	6.0
Value (at point of consumption) of gas consumed:					
Domestic thousands of dollars	370,558	388,359	415,122	447,018	526,355
Commercial do	87,648	92,137	97,572	102,566	125,844
Industrial do	300,731	313,775	321,501	332,772	376,119
Total value do	758,937	794,271	834,195	882,356	1,028,318
Average per M cubic feet:					
Domestic cents	70.0	69.1	68.3	67.6	65.6
Commercial do	42.8	41.7	42.4	42.4	44.1
Industrial do	11.3	10.8	10.5	10.7	11.3
Domestic and commercial do	62.4	61.4	61.2	60.9	60.0
Domestic, commercial, and industrial cents	22.3	21.5	21.4	22.0	23.2
Treated for natural gasoline:					
Quantity millions of cubic feet	3,028,000	3,300,000	3,653,870	3,663,760	4,070,150
Ratio to total consumption	.89	.89	.94	.91	.92

[1] Subject to revision.
[2] Revised figure.
[3] Federal Power Commission. Figures include gas other than natural (impossible to segregate); therefore shown separately from other consumption.
[4] Exclusive of oil- and gas-field operators.

The average value at points of consumption increased from 22 cents in 1946 to 23.2 cents in 1947. A decline in the average value for domestic consumption was more than offset by increases in the average for commercial and industrial consumption.

Exports to Canada in 1947 increased 7 million cubic feet over the previous record of 207 million in 1946. Shipments to Mexico increased from 17,475 million in 1946 to 17,942 million in 1947.

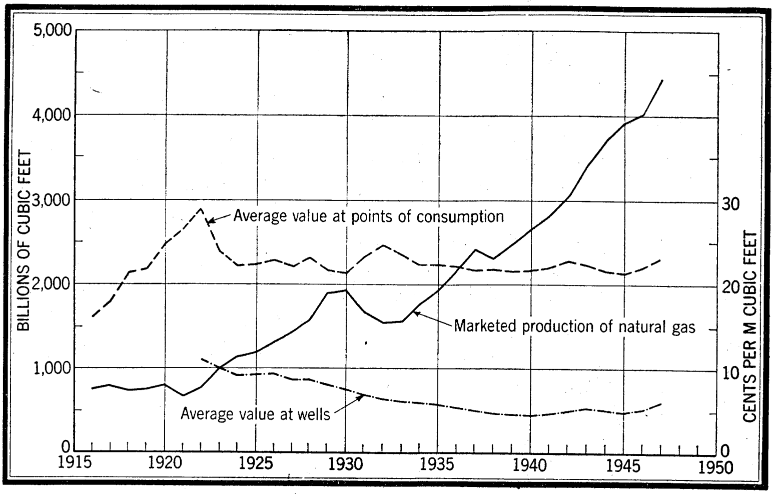

FIGURE 1.—Production and value of natural gas in the United States, 1916–47.

OUTLOOK

As materials are becoming more plentiful, facilities for distributing natural gas are being expanded rapidly. Several large gas-transmission lines are to be built in the near future, and it is expected that the natural-gas industry will continue to grow vigorously.

To build reserve supplies for peak seasonal demands, the practice of underground storage of natural gas in depleted gas fields is growing rapidly. As it becomes more accessible, companies serving mixed natural and manufactured gas will increase their use of natural gas.

Industries such as steel, glass, and ceramic manufacture, where controlled heat is an advantage, will use more natural gas as it becomes available.

A great impetus to the demand for natural gas has been provided by the recent divergent trends in costs of all fuels. Relative stability in the cost of natural gas to consumers contrasts with sharply rising costs of coal and fuel oils, with resultant strengthening of the competitive position of the gas. Hence, the demand for natural gas in many market areas tends to be limited only by the capacity of facilities to deliver it.

GOVERNMENT REGULATIONS

In sections supplied by pipe lines far distant from the source of gas production, it is still necessary to have Government regulations curtailing deliveries to large industrial consumers during periods of peak loads, and to limit the number of space-heating customers in order to maintain a steady supply of gas to domestic consumers. Regulations as to production and end use of gas are also still in force.

There was increasing demand—primarily from producers and State regulatory officials—for amendments to the Natural Gas Act minimizing Federal control of the movement of natural gas in interstate commerce.

The Federal Power Commission granted permission to build a number of new pipe lines and to add loops and extensions to old ones.

Regulatory bodies of several States, especially Texas, are increasing their efforts to reduce the volume of casinghead gas flared in the oil fields.

RESERVES

The proved recoverable reserves of natural gas in the United States increased during 1947 about 3 percent to 165.9 trillion cubic feet, according to estimates of the Committee on Natural Gas Reserves of the American Gas Association. Details of the committee's estimates of changes in reserves during 1947 and total reserves by States on December 31, 1947, are shown in the accompanying table.

The additions to reserves in 1947 are divided for the first time into two types—those resulting from extensions to known pools and revisions of earlier estimates and those resulting from discoveries of new fields or of new pools in old fields.

Estimated proved recoverable reserves of natural gas in the United States, 1946–47, in millions of cubic feet [1]

[Committee on Natural Gas Reserves, American Gas Association]

State	Changes in reserves during 1947 [2]				Reserves as of Dec. 31, 1947 [2]			
	Reserves as of Dec. 31, 1946	Extensions and revisions	Discoveries of new fields and new pools in old fields	Net production [3]	Total	Nonassociated [4]	Associated [5]	Dissolved [6]
Alabama	97	503		76	524			524
Arkansas	871, 662	50, 926	29, 940	62, 379	890, 149	455, 278	155, 408	279, 463
California	11, 126, 301	−460, 302	58, 251	559, 894	10, 164, 356	3, 088, 452	2, 951, 684	4, 124, 220
Colorado	315, 763	11, 906	15, 238	11, 041	331, 866	174, 939	40, 771	116, 156
Illinois	268, 000	−5, 832	7, 770	48, 807	221, 131	5, 526	25, 000	190, 605
Indiana	17, 000	−1, 000		3, 000	13, 000	4, 000	4, 000	5, 000
Kansas	13, 680, 844	1, 090, 607	24, 877	239, 412	14, 556, 916	14, 155, 560	212, 612	188, 744
Kentucky	1, 386, 000	88, 480		95, 000	1, 379, 480	1, 299, 480		80, 000
Louisiana	22, 411, 511	1, 164, 711	590, 878	685, 867	23, 481, 233	18, 697, 916	3, 264, 720	1, 518, 597
Michigan	131, 000	38, 008	36, 881	37, 420	168, 469	124, 339		44, 130
Mississippi	2, 370, 513	65, 536	71, 877	55, 166	2, 452, 760	1, 831, 826	390, 222	230, 712
Montana	853, 401	−165, 947	49, 255	36, 199	700, 510	469, 515	200, 245	30, 750
Nebraska	1	809		160	650			650
New Mexico	5, 904, 786	6, 293	311, 265	232, 161	5, 990, 283	3, 126, 494	2, 111, 027	752, 762
New York	69, 900	1, 000		6, 000	64, 900	64, 100		800
Ohio	614, 000	71, 200		74, 000	611, 200	571, 200		40, 000
Oklahoma	10, 735, 845	272, 040	967, 265	624, 286	11, 350, 864	7, 752, 994	1, 896, 068	1, 701, 802
Pennsylvania	503, 000	56, 063		76, 000	483, 063	435, 313		47, 750
Texas	86, 363, 459	4, 960, 772	1, 205, 496	2, 504, 161	90, 025, 566	64, 971, 473	16, 308, 314	8, 745, 779
West Virginia	1, 840, 000	163, 735		223, 000	1, 780, 735	1, 685, 235		95, 500
Wyoming	1, 035, 597	164, 536	41, 077	49, 422	1, 191, 788	771, 115	130, 448	290, 225
Florida, Missouri, and Utah	77, 221	−3, 390		6, 360	67, 471	66, 724		747
Total	160, 575, 901	7, 570, 654	3, 410, 170	5, 629, 811	165, 926, 914	119, 751, 479	27, 690, 519	18, 484, 916

1 Volumes are reported at a pressure base of 14.65 pounds per square inch absolute and at a standard temperature of 60° F.
2 Excludes shrinkage caused by natural gas liquids recovery.
3 Net production equals gross withdrawals less gas reinjected into underground reservoirs.
4 Nonassociated gas is free gas not in contact with crude oil in the reservoir.
5 Associated gas is free gas in contact with crude oil in the reservoir.
6 Dissolved gas is gas in solution with crude oil in the reservoir.

PRODUCTION

GROSS PRODUCTION

Estimated gross production of natural gas in the United States in 1946 increased 5 percent over the 1945 record to 6,190,200 million cubic feet. Gas produced from gas wells decreased 2 percent to

3,807,500 million cubic feet or 62 percent of the total output, while gas from oil wells increased 18 percent to 2,382,700 million cubic feet. A total of 5,132,638 million cubic feet was withdrawn from the Nation's reserves and consumed or lost in 1946. This was 7 percent over withdrawals in 1945. Large pipe lines connecting eastern and California markets with Texas, Louisiana, Kansas, and Oklahoma reserves have increased the rate of withdrawals heavily.

Reported decreases in the volume of gas used for pressure maintenance and repressuring in Texas were the primary cause of a 2-percent

Gross production and disposition of natural gas in the United States, by States, 1945–46, 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]
1945							
Arkansas	39,000	37,000	76,000	46,600	11,400	250	17,750
California	188,000	446,000	634,000	502,442	102,724	144	28,690
Colorado	4,200	1,800	6,000	4,914			1,086
Illinois	500	49,500	50,000	16,663	7,417	415	25,505
Indiana	1,100	1,400	2,500	1,543	564	[3] 345	427
Kansas	107,000	46,000	153,000	145,959	2,032	[3] 791	11,718
Kentucky	83,000	11,000	94,000	81,714	701	[3] 286	8,325
Louisiana	618,000	180,000	798,000	542,789	131,812		123,399
Michigan	18,000	7,000	25,000	21,874		−201	3,327
Mississippi	1,900	6,750	8,650	4,587			4,063
Missouri	77	23	100	90			10
Montana	30,300	2,200	32,500	31,829			671
New Mexico	33,000	107,000	140,000	105,023	7,621	673	26,683
New York	10,150	250	10,400	9,210		[3] 595	589
Ohio	51,500	3,500	55,000	49,967	10	[3] 4,529	5,923
Oklahoma	249,000	177,000	426,000	357,530	15,973	6,464	40,362
Pennsylvania	85,500	4,500	90,000	82,188	2,233	[3] 5,181	4,721
Texas	2,160,000	900,000	3,060,000	1,711,401	767,140		572,430
Utah	6,700		6,700	6,562			138
West Virginia	173,500	8,500	182,000	160,225	924	[3] 5,785	15,115
Wyoming	27,000	25,000	52,000	35,282	11,400	78	5,240
Other States [4]	300	30	330	294			36
Total	3,887,727	2,014,453	5,902,180	3,918,686	1,061,951	25,335	896,208
1946							
Arkansas	34,000	38,000	72,000	45,177	11,010	1,189	14,624
California	189,000	465,000	654,000	487,904	134,668	4,442	26,986
Colorado	6,900	3,210	10,110	6,728	500		2,882
Illinois	400	59,600	60,000	17,166	8,000	451	34,383
Indiana	600	1,420	2,020	1,094	622	[3] 278	358
Kansas	128,000	81,910	209,910	165,725	1,918	[3] −339	48,677
Kentucky	71,000	9,000	80,000	70,396	829	[3] 447	6,173
Louisiana	602,000	167,000	769,000	525,178	151,369		92,453
Michigan	23,800	3,300	27,100	20,879		−1,363	7,584
Mississippi	1,900	20,800	22,700	7,225	1,482		13,993
Missouri	43		43	40			3
Montana	30,500	2,600	33,100	30,713	132	435	1,820
New Mexico	27,200	162,100	189,300	119,262	2,595	1,334	66,109
New York	6,280	250	6,530	5,084		[3] 1,513	495
Ohio	57,600	3,700	61,300	61,570	10	[3] 3,963	5,015
Oklahoma	240,200	349,800	590,000	380,938	15,591	[3] 2,784	185,197
Pennsylvania	88,900	4,300	93,200	92,443	64	[3] 2,480	3,306
Texas	2,074,900	980,000	3,054,900	1,776,148	696,000	−425	571,529
Utah	4,320		4,320	4,252			68
West Virginia	193,500	7,000	200,500	178,958	1,605	[3] 2,127	15,787
Wyoming	26,000	23,700	49,700	33,266	11,847	4	4,583
Other States [4]	457	10	467	459			8
Total	3,807,500	2,382,700	6,190,200	4,030,605	1,038,242	19,320	1,102,033

[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] Florida, North Dakota, South Dakota, Tennessee, and Virginia.

decrease in the total volume used for that purpose in 1946. Of the total, California used 13 percent, Louisiana 15 percent, and Texas 67 percent.

The use of underground storage reservoirs to build up reserve supplies of gas near market centers is growing rapidly. In 1946, 75,458 million cubic feet were stored compared with 61,502 million in 1945 and 43,502 million in 1944. Comparative amounts withdrawn from storage were 56,138 million, 36,167 million, and 33,585 million cubic feet, respectively. These figures indicate an increase of 73 percent in the volume of gas stored and 67 percent in that withdrawn from storage in 1946 over the 1944 totals. With large transmission lines increasing facilities for transporting gas to markets far from the points of supply and with corresponding expansions in its use, the practice of storing gas to assure supplies during times of peak loads will continue to grow.

Indicated losses and waste were 1,102,033 million cubic feet, a 205,825-million-cubic-foot increase in 1946 over the 1945 figure. This gain is due primarily to the loss of casinghead gas in connection with oil production in new fields in Kansas and Oklahoma (and partly to more complete coverage of this type of gas production in 1946).

MARKETED PRODUCTION

Natural gas produced and marketed, including withdrawals from storage, in 1946 continued the upward curve which has characterized the industry for a number of years, reaching 4,030,605 million cubic feet, 3 percent above the former peak of 3,918,686 million in 1945..

Texas, Oklahoma, Kansas, and New Mexico made the largest gains, while California and Louisiana reported declines. The southwestern group—Texas, Oklahoma, Louisiana, and New Mexico—pro-

Natural gas produced in the United States and delivered to consumers, by States, 1942–46, in millions of cubic feet

Year	Arkansas	California	Colorado	Illinois	Indiana	Kansas	Kentucky	Louisiana	Michigan	Mississippi	Montana	New Mexico
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
1945	46,600	502,442	4,914	16,663	1,543	145,959	81,714	542,789	21,874	4,587	31,829	105,023
1946	45,177	487,904	6,728	17,166	1,094	165,725	70,396	525,178	20,879	7,225	30,713	119,262

Year	New York	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Other States	Total	Value at point of consumption: Total (thousands of dollars)	Value at point of consumption: Average (cents per M)
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
1945	9,210	49,967	357,530	82,188	1,711,401	160,225	35,282	6,946	3,918,686	837,852	21.4
1946	5,084	61,570	380,938	92,443	1,776,148	178,958	33,266	4,751	4,030,605	885,878	22.0

duced over 69 percent of the national total, as in 1945. The average value of natural gas at wells in those four States was 3.1 cents in 1946 compared with 2.9 cents in 1945. The average for the Appalachian group—New York, Ohio, Pennsylvania, and West Virginia—was 18.6 cents in 1946 compared with 17.8 cents in 1945. There were declines in the average value of gas at wells in a number of the smaller producing States, but production was not large enough to affect the total average.

Natural gas produced and consumed in the United States in 1946, 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 point of consumption		Quantity		Value at point of consumption	
	Millions of cubic feet	Percent of total	Total (thousands of dollars)	Average (cents per M)	Total (thousands of dollars)	Average (cents per M)	Millions of cubic feet	Percent of total	Total (thousands of dollars)	Average (cents per M)
Alabama	-----	-----	-----	-----	-----	-----	45,445	1.1	10,234	22.5
Arizona	-----	-----	-----	-----	-----	-----	24,198	.6	7,298	30.2
Arkansas	45,177	1.1	1,107	2.5	6,183	13.7	87,668	2.2	12,068	13.8
California	487,904	12.1	36,056	7.4	143,790	29.5	487,904	12.2	143,790	29.5
Colorado	6,728	.2	314	4.7	1,829	27.2	40,418	1.0	12,384	30.6
District of Columbia	-----	-----	-----	-----	-----	-----	7,428	.2	5,220	70.3
Florida	6	(1)	(2)	3.2	(2)	3.2	7,065	.2	1,421	20.1
Georgia	-----	-----	-----	-----	-----	-----	36,679	.9	12,804	34.9
Illinois	17,166	.4	872	5.1	3,139	18.3	124,284	3.1	54,939	44.2
Indiana	1,094	(1)	113	10.3	848	77.5	40,185	1.0	20,156	50.2
Iowa	-----	-----	-----	-----	-----	-----	33,163	.8	12,794	38.6
Kansas	165,725	4.1	8,286	5.0	52,562	31.7	175,820	4.4	32,876	18.7
Kentucky	70,396	1.8	10,426	14.8	31,626	44.9	29,494	.7	12,468	42.3
Louisiana	525,178	13.0	18,591	3.5	85,406	16.3	331,364	8.3	32,305	9.7
Maryland	-----	-----	-----	-----	-----	-----	2,830	.1	2,098	74.1
Michigan	20,879	.5	2,681	12.8	12,883	61.7	69,251	1.7	48,805	70.5
Minnesota	-----	-----	-----	-----	-----	-----	37,624	.9	12,979	34.5
Mississippi	7,225	.2	332	4.6	1,710	23.7	41,778	1.0	9,897	23.7
Missouri	40	(1)	6	15.0	21	52.5	74,257	1.8	31,015	41.8
Montana	30,713	.8	1,419	4.6	8,829	28.7	28,212	.7	7,705	27.3
Nebraska	-----	-----	-----	-----	-----	-----	33,572	.8	11,231	33.5
New Mexico	[3] 119,262	3.0	1,694	1.4	17,054	14.3	85,662	2.1	7,481	8.7
New York	[4] 5,084	.1	1,351	26.6	3,461	68.1	32,892	.8	24,744	75.2
North Dakota	344	(1)	10	2.9	126	36.6	2,519	.1	1,027	40.8
Ohio	61,570	1.5	11,280	18.3	31,929	51.9	188,527	4.7	98,368	52.2
Oklahoma	380,938	9.5	12,342	3.2	74,698	19.6	245,981	6.1	29,708	12.1
Pennsylvania	[5] 92,443	2.3	23,508	25.4	46,213	50.0	158,587	4.0	69,296	43.7
South Dakota	5	(1)	(2)	5.3	2	40.0	7,526	.2	2,702	35.9
Tennessee	47	(1)	5	10.6	20	42.6	24,344	.6	8,016	32.9
Texas	[6] 1,776,148	44.1	53,640	3.0	278,420	15.7	1,366,457	34.1	107,679	7.9
Utah	4,252	.1	213	5.0	1,346	31.7	15,733	.4	4,990	31.7
Virginia	57	(1)	5	8.8	59	103.5	2.101	.1	2,036	96.9
West Virginia	178,958	4.4	26,736	14.9	75,909	42.4	100,733	2.5	27,459	27.3
Wisconsin	-----	-----	-----	-----	-----	-----	86	(1)	132	153.5
Wyoming	33,266	.8	1,264	3.8	7,815	23.5	23,143	.6	4,231	18.3
Total: 1946	4,030,605	100.0	212,251	5.3	885,878	22.0	4,012,930	100.0	882,356	22.0
1945	3,918,686	100.0	191,006	4.9	837,852	21.4	3,900,479	100.0	834,195	21.4

1 Less than 0.05 percent.
2 Less than $500.
3 Includes 3,315 million cubic feet piped to Mexico.
4 Includes 20 million cubic feet piped to Canada.
5 Includes 180 million cubic feet piped to Canada.
6 Includes 14,160 million cubic feet piped to Mexico.

NUMBER OF WELLS

The need for increased production and new reserves of natural gas stimulated drilling in 1947. There were 3,353 gas wells drilled compared with 3,090 in 1946. Reported completions in California, Kentucky, Louisiana, Oklahoma, and Pennsylvania declined. All other producing States reported increases. Kansas, Michigan, Ohio, Texas, and West Virginia made the largest gains in new wells drilled.

Producing gas wells totaled 62,740 at the close of 1946 compared with 60,660 at the close of 1945.

These figures indicate 1,010 wells abandoned or shut in during 1946.

Gas wells in the United States, 1945–47, by States

State	Producing Dec. 31, 1945	Drilled during 1946 [1]	Producing Dec. 31, 1946	Drilled during 1947 [1]
Arkansas	180	2	180	10
California	250	65	310	45
Colorado	20	1	20	7
Illinois	80	6	90	9
Indiana	820	25	840	35
Kansas	2,220	300	2,400	400
Kentucky	[2] 3,250	139	[2] 3,390	110
Louisiana	1,900	115	2,000	105
Michigan	640	107	750	150
Mississippi	20	6	30	29
Missouri	110		110	2
Montana	620	71	650	93
New Mexico	150	42	170	63
New York	1,850	8	1,830	10
Ohio	7,000	543	7,200	580
Oklahoma	2,680	341	3,000	269
Pennsylvania	19,300	271	19,500	270
Tennessee	(2)		(2)	
Texas	4,400	499	4,800	537
West Virginia	15,000	535	15,300	610
Wyoming	140	11	140	19
North Dakota, South Dakota, Utah, and Virginia	30	3	30	
	60,660	3,090	62,740	3,353

[1] From Oil and Gas Journal and from State sources.
[2] Tennessee included with Kentucky.

DEVELOPMENT AND PRODUCTION BY STATES

Arkansas.—South Arkansas produced 69,008 million cubic feet of natural gas from controlled oil and condensate pools in 1947, a 20-percent increase over 1946, according to J. W. Saunders, chief engineer, Arkansas Oil and Gas Commission. Dry gas produced in northwest Arkansas and used for light, fuel, and drilling increased 1,157 million cubic feet over the 1946 total to 4,812 million. Of the total output, 59,372 million cubic feet were treated at natural gasoline plants—6,781 million cubic feet more than in 1946.

There were two major discoveries in 1947 in the Mars Hill field, with production totaling 56,249 thousand cubic feet of sour gas and 15,684 barrels of condensate. The Warnock Springs condensate field had three completions, with a total output of 624,606 thousand cubic feet of sour gas and 22,973 barrels of condensate. Sweet gas, which is being used to operate a gasoline plant, was discovered by three small gas completions in the Travis Peak zone of the Village field. One well completed in the Columbia field was plugged and abandoned for lack of a market.

California.—Total net natural-gas withdrawals from formations in California were 551,145 million cubic feet in 1947 compared with 502,845 million in 1946, states R. M. Bauer, Southern California Gas

Co. Oil-well withdrawals from formations increased from 351,289 million in 1946 to 392,670 million cubic feet in 1947 and dry-gas withdrawals from 180,249 million to 190,392 million cubic feet. Shrinkage due to processing at gasoline plants totaled 28,693 million cubic feet in 1946 and 31,917 million in 1947.

According to the Public Utilities Commission, State of California, the first commercial deliveries of gas from the Cache Slough, Kirby Hills, Maine Prairie, Millar, and Suisun Bay fields, which had 25 potential producers at the close of the year, were made in 1947. In Butte County, five wells were drilled during the year, activity centering in the Durham area. Although no new gas fields were discovered in central and northern California, the productive limits of several fields were extended by successful operations in Glenn and Solano Counties. There were 135 producing gas wells in the Rio Vista field at the end of 1947 compared with 131 at the end of 1946.

The reserves of natural gas were estimated on January 1, 1948, to be 11,722 billion cubic feet, of which 6,757 billion consisted of casinghead gas and 4,965 dry and underground storage gas. Two high-pressure underground storage holders were installed in the Paso Robles and San Luis Obispo fields in 1947.

The major pipe-line project in southern California was completion of the Texas-California gas line, the importance of which is indicated by the fact that deliveries have been advanced almost 3 years from the time first contemplated. The first gas was delivered November 13, 1947.

Colorado.—Metered production in Colorado increased 22 percent from 4,941 million cubic feet in 1946 to 6,030 million in 1947, according to J. R. Schwabrow, Geological Survey, United States Department of the Interior. This increase is accounted for in the Powder Wash, Hiawatha, and Craig fields, as the other fields reported declines. Production by fields, in millions of cubic feet, was: Hiawatha 2,904, Powder Wash 2,805, Thornburg 288, Berthoud 31, and Craig 2.

Shallow wells having an open flow of about 200,000 cubic feet each discovered a possible gas field—the Ridgway—in 1947. The commercial importance of the discovery is questionable. Two gas wells were completed in the Piceance Creek field, and one gas well was completed in the Hiawatha field.

In the North McCallum field, a pressure-maintenance project returned 10,937 million cubic feet of carbon dioxide gas to the producing sand in 1947—an increase of 1,423 million cubic feet over the 1946 record. In all, 22,386 thousand cubic feet were used in manufacturing Cardox (dry ice), an increase of 4,215 thousand cubic feet over 1946, and 3,500 million cubic feet were lost—1,741 million cubic feet below the 1946 total.

Gas production in the Rangely field totaled 4,055 million cubic feet, 1,317 million cubic feet more than the 1946 output. Field use consumed 3,041 million cubic feet, and 1,014 million cubic feet were lost. It is estimated that approximately 4 billion cubic feet of gas will be available for processing in a proposed gasoline plant and will then be returned to formations for pressure maintenance in the Rangely field. Gross production of gas at Wilson Creek was 624 million cubic feet, of which 304 million were recycled, 182 million used in the field, and 138 million lost.

The pressure-maintenance project in the Hiawatha field was discontinued in 1947 because results had doubtful value and a need for additional gas to supply market demands had developed. The Piceance Creek, White River, and Douglas Creek fields remained shut in for lack of pipe-line connection.

Illinois.—The following information was contributed by A. H. Bell and D. H. Swann of the Illinois State Geological Survey:

From spot checks of a few typical wells, it is estimated that 35 to 45 billion cubic feet of unmetered gas were produced with oil in pools without gasoline plants in 1947. Less than half of this gas was used for lease fuel, less than 1 percent was injected into producing sands for pressure maintenance, and about 0.2 percent was marketed. The remainder—about 20 billion cubic feet—was flared. The greatest portion of this waste gas comes from recently completed wells with rather large initial productions and particularly from wells in the McClosky limestone and Aux Vases sandstone.

Distributing companies marketed 128 million cubic feet from the Russellville field, 15 million from the Ayers and Panama field, 303 million cubic feet of residue gas from gasoline plants in the Louden field, and 46 million cubic feet of casinghead gas from the Storms field.

Of nine gas wells completed during 1947, only two in the Louden pool were used. Five wells proving over 200 acres of Cypress sand for gas production in the Dubois pool, Washington County, were the most promising gas developments of the year, but they had no outlet at the year's end.

The most important economic use of natural gas in Illinois is its use in the production of natural gasoline. Approximately 18,230 million cubic feet of gas from oil wells in the Louden, Salem, New Harmony, Benton, Dale-Hoodville, and Southeastern Illinois fields were processed during 1947. About 5½ billion cubic feet of the residue gas from the natural-gasoline plants were injected into the producing formation, 306 million cubic feet were marketed, less than 100 million were flared, and the remaining 7 or 8 billion were used as plant or lease fuel.

Indiana.—Thirty-three gas wells were completed in Indiana during 1947, A. C. Colby, supervisor of oil and gas, Indiana Department of Conservation, reports. Most of these were drilled in the Old Trenton area by land owners for their personal use. There were three discoveries, the importance of which has not been determined—a Devonian limestone well with production of 5 million cubic feet in Greene County, a Devonian shale well producing 200 thousand cubic feet in Martin County, and a gas well producing 3 million cubic feet of gas in Pike County, probably from the Cunningham sand.

Kansas.—In 1947, 180 billion cubic feet of gas were produced in Kansas, a 25-percent increase over the 1946 output; this information was supplied by G. A. Peschke, Kansas State Corporation Commission, Conservation Division. Development in the Hugoton field accounted for 370 of the 423 gas wells completed in 1947.

In all, 11 new fields were discovered in 10 different counties—6 producing from the Arbuckle limestone, 1 from the Bartlesville sand, 2 from the Mississippi lime, 1 from a Pennsylvanian sand, and 1 from the Tarkio sand. The discovery of gas in the Liberal-Southeast field gave Kansas its deepest commercial production from the Pennsylvanian at about 6,100 feet.

A pipe line and compression plant were placed in operation to provide a gas outlet for wells located in the Ryan-Behrens-Pawnee Rock area of Barton, Pawnee, and Rush Counties, where wells had been under stringent gas:oil ratio control owing to lack of a low-pressure gas outlet.

Fields having the largest output in 1947, in millions of cubic feet, were Hugoton, 140,840; McPherson County, 8,479; Lake City, 7,164; and Otis, 4,476. These fields supplied 89 percent of the total production in Kansas.

Earl K. Nixon, geologist, Kansas Geological Survey, reported that the most important developments in the Hugoton field were in the northern portion, mainly in Kearny County.

Kentucky.—A report of the American Institute of Mining and Metallurgical Engineers[1] showed a total of 316 gas wells drilled in Kentucky in 1947, an increase of 70 over 1946. Of the total wells drilled in 1947, 248 were in eastern Kentucky, 28 in western Kentucky, and 40 in south central Kentucky. Comparative figures for 1946 are 223, 20, and 3, respectively.

The discovery of the Royalton-Lakeville-Magoffin County Big Six gas field in eastern Kentucky added 114,558 thousand cubic feet to the open flow developed during the year, while the 228 productive wells drilled in the Big Sandy field added 220,481 thousand.

As in former years, the Big Sandy gas field furnished a large percentage of the total production in the State. Of the 228 gas wells drilled in the area, 66 were in Pike County, 47 in Knott, 45 in Magoffin, 38 in Martin, 26 in Floyd, and 6 in Johnson.

Louisiana.—An American Institute of Mining and Metallurgical Engineers report showed that natural-gas production in Louisiana in 1947 increased 39 percent over the 1946 output. Gas and condensate wells produced 651 billion and oil wells 187 billion cubic feet in 1947. The State ranked second in gas output in the United States in 1947, and has known recoverable gas reserves of 23 trillion cubic feet.

In north Louisiana, one gas condensate and three gas fields were found in 1947.

In south Louisiana, 1,200 drilling permits were issued, 27 of which resulted in gas wells and 41 in gas-condensate wells. In this area 10 gas-condensate and 3 gas sands were discovered in 1947.

Michigan.—The following information is from a report of the Michigan Public Service Commission: Dry-gas production in Michigan in 1947 totaled 15,254 million cubic feet compared with 19,309 million in 1946 and casinghead gas production 2,312 million compared with 2,634 million in 1946.

Commercial production from eight previously discovered gas fields was begun for the first time in 1947. The number and size of the gas fields discovered in Michigan in 1947 were disappointing. The Turk Lake field in Montcalm County was discovered, and four commercial wells were drilled. Three other wells were classed as discoveries but hold no promise of development into large commercial reserves.

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[1] American Institute of Mining and Metallurgical Engineers, Petroleum Division Committee on Production (statistical), Statistics of Oil and Gas Development and Production (1947): New York, 1948, 514 pp.

Dry natural-gas reserves available to public utilities outside of storage reservoirs approximated 75 to 80 billion cubic feet at the end of 1947. About 14 billion cubic feet were being produced for private industries. Additional storage facilities were developed during the year by the addition of input and output wells and by the construction of connecting pipe lines.

Owing to the shortage of available natural gas in 1947, restrictions were placed upon service to 12 large industries in the Muskegon and Grand Rapids areas, and service was denied to new space-heating customers. Limited production in Michigan and shortage of the storage supply caused more complete dependence on gas piped from other States. The failure to secure pipe has prevented in a large measure the transportation companies from increasing their deliveries of gas from the Western States.

Mississippi.—Two gas lines were put into operation from the Gwinville field, which had a total of 51 gas wells and a production of 26,699 million cubic feet of gas in 1947. The total production for the State was 32,811 million cubic feet, an increase of 92 percent over the 1946 output. These data were supplied by H. M. Morse, supervisor, Mississippi State Oil and Gas Board.

Missouri.—Gas production in Missouri decreased from 37.9 million cubic feet in 1946 to 30 million in 1947, according to Frank C. Greene, geologist, Missouri Geological Survey and Water Resources. Only two wells were completed in the State in 1947, one in Cass and one in Jackson County. Of 11 producing wells, 2 were abandoned during the year. The Polo gas field in Caldwell County remained capped.

Montana.—Marketed production in Montana totaled 33,013 million cubic feet in 1947 reports J. R. Schwabrow, Geological Survey, United States Department of the Interior. Gas used in repressuring accounted for 270 million cubic feet, field use for 3,617 million, and losses for 1,355 million. Comparative figures for 1946, in millions of cubic feet, are 31, 136; 132; 1,130, and 749, respectively.

In all 92 gas wells were completed in the State in 1947 compared with 83 in 1946. Completions by fields were: Bowdoin 43, Cedar Creek 10, Cut Bank 15, Kevin-Sunburst 4, Hardin 6, and other areas 14.

Discovery wells were completed on the Casady (McLaren Coulee) and the Flat Coulee structures and in the Six Shooter and the East Keith areas. The last producing gas well in the Bow and Arrow field was abandoned during 1947, and production from the Havre field was suspended in December 1946. Marketed production of major fields, in millions of cubic feet, was: Bowdoin 6,157, Cedar Creek 4,812, Cut Bank 15,380, Dry Creek 1,445, and Kevin-Sunburst 2,324.

New Mexico.—In southeastern New Mexico, 151.7 billion cubic feet of gas were produced in 1947 compared with 130.7 billion in 1946, as reported by Foster Morrell, supervisor, Geological Survey, United States Department of the Interior. Of this, 118.4 billion cubic feet were treated in natural-gasoline plants, 7.2 billion were delivered direct to carbon-black plants in Lea County, and 20.6 billion were delivered to domestic, commercial, and industrial markets. Of the residue gas, 52.5 billion cubic feet were sold for domestic, commercial, and industrial consumption and 24.7 billion were delivered to carbon-black plants. Plant fuel accounted for 9.9 billion cubic feet of the total production, lease fuel for 1.1 billion, shrinkage for 6.6 billion, gas vented at the gasoline plants for 25.5 billion, and gas returned to the ground for 1.4 billion.

There were no major gas discoveries in southeastern New Mexico during 1947, but proved areas were extended. One gas discovery, a well of undetermined importance, in the northwestern part of the State was completed in November. Of the 24 gas wells drilled in the northwestern area, 12 were in the Fulcher Basin field, 9 in the Kutz Canyon, and 1 each in the Oswell, Barker Creek Dome, and the Ute Dome fields; the last 2 are on Indian land. Marketed production in the area totaled 8.2 billion cubic feet in 1947.

Two carbon dioxide wells were completed in Harding County during 1947, making a total of 14 commercial wells in central and east central New Mexico.

The gas transportation line from the Permian Basin to California began operating in November, and deliveries averaged 190 million cubic feet a day in December 1947.

New York.—Most of the 21 wells completed in New York in 1947 were not commercially important, states John G. Broughton, acting State geologist, New York State Geological and Natural History Surveys. These wells were drilled to the Oriskany formations or below. Four large Oriskany producers in Allegany County had a combined open flow of 23,400,000 cubic feet daily. This compares with an open flow of 9 million cubic feet daily of producing wells developed in 1946. The 22 wells drilled in the Medina area were mainly storage wells. The few producing wells developed were within the boundaries of known pools.

North Dakota.—There were no important gas developments in North Dakota during 1947, according to Wilson M. Laird, State geologist, North Dakota Geological Survey. The total natural-gas production in the State, taken from 25 gas wells, was 442,213 thousand cubic feet, a 29-percent increase over 1946.

J. R. Schwabrow, Federal Geological Survey, reported no new gas fields discovered in the State during 1947. Five gas wells were completed in the Cedar Creek field, with a combined open flow of approximately 1 million cubic feet.

Ohio.—There were no particularly outstanding developments in Ohio in 1947. Information was supplied by K. C. Cottingham, chief geologist, Ohio Fuel Gas Co. Gas wells drilled totaled 582 compared with 547 in 1946. Fifty-six percent of the new wells were Clinton and 24 percent Berea wells. The largest gas well of 1947 was the Franks-Seaville No. 1, in the Clinton sand in Stark County, which had an initial flow of 15 million cubic feet. In the same section, the Smail et al. Kemeny gaged 10 million and the Franks Kieffer 7.4 million cubic feet; approximately 15 other wells in this area ranged from 4 to 7 million cubic feet in initial volume. The largest well in the Berea sand was in Monroe County.

Areas proved by new pool discoveries totaled 1,850 acres compared with 4,400 acres in 1946. Pools were extended by approximately 10,500 acres. The largest Clinton extension was in the Canton field, where 103 gas wells and 10 dry holes were drilled, adding 3,000 acres to proved territory. In Stark County 72 Clinton wells extended proved acreage 1,500 acres. In this extension, 8 wells exceeded 5 million cubic feet initial volume.

Clinton completions totaled 384, Berea 103, Shallow 43, Ohio Shale 23, Trenton 12, Newburg 10, and Oriskany 7. Stark County was again the most active with 185 completions followed by Perry with 57, Monroe with 50, Muskingum with 42, and Lorain with 36.

Oklahoma.—Gas wells completed in Oklahoma in 1947 totaled 269, of which 154 were in the Hugoton gas field area of Texas County. Elmer Capshaw, gas engineer, Oklahoma Corporation Commission, is the source of this information.

The output in Texas County alone increased approximately 15 billion cubic feet in 1947. Dry-gas production in the State totaled 267,395 million cubic feet, an increase of 27,148 million over the 1946 figure of 240,247 million.

A 21-billion-cubic-foot increase in residue gas available for transportation lines was due largely to an increase in the capacity of natural-gasoline plants in the West Edmond field. A plant being built for reinjecting gas into the formations will materially decrease the volume of residue gas available for distribution in the future.

Pennsylvania.—In this State, there were 502 productive shallow-sand gas wells having a total initial open flow of 71,667,000 cubic feet in 1947 compared with 592 wells having an initial open flow of 128,811,000 cubic feet in 1946. J. G. Montgomery, Jr., vice president, United Natural Gas Co., furnished this information. Of the 16 newly discovered shallow-sand gas pools, none is of major importance. In all, 32 producing wells were drilled in 1947 with average initial open flow ranging from 620,000 cubic feet to 3,550,000 per day. A number of Oriskany and Medina sand tests were failures.

Development of underground storage areas continued to be increasingly important. There were 26 shallow and 6 deep sand wells drilled for storage purposes. Transportation facilities were being increased as rapidly as a critical shortage of pipe would permit.

South Dakota.—Marketed production in South Dakota in 1947 decreased 379 thousand cubic feet from the 1946 record to 9,061 thousand cubic feet, according to information supplied by J. R. Schwabrow, Federal Geological Survey. In the Pierre gas field 4,531 thousand cubic feet were lost from gas-water wells, a decrease of 336 thousand cubic feet from the amount lost in 1946. No new gas fields were discovered in the State during 1947. In the Ardmore field one gas well, which is of doubtful commercial value, was completed; it had no pipe-line connection.

Tennessee.—The total production of natural gas in Tennessee in 1947, estimated at 40 million cubic feet, came from eight wells in Morgan County and six in Fentress County fields, reports Holman Milhous, assistant geologist, Tennessee Department of Conservation. Although a total of 50 oil and gas exploratory tests were completed or drilling at the end of the year, none was known to be commercially important.

Texas.—A production of 2½ trillion cubic feet of natural gas in Texas in 1947 is shown by records of the Texas Mid-Continent Oil and Gas Association. The State's huge reserves increased 3.7 trillion cubic feet.

There were over 5,000 producing gas wells in the State in 1947. New gas markets made available by large transportation lines stimulated drilling during the year. Of 1,656 wildcat wells drilled, only 78 were gas wells.

Information from a report of the American Institute of Mining and Metallurgical Engineers shows 101 gas wells drilled in east and east central Texas in 1947. Three condensate fields were discovered, and the Longwood field of Caddo Parish, La., was extended into Harrison County, Tex.

In the upper Gulf coast region, 18 gas wells were drilled in proved fields, and 8 wildcat wells extended or deepened proved areas. New fields were discoverd by five wildcat wells.

North Texas had 16 gas completions. In north central Texas 216 gas wells were shut in for lack of a market. There were 34 gas wells drilled during the year. Four gas fields were discovered.

The south central area had only nine gas completions. Gas production decreased 20 percent and condensate output 9 percent from 1946.

West Texas had 21 gas completions, 4 of which were wildcat wells.

In south Texas 35 gas or condensate fields were discovered and 35 wildcat wells completed as gas wells. In addition, there were 157 gas or condensate completions.

The Texas Panhandle had 174 gas completions in 1947 compared with 136 in 1946. Production from the Panhandle area was 886,134 million cubic feet. Of this volume, pipe-line companies took 350,558 million cubic feet, slightly more than in 1946.

Utah.—The metered production in Utah for 1947 was 6,036 million cubic feet compared with 4,295 million in 1946, according to J. R. Schwabrow, Federal Geological Survey.

An important discovery of carbon dioxide gas was made in a well in the Gordon Creek unit area. Carbon dioxide gas used in manufacturing dry ice and liquid carbon dioxide at Farnham totaled 183,309,000 cubic feet as compared with 139,866,000 used in 1946.

A deep test well in the Clay Basin field was unsuccessful in the lower formations and was plugged back to the Dakota sand, where it was completed.

Virginia.—The following information relative to southwest Virginia was furnished by David B. Reger, consulting geologist, Morgantown, W. Va.

No new gas wells were drilled in the Early Grove gas field in Virginia in 1947 but two wells were deepened in the Little Valley formation, increasing the production of 57 million cubic feet of gas in 1946 to a yield of 64 million in 1947. Proved territory is estimated to be about 1,000 acres.

In the East Stone field, a wildcat well, not completed, in Wise County found approximately 200,000 cubic feet of gas in the Trenton lime at 1,025 to 1,125 feet.

West Virginia.—About 45,000 acres were added to proved gas territory in West Virginia in 1947, compared with 44,000 in 1946, according to David B. Reger, consulting geologist, Morgantown, W. Va. Production for 1947 was estimated at 190 billion cubic feet, 11 billion over 1946. There were 536 gas wells drilled in West Virginia in 1947, with a total daily open flow of 427,834,000 cubic feet. The deepening of 80 old wells added 15,926,000 cubic feet to production.

Large volumes of Texas gas piped into the State—most of which was transported to Ohio, Pennsylvania, and New York—necessitated new gas lines, new compressor stations, and additional units installed to old stations.

The practice of storing gas in depleted fields was continued, and some of the Texas gas was conserved in this way for later consumption.

Active interest continued in exploring marginal areas to the east and south of the main gas-producing territory of the State.

Wyoming.—Production in Wyoming in 1947 totaled 57,740 million cubic feet, a 16-percent increase over the 1946 output. Of this amount, 68 percent was marketed, 20 percent used in repressuring, 2 percent used in the field, and 10 percent was lost. Comparable figures for 1946 are 68, 24, 2, and 6 percent, respectively. This information was provided by J. R. Schwabrow, Federal Geological Survey.

The completion of two gas wells in the Church Buttes field extended its proved area and established its importance as a reserve. Twelve gas wells were completed in the East Antelope field, a new discovery, with a total flow of about 68 million cubic feet. An old area revived by the Pine Mountain well awaits further development and pipe-line facilities.

Sulfur-extraction plants to be constructed in the Elk Basin and Worland fields will process 4 billion cubic feet of high-sulfur content gas in the future. This volume of gas was lost in 1947. The loss in other areas is mostly nominal. Gas returned to sands in seven fields totaled 6,604 million cubic feet.

Metered production, in millions of cubic feet, from fields that produced over 1 billion cubic feet of gas in 1947 was: Baxter Basin 9,936, Beaver Creek 4,767, Big Sand Draw 3,953, Elk Basin 1,259, Garland 2,398, Hiawatha 1,218, Lance Creek 2,594, Little Buffalo Basin 2,439, Oil Springs 1,542, and Salt Creek 3,308.

Small amounts of outside gas were introduced for storage purposes into the Billy Creek field and to stimulate production of oil in the Rock Creek and Salt Creek fields.

INTERSTATE SHIPMENTS AND EXPORTS

Interstate and export movements of natural gas in 1946 were 28 percent of the national marketed production as in 1945. Total shipments increased 4 percent over the 1945 record from 1,105,760 million cubic feet to 1,145,901 million in 1946.

Shipments from Texas and Oklahoma continued the expansion indicated in 1945, when large new transportation lines connected them with distant markets, and a material gain was indicated in shipments from Kansas. The volume of gas transported from Kentucky and Louisiana continued the decline registered in 1945, while West Virginia showed a slight gain. Texas supplied 39 percent of the total shipments in 1946, Louisiana 18, Oklahoma 13, West Virginia 10, and Kansas 8. Comparable figures for 1945 are 37, 21, 11, 10, and 7, respectively. The leading States which supplement local supplies with gas from outside sources in 1946 and the amounts of gas used, in billions of cubic feet, were Ohio, 127.7; Illinois, 107.1; Kansas, 103.8; Pennsylvania, 86.5; and Missouri, 74.2.

There was a 3-percent decline in exports to Mexico—from 18,016 million cubic feet in 1945 to 17,475 million in 1946.

Interstate transportation of natural gas in 1946 [1]

Producing State	Transit State	Consuming State [1]	Millions of cubic feet
Arkansas		Louisiana	354
Colorado	Wyoming	Utah	4,524
		Wyoming	343
			4,867
Indiana		Illinois	6
Kansas		Colorado	1,022
	Missouri	Illinois	3,760
	do Illinois	Indiana	6,709
	Nebraska	Iowa	13,017
	do South Dakota	do	67
	Missouri Illinois Indiana Ohio	Michigan	12,379
	Nebraska Iowa	Minnesota	19,590
		Missouri	6,421
		Nebraska	19,578
	Nebraska Iowa	do	14
	Missouri Illinois Indiana	Ohio	7,951
		Oklahoma	972
	Nebraska	South Dakota	2,230
			93,710
Kentucky	West Virginia Virginia Maryland	District of Columbia	5,200
	Indiana	Illinois	5
		Indiana	545
	West Virginia Virginia	Maryland	39
	West Virginia Virginia Maryland District of Columbia	do	989
	West Virginia Pennsylvania	New York	360
		Ohio	5,075
	West Virginia	do	5,214
	do	Pennsylvania	19,333
	do	Virginia	93
	do Virginia Maryland District of Columbia	do	664
		West Virginia	13,824
			51,341
Louisiana	Mississippi	Alabama	34,598
		Arkansas	30,910
	Mississippi Alabama	Florida	7,038
	Mississippi Alabama	Georgia	23,680
	Arkansas Missouri	Illinois	18,993
		Mississippi	25,618
	Arkansas	do	3,973
	do	Missouri	22,532
	Arkansas Mississippi	Tennessee	21,526
		Texas	15,388
			204,256
Mississippi		Alabama	58
	Alabama	Florida	21
			79

[1] Includes exports to Canada and Mexico.

Interstate transportation of natural gas in 1946 [1]—Continued

Producing State	Transit State	Consuming State [1]	Millions of cubic feet
Montana		North Dakota	2,519
	North Dakota	South Dakota	2,892
			5,411
New Mexico	Texas New Mexico	Arizona	24,198
		Colorado	389
	Texas New Mexico Arizona	Mexico	3,315
		Texas	8,201
			36,103
New York		Canada	20
		Pennsylvania	1,145
			1,165
North Dakota	Montana North Dakota	South Dakota	344
Ohio		West Virginia	772
Oklahoma		Arkansas	4,133
	Kansas Missouri	Illinois	3,909
	Kansas Missouri Illinois	Indiana	6,971
		Kansas	66,774
	Kansas Missouri Illinois Indiana Ohio	Michigan	12,794
	Kansas	Missouri	28,522
	do	Nebraska	879
	Kansas Missouri Illinois Indiana	Ohio	8,263
		Texas	17,891
			150,136
Pennsylvania	New York	Canada	180
		Maryland	275
		New York	18,702
		Ohio	98
		West Virginia	1,060
			20,315
Texas	Louisiana Mississippi	Alabama	10,789
	Louisiana	Arkansas	7,802
	New Mexico	Colorado	37,146
	Louisiana Mississippi Alabama	Georgia	12,999
	Oklahoma Kansas Missouri	Illinois	7,081
	Oklahoma Kansas Nebraska Iowa	do	73,364
	Oklahoma Kansas Missouri Illinois	Indiana	12,627
	Oklahoma Kansas Nebraska Iowa Illinois	do	12,245
	Oklahoma Kansas Nebraska	Iowa	20,015
	Oklahoma Kansas Nebraska South Dakota	do	64

[1] Includes exports to Canada and Mexico.

Interstate transportation of natural gas in 1946 [1]—Continued

Producing State	Transit State	Consuming State [1]	Millions of cubic feet
Texas—Continued	Oklahoma	Kansas	37,031
	Arkansas Louisiana Mississippi Tennessee	Kentucky	6,814
		Louisiana	10,088
	Louisiana Arkansas Mississippi Tennessee Kentucky West Virginia	Maryland	175
		Mexico	14,160
	Oklahoma Kansas Missouri Illinois Indiana Ohio	Michigan	23,109
	Oklahoma Kansas Nebraska Iowa Illinois Indiana	do	90
	Oklahoma Kansas Nebraska Iowa	Minnesota	18,034
	Louisiana	Mississippi	3,319
	Louisiana Arkansas	do	1,722
	Oklahoma Kansas	Missouri	16,742
	Oklahoma Kansas	Nebraska	11,464
	Oklahoma Kansas Nebraska Iowa	do	13
		New Mexico	2,503
	Louisiana Arkansas Mississippi Tennessee Kentucky West Virginia Pennsylvania	New York	3,761
	Louisiana Arkansas Mississippi Tennessee Kentucky West Virginia	Ohio	28,439
	Oklahoma Kansas Missouri Illinois Indiana	do	16,080
		Oklahoma	14,207
	Louisiana Arkansas Mississippi Tennessee Kentucky West Virginia	Pennsylvania	22,958
	Oklahoma Kansas Nebraska	South Dakota	2,055
	Louisiana Arkansas Mississippi	Tennessee	2,747
	Oklahoma Kansas Missouri Illinois Indiana Ohio Michigan	Wisconsin	86

[1] Includes exports to Canada and Mexico.

Interstate transportation of natural gas in 1946 [1]—Continued

Producing State	Transit State	Consuming State [1]	Millions of cubic feet
Texas—Continued.	Louisiana, Arkansas, Mississippi, Tennessee, Kentucky	West Virginia	20,417
	New Mexico, Colorado	Wyoming	1,025
			451,171
Utah		do	29
Virginia		Tennessee	24
West Virginia	Virginia, Maryland	District of Columbia	2,228
		Kentucky	3,625
	Virginia	Maryland	454
		do	473
	Virginia, Maryland, District of Columbia	do	425
	Pennsylvania	New York	6,150
		Ohio	52,119
	Kentucky	do	4,490
		Pennsylvania	41,091
	Virginia, Maryland	do	1,932
		Virginia	1,027
	Virginia, Maryland, District of Columbia	do	284
			114,298
Wyoming		Montana	2,910
		Nebraska	1,624
		Utah	6,986
			11,520
Total United States			1,145,901

[1] Includes exports to Canada and Mexico.

PIPE-LINE DEVELOPMENTS

In 1947 the Federal Power Commission authorized the construction and operation of 132 pipe-line projects which would increase the daily capacity of the transportation systems by 1,861 million cubic feet and add 5,369 miles of line and 360,349 compressor horsepower.

The largest of the new projects was a 1,069-mile line of 22- and 26-inch pipe to carry Texas gas from the Hugoton field to Michigan. The line was begun in January 1948. It will have a capacity of 350 million cubic feet.

The Texas-California line was completed in 1947 and the first gas delivered in December.

The Texas Eastern Gas Transmission Corp., organized in 1947, purchased the "Big Inch" and "Little Inch" lines and began deliveries of gas from Texas to Indiana and the Appalachian region in May.

The Colorado-Wyoming Gas Co. started its line from the Hugoton field into the Rocky Mountain area in 1947.

Another completion was the Hidalgo-Monterey line built by the Reynosa Pipe Line Co. Deliveries from Texas to Mexico began about the middle of the year.

The Colorado Interstate Gas Co. built a 300-mile line of 20-inch pipe from the Hugoton field in Kansas to Denver.

Extensions to existing systems and compressor stations were added to most of the systems of the large pipe-line companies.

CONSUMPTION

Consumption of natural gas in the United States in 1946 increased 3 percent over the 1945 total to 4,012,930 million cubic feet. Domestic consumption increased 9 percent, commercial 5 percent, and industrial 2 percent over the 1945 record. Gas used for field purposes decreased for the first time since 1941.

Treated for Natural Gasoline.—Gas treated at natural-gasoline and cycle plants totaled 3,663,760 million cubic feet in 1946 compared with 3,653,870 million in 1945. States reporting increases were Kansas, New Mexico, New York, Oklahoma, West Virginia, and Wyoming. The other producing States recorded decreases. As gasoline production increased more rapidly than the supply of gas treated, more efficient methods of operating the plants are indicated, as well as the operation of more cycle plants. The ratio of gas treated to total natural gas production was 0.91 in 1946 compared with 0.94 in 1945.

Natural gas consumed in the United States, 1942–46

Year	Domestic and commercial consumption							
	Consumers (thousands) [1]			Billion cubic feet			Average M cubic feet used per consumer	Average value at point of consumption (cents per M)
	Domestic	Commercial	Total	Domestic	Commercial	Total		
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
1945	10,959	889	11,848	607	230	837	70.7	61.2
1946	11,472	965	12,437	661	242	903	72.6	60.9

Year	Industrial consumption							Total consumption		Electric public utility power plants (billions of cubic feet) [2]
	Billions of cubic feet						Average value at point of consumption (cents per M)	Billions of cubic feet	Average value at point of consumption (cents per M)	
	Field	Carbon-black manufacture	Petroleum refineries	Portland cement plants	Other industrial	Total industrial				
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	315	35	1,352	2,913	10.8	3,696	21.5	360
1945	917	432	339	38	1,337	3,063	10.5	3,900	21.4	326
1946	898	478	331	58	1,345	3,110	10.7	4,013	22.0	307

[1] Includes consumers served with mixed gas.
[2] Federal Power Commission. Figures include gas other than natural (impossible to segregate); therefore shown separately from other consumption.

Domestic and Commercial.—The 9-percent gain in domestic or household consumption from 607,400 million cubic feet in 1945 to 660,820 million in 1946 was accompanied by a 5-percent gain in the number of consumers. The average amount of gas used in 1946, per consumer, increased 4 percent from 55,400 to 57,600 cubic feet, indicating a probable increase in household equipment run by gas.

Commercial consumption increased 5 percent from 230,099 million

Natural gas consumed in the United States, by States, 1942–46, in millions of cubic feet

State	1942	1943	1944	1945	1946
Alabama	36,287	40,123	44,323	43,417	45,445
Arizona	24,783	24,048	23,908	22,488	24,198
Arkansas	54,069	82,825	94,783	91,198	87,668
California	403,968	457,757	502,017	502,442	487,904
Colorado	28,860	31,424	33,101	34,877	40,418
District of Columbia	5,966	6,754	6,782	6,883	7,428
Florida	3,303	4,033	6,545	7,331	7,065
Georgia	31,996	33,280	35,603	35,915	36,679
Illinois	110,941	122,340	123,325	121,366	124,284
Indiana	37,642	39,227	38,581	40,274	40,185
Iowa	29,481	28,687	27,307	27,794	33,163
Kansas	121,354	129,173	143,814	160,406	175,820
Kentucky	21,382	23,409	24,399	26,802	29,494
Louisiana	253,894	290,651	310,127	325,888	331,364
Maryland	7,438	2,395	2,491	2,584	2,830
Michigan	42,202	53,010	56,077	59,594	69,251
Minnesota	29,116	33,501	35,229	35,930	37,624
Mississippi	26,444	30,113	33,111	38,297	41,778
Missouri	61,354	59,577	65,046	72,059	74,257
Montana	27,773	28,815	29,019	29,575	28,212
Nebraska	20,730	20,462	24,699	28,235	33,572
New Mexico	45,822	52,126	55,284	71,459	85,662
New York	27,150	27,787	27,057	29,577	32,892
North Dakota	1,904	2,030	2,267	2,640	2,519
Ohio	144,325	162,371	166,785	172,258	188,527
Oklahoma	220,991	230,423	249,996	249,927	245,981
Pennsylvania	143,187	159,004	148,675	149,092	158,587
South Dakota	7,611	7,483	7,688	7,158	7,526
Tennessee	22,806	24,252	24,693	24,419	24,344
Texas	917,657	1,059,329	1,221,383	1,348,140	1,366,457
Utah	18,920	20,303	20,275	20,264	15,733
Virginia	1,418	1,610	1,694	1,791	2,101
West Virginia	93,365	94,315	88,953	88,757	100,733
Wisconsin	---	---	---	---	86
Wyoming	20,634	20,842	21,426	21,642	23,143
Total United States	3,044,773	3,403,479	3,696,463	3,900,479	4,012,930

Natural gas treated at natural-gasoline and cycle plants in the United States, by States, 1942–46, in millions of cubic feet

State	1942	1943	1944 [1]	1945	1946
Arkansas	25,365	43,309	53,539	55,725	53,246
California	345,191	349,383	397,860	420,482	414,881
Colorado	25	---	---	---	---
Illinois	25,722	32,200	32,000	27,690	25,161
Kansas	179,710	196,043	158,524	165,538	189,834
Kentucky	35,408	46,149	48,746	41,562	41,447
Louisiana	247,370	236,286	307,912	310,614	308,723
Michigan	1,418	835	3,330	4,271	3,253
Montana	11,728	11,950	11,630	12,000	10,000
New Mexico	108,911	94,194	103,277	116,539	123,234
New York	4	4	4	3	10
Ohio	39,851	39,106	40,482	35,210	31,898
Oklahoma	202,653	188,029	191,610	193,744	207,139
Pennsylvania	46,603	53,616	53,672	42,565	38,084
Texas	1,372,563	1,520,043	1,682,738	2,039,983	2,012,357
West Virginia	197,643	198,636	195,000	166,037	181,903
Wyoming	24,235	18,217	19,676	21,907	22,590
Total	2,864,400	3,028,000	3,300,000	3,653,870	3,663,760
Ratio to total consumption	.94	.89	.89	.94	.91

[1] Partly estimated.

cubic feet in 1945 to 241,802 million in 1946, and the number of consumers increased 9 percent to 964,990.

Field.—Field use declined 2 percent from 916,952 million cubic feet in 1945 to 897,809 million in 1946. The greatest declines were recorded in California, Oklahoma, and Texas; gains were recorded in Illinois, Kansas, Louisiana, and New Mexico.

Domestic and commercial consumption of natural gas in the United States in 1946, by States [1]

State	Domestic				Commercial				Total			
	Consumers	Quantity (millions of cubic feet)	Value at point of consumption		Consumers	Quantity (millions of cubic feet)	Value at point of consumption		Consumers	Quantity (millions of cubic feet)	Value at point of consumption	
			Total (thousands of dollars)	Average (cents per M)			Total (thousands of dollars)	Average (cents per M)			Total (thousands of dollars)	Average (cents per M)
Alabama	61,340	3,767	2,801	74.4	6,130	1,564	710	45.4	67,470	5,331	3,511	65.9
Arizona	57,480	2,944	2,487	84.5	6,990	2,260	926	41.0	64,470	5,204	3,413	65.6
Arkansas	109,070	10,227	4,976	48.7	18,000	5,365	1,872	34.9	127,070	15,592	6,848	43.9
California	2,034,090	124,968	80,936	64.8	180,420	60,103	22,260	37.1	2,214,510	184,981	103,196	55.8
Colorado	121,730	10,777	6,957	64.6	14,380	3,954	1,920	48.6	136,110	14,731	8,877	60.3
District of Columbia	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Florida	7,830	397	420	105.8	850	199	108	54.3	8,680	596	528	88.6
Georgia	117,440	7,989	6,444	80.7	11,130	3,890	1,513	38.9	128,570	11,879	7,957	67.0
Illinois	1,430,570	29,180	31,922	109.4	78,970	7,741	5,663	73.2	1,509,540	36,921	37,585	101.8
Indiana	240,400	8,610	9,858	114.5	15,510	2,259	1,887	83.5	255,910	10,869	11,745	108.1
Iowa	171,420	8,429	7,360	87.3	15,020	2,674	1,692	63.3	186,440	11,103	9,052	81.5
Kansas	270,180	25,554	15,173	59.4	33,140	12,703	4,087	32.2	303,320	38,257	19,260	50.3
Kentucky	202,720	13,265	7,569	57.1	21,240	4,092	1,931	47.2	223,960	17,357	9,500	54.7
Louisiana	273,300	15,263	9,257	60.6	30,310	9,114	2,836	31.1	303,610	24,377	12,093	49.6
Maryland	[2] 246,670	[2] 8,853	[2] 7,147	[2] 80.7	[2] 17,180	[2] 2,111	[2] 1,473	[2] 69.8	[2] 263,850	10,964	[2] 8,620	[2] 78.6
Michigan	856,310	37,743	33,778	89.5	38,680	6,158	4,574	74.3	894,990	43,901	38,352	87.4
Minnesota	187,430	11,175	7,377	66.0	9,160	3,060	1,264	41.3	196,590	14,235	8,641	60.7
Mississippi	81,600	5,915	4,256	72.0	12,090	4,451	1,588	35.7	93,690	10,366	5,844	56.4
Missouri	469,920	21,577	18,684	86.6	35,580	5,807	3,194	55.0	505,500	27,384	21,878	79.9
Montana	53,320	8,731	4,107	47.0	6,140	5,416	1,667	30.8	59,460	14,147	5,774	40.8
Nebraska	146,000	9,347	6,194	66.3	11,390	3,492	1,591	45.6	157,390	12,839	7,785	60.6
New Mexico	44,610	3,911	2,493	63.7	5,860	3,531	1,117	31.6	50,470	7,442	3,610	48.5
New York	570,480	22,494	18,174	80.8	43,400	4,433	3,207	72.3	613,880	26,927	21,381	79.4
North Dakota	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Ohio	1,371,820	94,343	58,695	62.2	115,130	20,291	11,393	56.1	1,486,950	114,634	70,088	61.1
Oklahoma	322,200	28,482	13,218	46.4	40,410	15,430	4,370	28.3	362,610	43,912	17,588	40.1
Pennsylvania	719,630	48,854	31,098	63.7	50,810	9,652	5,094	52.8	770,440	58,506	36,192	61.9
South Dakota	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Tennessee	84,700	5,623	4,025	71.6	11,110	2,730	1,391	51.0	95,810	8,353	5,416	64.8
Texas	893,470	56,501	35,514	62.9	105,060	27,923	9,332	33.4	998,530	84,424	44,846	53.1
Utah	[3] 76,140	[3] 6,904	[3] 5,058	[3] 73.3	[3] 5,350	[3] 3,296	[3] 1,250	[3] 37.9	[3] 81,490	[3] 10,200	[3] 6,308	[3] 61.8
Virginia	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
West Virginia	222,120	24,783	8,948	36.1	21,480	5,290	1,817	34.3	243,600	30,073	10,765	35.8
Wisconsin	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Wyoming	27,650	4,214	2,092	49.6	4,070	2,903	839	28.9	31,720	7,117	2,931	41.2
Total: 1946	11,471,640	660,820	447,018	67.6	964,990	241,802	102,566	42.4	12,436,630	902,622	549,584	60.9
1945	10,959,060	607,400	415,122	68.3	888,660	230,099	97,572	42.4	11,847,720	837,499	512,694	61.2

[1] Includes natural gas used with manufactured gas. [2] Maryland includes District of Columbia and Virginia. [3] Utah includes North Dakota, South Dakota, and Wisconsin.

Industrial consumption of natural gas in the United States in 1946, 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 point of consumption (estimated; thousands of dollars)	Millions of cubic feet	Value at point of consumption		Millions of cubic feet				Value at point of consumption		Millions of cubic feet	Value at point 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							(2)	[2] 40, 114	40, 114	6, 723	16. 8	40, 114	6, 723	16. 8	6, 090
Arizona								18, 994	18, 994	3, 885	20. 5	18, 994	3, 885	20. 5	3, 574
Arkansas	18, 233	903				6, 965	(2)	[2] 46, 878	53, 843	4, 317	8. 0	72, 076	5, 220	7. 2	6, 615
California	129, 427	9, 864	(3)	(3)	(3)	47, 883	10, 860	[3] 114, 753	[3] 173, 496	[3] 30, 730	[3] 17. 7	302, 923	40, 594	13. 4	18, 578
Colorado	1, 674	272				1	(2)	[2] 24, 012	24, 013	3, 235	13. 5	25, 687	3, 507	13. 7	5, 090
District of Columbia								(4)	(4)	(4)	(4)	(4)	(4)	(4)	
Florida	6	(5)						6, 463	6, 463	893	13. 8	6, 469	893	13. 8	2, 296
Georgia								24, 800	24, 800	4, 847	19. 5	24, 800	4, 847	19. 5	12, 818
Illinois	16, 233	745				100		71, 030	71, 130	16, 609	23. 4	87, 363	17, 354	19. 9	2, 170
Indiana	402	40				1, 546		27, 368	28, 914	8, 371	29. 0	29, 316	8, 411	28. 7	1, 428
Iowa							(2)	[2] 22, 060	22, 060	3, 742	17. 0	22, 060	3, 742	17. 0	7, 741
Kansas	19, 809	1, 161	(3)	(3)	(3)	10, 446	9, 571	[3] 97, 737	[3] 117, 754	[3] 12, 455	[3] 10. 6	137, 563	13, 616	9. 9	27, 883
Kentucky	3, 265	475				66		8, 806	8, 872	2, 493	28. 1	12, 137	2, 968	24. 5	
Louisiana	99, 260	3, 828	26, 833	913	3. 4	55, 397	(2)	[2] 125, 497	180, 894	15, 471	8. 6	306, 987	20, 212	6. 6	38, 493
Maryland								[4] 1, 395	[4] 1, 395	[4] 734	[4] 52. 6	[4] 1, 395	[4] 734	[4] 52. 6	1
Michigan	2, 236	297				51		23, 063	23, 114	10, 156	43. 9	25, 350	10, 453	41. 2	5
Minnesota								23, 389	23, 389	4, 338	18. 5	23, 389	4, 338	18. 5	7, 794
Mississippi	6, 998	547						24, 414	24, 414	3, 506	14. 4	31, 412	4, 053	12. 9	3, 187
Missouri	18	2				912	(2)	[2] 45, 943	46, 855	9, 135	19. 5	46, 873	9, 137	19. 5	14, 067
Montana	1, 631	138				2, 198		10, 236	12, 434	1, 793	14. 4	14, 065	1, 931	13. 7	990
Nebraska						6	(2)	[2] 20, 727	20, 733	3, 446	16. 6	20, 733	3, 446	16. 6	7, 287
New Mexico	32, 203	638	25, 148	659	2. 6	1, 192		19, 677	20, 869	2, 574	12. 3	78, 220	3, 871	4. 9	6, 873
New York	74	29				176		5, 715	5, 891	3, 334	56. 6	5, 965	3, 363	56. 4	777
North Dakota								(6)	(6)	(6)	(6)	(6)	(6)	(6)	190
Ohio	1, 429	313				1	(2)	[2] 72, 463	72, 464	27, 967	38. 6	73, 893	28, 280	38. 3	1, 710
Oklahoma	105, 126	3, 296	14, 561	672	4. 6	27, 589	(2)	[2] 54, 793	82, 382	8, 152	9. 9	202, 069	12, 120	6. 0	22, 843
Pennsylvania	4, 892	1, 569				515		94, 674	95, 189	31, 535	33. 1	100, 081	33, 104	33. 1	5
South Dakota								(6)	(6)	(6)	(6)	(6)	(6)	(6)	2, 458
Tennessee								15, 991	15, 991	2, 600	16. 3	15, 991	2, 600	16. 3	3, 026
Texas	433, 901	14, 346	393, 303	11, 449	2. 9	170, 366	14, 755	269, 708	454, 829	37, 038	8. 1	1, 282, 033	62, 833	4. 9	101, 780

Utah	----------	----------	----------	----------	----------	1,000	(2)	[2] [6] 14,664	[6] 15,664	[6] 2,543	[6] 16.2	[6] 15,664	[6] 2,543	[6] 16.2	16
Virginia	----------	----------	----------	----------	----------	----------	----------	(4)	(4)	(4)	(4)	(4)	(4)	(4)	----------
West Virginia	12,546	2,467	----------	----------	----------	1,018	----------	57,096	58,114	14,227	24.5	70,660	16,694	23.6	802
Wisconsin	----------	----------	----------	----------	----------	----------	----------	(6)	(6)	(6)	(6)	(6)	(6)	(6)	5
Wyoming	8,446	387	----------	----------	----------	4,092	----------	3,488	7,580	913	12.0	16,026	1,300	8.1	332
Unclassified by States	----------	----------	[3] 18,504	[3] 777	[3] 4.2	----------	[2] 22,818	----------	----------	----------	----------	----------	----------	----------	----------
Total: 1946	897,809	41,317	478,349	14,470	3.0	331,520	58,004	1,344,626	1,734,150	276,985	16.0	3,110,308	332,772	10.7	306,924
1945	916,952	40,090	431,830	9,854	2.3	338,458	38,349	1,337,391	1,714,198	271,557	15.8	3,062,980	321,501	10.5	326,190

[1] Federal Power Commission. These figures include natural and manufactured gas. However, Bureau of Mines figures on consumption of gas by electric public-utility power plants (combined with other industries under "Other industrial") comprise only natural gas.

[2] Gas used in portland-cement plants included under "Unclassified by States" 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 "Unclassified by States," 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, South Dakota, and Wisconsin.

Carbon-Black Manufacture.—Gas used in the manufacture of carbon black totaled 478,349 million cubic feet, 11 percent over the 1945 volume, reflecting an 18-percent increase in carbon-black production. The value of gas used in carbon-black manufacture continued the upward trend started in 1938, and averaged 3.02 cents in 1946 per thousand cubic feet, 0.74 cent above the 1945 average. The average yield of carbon black per thousand cubic feet of gas used increased from 2.32 pounds in 1945 to 2.44 in 1946, reflecting an increase in the output by the high-yield furnace processes.

Petroleum Refineries.—The volume of gas used as fuel at petroleum refineries decreased 2 percent—from 338,458 million cubic feet in 1945 to 331,520 million in 1946. This decrease probably results from more efficient use, as the proportion of gas to other fuels used at refineries increased from 28.6 percent in 1945 to 29.3 percent in 1946.

Electric Public-Utility Power Plants.—Natural gas used at electric public-utility power plants totaled 306,924 million cubic feet in 1946, 6 percent below the 1945 volume, according to the Federal Power Commission, whose data include a small percentage of manufactured gas. California continued to decline, following a decrease of 21.6 billion cubic feet in 1945 with one of 16.5 billion in 1946. Other large consuming States with smaller declines were Georgia, Louisiana, and Texas. Kansas increased 1.8 billion cubic feet and Oklahoma 0.5 billion.

Portland-Cement Plants.—Gas used as fuel in portland-cement plants totaled 58,004 million cubic feet, a 51-percent increase over the 1945 volume, influenced by a 60-percent gain in the output of portland cement.

Other Industrial.—Gas used by miscellaneous industrial consumers reversed the decline of 1945 with a 1-percent increase. Small declines in a large proportion of the States were offset by increases in States using large volumes as in California, Kansas, and Texas. Comparative figures are 1,337,391 million cubic feet for 1945, and 1,344,626 million for 1946.

Mixed Gas.—The volume of gas sold in mixtures with manufactured gas increased 11 percent from 95,284 million cubic feet in 1945 to 105,863 million in 1946. Domestic use gained 13 percent, commercial 11 percent, and industrial 5 percent. Illinois was the largest consumer of mixed gas, with 1,119,800 domestic and 55,790 commercial consumers, followed by New York, with 406,640 domestic and 23,340 commercial consumers.

Consumption of natural gas used with manufactured gas in the United States, by States, in 1946

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 point of consumption (thousands of dollars)
District of Columbia	155,600	5,374	12,370	1,335	568	7,277	5,132
Illinois	1,119,800	21,232	55,790	5,570	7,851	34,653	28,848
Indiana	36,000	1,729	1,800	400	1,175	3,304	3,129
Iowa	61,450	990	4,220	241	247	1,478	1,202
Kentucky	87,490	4,221	8,410	1,818	1,562	7,601	4,033
Maryland	31,440	1,089	870	84	24	1,197	990
Michigan	5,350	60	210	11	19	90	102
Minnesota	149,750	7,435	5,510	646	736	8,817	5,655
Missouri	274,640	6,806	11,600	1,188	940	8,934	8,655
Nebraska	60,940	1,883	430	112	207	2,202	1,287
New York	406,640	10,778	23,340	1,910	1,542	14,230	10,919
Ohio	189,430	6,595	18,590	2,133	2,895	11,623	6,551
Pennsylvania	43,100	2,720	2,840	453	571	3,744	2,264
Tennessee	1,340	14	110	10		24	27
Virginia	32,040	510	1,580	153	26	689	635
Total: 1946	2,655,010	71,436	147,670	16,064	18,363	105,863	79,429
1945	2,505,490	63,297	133,700	14,462	17,525	95,284	72,888

Natural Gasoline
and Liquefied Petroleum Gases[1]

By F. S. LOTT, P. M. TYLER, AND A. T. COUMBE[2]

GENERAL SUMMARY

AGAIN breaking all previous records in 1947, total production of the natural gasoline industry climbed to 5,544 million gallons. Gains were registered in every month over the corresponding month of the preceding year, and output for the full year was 14.1 percent higher than the record total for 1946. Demand for all classes of light hydrocarbons kept well ahead of the accelerated production schedules, and total stocks at plants and terminals were reduced from 209 to 180 million gallons. Due to increased consumption rates, closing inventories for the year represented only 16 days' supply of natural gasoline, 6 days' supply of liquefied petroleum gases (LP-gases), and 13 days' supply of other products.

Export shipments increased even faster than domestic sales, totaling 256.2 million gallons as against 177.9 million gallons in 1946 and 63 million in 1945. Canada received approximately 60 percent of the LP-gases and 33 percent of natural gasoline shipped to foreign countries. Over 50 percent of the natural-gasoline exports went to the United Kingdom.

Reflecting rising prices as well as increased production, the total value of products at plants rose to an all-time record of $287,000,000, 57 percent higher than the 1946 total of $182,281,000. The average value per gallon advanced in 1947 to 5.2 cents, following declines in 1946 and 1945 from the previous peak of 4.3 cents a gallon in 1944.

The production of natural gasoline and other light products equaled 7 percent of the total crude-oil output. Demand for all light products was increasingly firm at the end of the year and that for LP-gas exceeded supply. Expansion of the industry was hampered by shortage of materials. However, a recent survey by the Production Subcommittee of the National Petroleum Council's Steel Requirements

[1] Data for 1947 are preliminary.
[2] Tables (except those on sales of LP-gases) compiled by E. M. Seeley, Petroleum Economics Branch.

Salient statistics of the natural-gasoline industry in the United States, 1943–47, in thousands of gallons

	1943	1944	1945	1946	1947[1]
Production:					
Natural gasoline and natural-gasoline mixtures	2,115,372	2,188,284	2,498,741	2,691,001	2,743,837
LP-gases:					
Isobutane	150,738	209,412	162,756	164,015	206,184
Other LP-gases	760,116	961,212	1,250,468	1,245,330	1,683,340
Other products	657,846	843,024	792,208	760,687	910,683
Total	3,684,072	4,201,932	4,704,173	4,861,033	5,544,044
Receipts from outside sources	55,600	112,182	120,074	118,850	122,705
Stock change at plants and terminals	−27,216	+798	+24,139	+33,996	−26,481
Total supply	3,766,888	4,313,316	4,800,108	4,945,887	5,693,230
Shipments to refineries:					
Natural gasoline and natural-gasoline mixtures	1,938,136	2,060,985	2,384,216	2,438,416	2,554,658
LP-gases	463,955	534,274	657,018	381,175	407,479
Other products	466,143	629,949	496,895	412,905	476,398
Shipments to jobbers and trade outlets:					
Natural gasoline	} 162,890	118,608	{ 94,155	157,523	177,848
Condensate			6,511	11,205	7,131
Finished gasoline and naphtha	129,262	134,610	229,948	265,819	356,776
Sales of LP-gases:					
For fuel	486,738	608,881	668,698	860,619	1,210,081
For chemical manufacture	(2)	96,558	170,386	209,394	242,280
Transfers of cycle products	66,108	76,482	35,658	52,990	71,576
Exports from plants	23,612	28,351	31,453	121,781	156,030
Losses	30,044	24,618	25,170	34,060	32,973
Total demand at plants and terminals	3,766,888	4,313,316	4,800,108	4,945,887	5,693,230
Stocks at plants, terminals, and refineries:					
Natural gasoline	130,410	114,702	101,726	138,667	118,346
LP-gases	45,024	46,452	39,517	32,264	30,225
Other products	15,288	{ 17,430 / [3] 25,788	} 40,270	38,278	31,847
Total	190,722	{ 178,584 / [3] 186,942	} 181,513	209,209	180,418
Value at plants:					
Natural gasoline ... thousands of dollars	95,273	[4] 110,000	112,018	111,798	162,300
LP-gases ... do	24,410	[4] 34,300	41,994	36,079	68,200
Other products ... do	27,227	[4] 38,200	33,552	34,404	56,500
Average per gallon ... cents	4.0	[4] 4.3	4.0	3.7	5.2
Natural gas treated ... millions of cubic feet	3,028,000	[4] 3,300,000	3,653,870	3,663,760	4,100,000
Average yield, light products except LP-gases per M cubic feet ... gallons	0.92	0.92	0.90	0.94	0.89
Average yield, all light products ... do	1.22	1.27	1.29	1.33	1.35
Sales to consumers for fuel and chemical uses:					
LP-gases	495,557	703,786	839,084	1,039,688	1,448,807
LR-gases	179,676	356,370	437,682	664,574	760,990
Total	675,233	1,060,156	276,766	1,704,262	2,209,797
Total exports of natural gasoline and LP-gases	35,154	42,702	62,971	177,875	256,160

[1] Subject to revision.
[2] Included in shipments to refineries.
[3] For comparison with 1945.
[4] Estimated.

Committee showed 57 natural gasoline and recycling plants under construction or planned and authorized in 10 States. The projected capacity of these new plants, 60 percent of which are scheduled for completion in 1948 and the remainder in 1949, forecasts an annual productive capacity for LP-gases 28 percent higher than the 1947 record by the end of 1948 and 51 percent higher by the end of 1949. This estimate does not include liquefied refinery gases (LR-gases) produced for fuel and chemical purposes (that is, production for use outside the refineries), which amounted to 784 million gallons in 1947, or 29 percent of the total requirements of liquefied gases for fuel and chemical uses.

Natural gasoline, although still the principal product of the industry, represented only 49 percent of the gallonage and 57 percent of the value of light products in 1947. Until the early 1930's this was virtually the only product of the industry; and, as recently as 1941, it represented 65 percent of the quantity and 75 percent of the value of the industry's products. LP-gases are rapidly becoming more important items, relatively as well as actually. In 1947 they contributed 34 percent of the total quantity and 24 percent of the total value of the industry's products compared with 21 and 11 percent in 1941. Other products (including finished gasoline, condensate, kerosine, distillate fuel, "special naphtha," etc.) are also attracting more attention. They represented 16 percent of the total quantity and 20 percent of the value in 1947 as against 14 percent of both quantity and value of the industry's products in 1941.

The volume of natural gas treated increased from 2.76 trillion cubic feet in 1941 to 4.10 trillion in 1947, and the average yield of light products per thousand feet of gas treated rose from 1.23 gallons in 1941 to 1.35 in 1947. The principal gains in recovery, of course, have been in LP-gases. The yield of natural gasoline and other light products, except LP-gases, after ranging between 0.92 and 0.97 gallons per thousand feet of gas treated for several years, dropped sharply from 0.94 gallons in 1946 to 0.89 gallons in 1947. Recoveries of LP-gases in general depend upon economic factors, and the average yield of propane in particular could be substantially increased as higher prices make it worth while to invest the necessary capital for equipment that would permit more complete recovery at a greater number of plants.

As not only the quantity of raw gas treated but also the average yield of LP-gases can be increased substantially, the growing employment of these products for a variety of purposes rests upon a firm foundation. Concurrently with increased production from the natural-gasoline industry, recoveries of LR-gases have also increased rapidly.

Sales to consumers of liquefied gases produced in oil refineries (LR-gases) amounted to 761 million gallons in 1947, compared with 665 million in 1946 and 199 million in 1941. The petroleum refineries are a large potential source of increased supplies, but under present conditions they can spare only limited quantities of LP-gas fractions for use outside of blending, polymerization, and other uses within the refineries themselves.

Future demand and potential supplies are sufficiently assured to justify the widespread conviction that the industry is still in its infancy and destined to grow rapidly. The use of bottled gas for domestic heating has grown amazingly. Many gas companies have accepted LP-gases for extending their sales of gas to outlying suburban consumers, as well as for conventional distribution through their mains, usually as an addition to manufactured gas but to an increasing extent also as a principal source of volatile hydrocarbons for gas enrichment or for supplementing gas supplies during periods of peak demand.

RESERVES

The proved, recoverable reserves of natural-gas liquids in the United States on December 31, 1947, as estimated by the Committee on

Natural Gas Reserves of the American Gas Association, are shown in the table following. These reserves are those extractable by methods now used in the respective fields.

The related natural-gas reserves on December 31, 1947, estimated by the committee, were 165,926,914 million cubic feet.

Estimated proved recoverable reserves of natural-gas liquids [1] in the United States, in thousands of barrels

[Committee on Natural Gas Reserves, American Gas Association]

State	Reserves as of Dec. 31, 1946	Changes in reserves during 1947			Reserves as of Dec. 31, 1947			
		Extensions and revisions	Discoveries of new fields and new pools in old fields	Net production	Total	Nonassociated	Associated	Dissolved
Arkansas	61,600	−264	768	3,845	58,259	37,638	7,864	12,757
California	308,272	28,364	432	24,917	312,151	36,900	115,605	159,646
Colorado	2,377	5,565			7,942		1,482	6,460
Illinois	34,200	−12,313	39	4,006	17,920	28	125	17,767
Indiana	85	−5		15	65	20	20	25
Kansas	82,492	7,786	159	1,625	88,812	85,315	2,553	944
Kentucky	16,071	711		1,438	15,344	[2] 15,344		
Louisiana	419,396	54,192	9,267	20,041	462,814	355,903	91,725	15,186
Michigan	655	466	184	240	1,065	624		441
Mississippi	[3] 53,233	4,220	1,796	590	58,659	25,611	30,741	2,307
Montana	8,534	−7,038		136	1,360			1,360
New Mexico	73,609	16,065	58	3,810	85,922	26,414	30,443	29,065
Ohio	1,714	189		167	1,736	[2] 1,736		
Oklahoma	68,317	83,986	17,952	15,252	155,003	61,464	36,464	57,075
Pennsylvania	2,309	242		315	2,236	[2] 2,236		
Texas	1,985,606	23,568	28,646	80,757	1,957,063	1,259,270	275,582	422,211
West Virginia	19,285	1,713		3,477	17,521	[2] 17,521		
Wyoming	25,458	−15,422		136	9,900	1,900		8,000
Alabama, Florida, New York, and Utah	6	212		15	203	[2] 203		
Total	[3] 3,163,219	192,237	59,301	160,782	3,253,975	1,928,127	592,604	733,244

[1] Includes condensate, natural gasoline, and LP-gases.
[2] Not allocated by types, but occurring principally in column shown.
[3] Revised.

PRODUCTION

Extending the general upward trend resumed in the last quarter of the preceding year, the production of natural gasoline and allied products rose throughout most of 1947. The monthly production curve showed a slight recession from May to July, but even during these months output was maintained above comparable 1946 rates. The daily average rate of 16.7 million gallons in December was almost 17 percent higher than the previous record of 14.3 million gallons established in December 1946, and the annual total of 5,544 million gallons topped the 1946 record by 14 percent.

Gains were recorded in all the leading classes of products. The new record output of 2,744 million gallons for natural gasoline was only 2 percent more than the 1946 total; but the output of LP-gases jumped 34 percent to a total of 1,890 million gallons, and that of other light products was up 20 percent, amounting to 911 million gallons.

Natural gasoline and allied products produced and natural gas treated in the United States, 1946–47, by States

State	Number of operators [2]	Production								Natural gas treated		
		Natural gasoline		LP-gases		Other products [1]		Total			Average yield (gallons per M cubic feet)	
		Thousands of gallons	Thousands of dollars	Thousands of gallons	Thousands of dollars	Thousands of gallons	Thousands of dollars	Thousands of gallons	Thousands of dollars	Millions of cubic feet	Light products except LP-gas	All light products
1946												
Arkansas	9	46,303	1,838	33,677	839	4,527	239	84,507	2,916	53,246	0.95	1.59
California	30	646,275	28,661	176,311	4,933	87,952	3,424	910,538	37,018	414,881	1.77	2.19
Colorado	----	840	50	----	----	----	----	840	50	----	----	----
Illinois	14	53,307	3,053	108,253	3,390	----	----	161,560	6,443	25,161	2.12	6.42
Kansas	9	63,666	2,455	18,925	467	----	----	82,591	2,922	189,834	.34	.44
Kentucky	4	9,062	472	44,800	986	----	----	53,862	1,458	41,447	.22	1.30
Louisiana	19	300,765	11,000	118,421	4,243	147,610	5,636	566,796	20,879	308,723	1.45	1.84
Michigan	2	4,624	216	7,713	210	----	----	12,337	426	3,253	1.42	3.79
Montana	1	2,624	183	1,973	109	----	----	4,597	292	10,000	.26	.46
New Mexico	7	87,677	3,759	15,965	344	----	----	103,642	4,103	123,234	.71	.84
New York	1	9	(3)	----	----	----	----	9	(3)	10	.90	.90
Ohio	5	5,153	270	----	----	1,100	59	6,253	329	31,898	.20	.20
Oklahoma	38	273,657	11,973	131,076	2,955	10,258	934	414,991	15,862	207,139	1.37	2.00
Pennsylvania	28	10,540	513	463	40	----	----	11,003	553	38,084	.28	.29
Texas	88	1,097,832	42,898	684,459	15,587	500,688	23,885	2,282,979	82,370	2,012,357	.79	1.13
Utah	----	578	35	----	----	----	----	578	35	----	----	----
West Virginia	17	52,302	2,269	59,590	1,653	8,552	227	120,444	4,149	181,903	.33	.66
Wyoming	5	35,787	2,153	7,719	323	----	----	43,506	2,476	22,590	1.58	1.92
Total	231	2,691,001	111,798	1,409,345	36,079	760,687	34,404	4,861,033	182,281	3,663,760	.94	1.33
1947 [4]												
Arkansas	8	47,425	2,798	40,155	1,485	5,622	393	93,202	4,676	60,877	.87	1.53
California	29	693,722	38,848	233,546	8,174	143,591	6,964	1,070,859	53,986	460,806	1.82	2.32
Colorado	----	640	47	----	----	----	----	640	47	----	----	----
Illinois	9	47,455	3,828	115,468	4,965	----	----	162,923	8,793	24,897	1.91	6.54
Kansas	8	72,224	3,628	27,956	1,034	15	1	100,195	4,663	214,675	.34	.47
Kentucky	3	9,700	572	50,450	1,312	41	2	60,191	1,886	38,717	.25	1.55
Louisiana	20	300,132	15,907	146,017	6,863	184,170	9,945	630,319	32,715	342,072	1.42	1.84
Michigan	1	3,640	248	628	17	----	----	4,268	265	2,368	1.54	1.80
Mississippi	1	2,014	109	2,712	136	12,387	681	17,113	926	8,079	1.78	2.12

Montana	1	2,638	216	2,989	208			5,627	424	12,066	.22	.47
New Mexico	7	92,443	5,639	21,443	836	7	(3)	113,893	6,475	137,514	.67	.83
New York	1	10	1					10	1	11	.91	.91
Ohio	5	5,779	377	187	6	1,165	71	7,131	454	32,869	.21	.22
Oklahoma	40	271,048	16,805	166,306	5,987	8,569	694	445,923	23,486	235,766	1.19	1.89
Pennsylvania	18	12,578	855	593	51	1	(3)	13,172	906	52,460	.24	.25
Texas	88	1,097,106	66,642	973,703	33,133	549,121	37,365	2,619,930	137,140	2,258,450	.73	1.16
Utah		696	51					696	51			
West Virginia	16	49,460	3,165	91,384	3,290	5,994	384	146,838	6,839	193,923	.29	.76
Wyoming	5	35,127	2,564	15,987	703			51,114	3,267	24,450	1.44	2.09
Total	214	2,743,837	162,300	1,889,524	68,200	910,683	56,500	5,544,044	287,000	4,100,000	.89	1.35

[1] Includes finished gasoline, condensate, kerosine, distillate fuel, "special" naphtha, etc.

[2] A producer operating in more than 1 State is counted but once in arriving at total for United States.

[3] Less than $500.

[4] Subject to revision.

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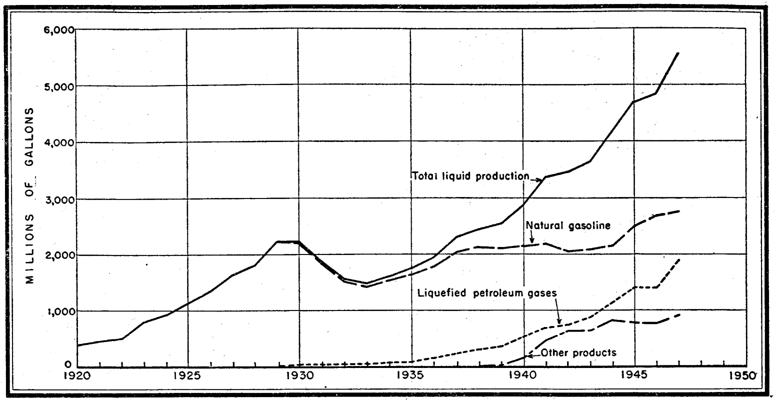

FIGURE 1.—Annual production of the natural-gasoline industry, 1920–47.

All the leading producing States shared in the expansion. Only two States—Michigan and Colorado, both minor producers—showed a decline in output, whereas, Mississippi was added to the list of producing States. In 1947, as in 1946, four States contributed 86 percent of the total output. Texas alone recovered 40 percent of all the natural gasoline, 52 percent of the LP-gases, and 60 percent of other products of the industry. California's shares were 25 percent, 12 percent, and 16 percent, respectively. Louisiana supplied 11 percent, 8 percent, and 20 percent, and Oklahoma furnished 10 percent of the natural gasoline and 9 percent of the LP-gases, but less than 1 percent of other products.

REVIEW BY STATES

California.—The combined liquid production of the industry in this State in 1947 increased 18 percent, or slightly more than the national total. The natural-gasoline output was up only 7 percent; but that of LP-gases rose 32 percent and other products, chiefly condensate, gained 63 percent. The total output of all light products was 1,071 million gallons.

Louisiana.—In Louisiana the output of natural gasoline declined slightly; but substantial gains in LP-gases and other products resulted in a net increase of 11 percent in the total output, which rose to 630 million gallons. The bulk of the increase occurred in the Inland district, reflecting the operation of new productive equipment.

Oklahoma.—The increase of 31 million gallons (7 percent) in production was due to expansion in LP-gases as the output of both natural gasoline and other products declined.

Texas.—The phenomenal increase of 289 million gallons (42 percent) in the production of LP-gases in Texas accounted for 60 percent of the increase in the national total of these products. The output of natural gasoline declined only slightly after increasing sharply in 1946, and that of other products resumed its upward trend. A sudden drop in output was reported in the Panhandle in May. Apart from this, the expansion proceeded in orderly fashion, month by month, in all the principal fields.

Monthly production of natural gasoline and allied products in the United States, 1946–47, by States and districts, in millions of gallons

Field	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1946													
West New York and west Pennsylvania	1.2	1.2	1.1	0.9	0.8	0.7	0.6	0.7	0.6	0.8	1.1	1.3	11.0
West Virginia	12.3	10.9	10.2	10.1	10.0	8.7	8.4	8.8	8.6	9.9	10.2	12.3	120.4
Ohio	.6	.5	.5	.5	.5	.4	.4	.4	.4	.6	.7	.8	6.3
Illinois	14.0	11.6	13.4	12.8	13.0	13.6	14.1	13.9	13.8	14.2	13.6	13.6	161.6
Kentucky	5.1	5.0	3.8	3.7	4.2	3.9	4.0	4.4	4.5	4.9	4.9	5.5	53.9
Michigan	1.1	1.0	1.2	1.2	1.1	1.2	1.2	1.1	1.0	1.1	.8	.3	12.3
Kansas	6.5	6.4	6.0	6.3	6.5	6.4	6.2	6.8	7.1	7.7	8.3	8.4	82.6
Oklahoma	36.6	34.2	35.2	32.0	33.4	32.5	33.1	33.8	33.8	36.7	36.1	37.6	415.0
Texas:													
Gulf	56.8	49.5	51.5	49.5	52.7	50.5	51.6	53.3	50.9	54.5	55.0	55.3	631.1
East Texas	25.7	23.2	26.7	30.3	31.2	25.9	29.8	30.2	29.8	29.3	27.7	29.6	339.4
Panhandle	46.2	43.0	44.3	37.9	33.8	47.7	35.1	42.2	44.4	47.9	47.4	48.2	518.1
Rest of State	62.4	57.8	62.7	60.9	64.7	64.5	68.5	71.2	69.6	70.8	67.9	73.4	794.4
Total Texas	191.1	173.5	185.2	178.6	182.4	188.6	185.0	196.9	194.7	202.5	198.0	206.5	2,283.0
Arkansas	7.2	6.5	6.6	6.5	6.8	6.8	6.7	7.1	7.0	7.8	7.6	7.9	84.5
Louisiana:													
Gulf	29.6	26.9	24.9	28.3	27.7	24.8	28.4	26.4	27.8	28.2	27.6	30.2	330.8
Inland	22.5	21.0	18.8	18.5	19.8	18.9	18.7	20.0	15.7	20.0	20.6	21.5	236.0
Total Louisiana	52.1	47.9	43.7	46.8	47.5	43.7	47.1	46.4	43.5	48.2	48.2	51.7	566.8
New Mexico	7.5	7.4	8.0	8.3	8.5	9.2	9.6	9.4	9.0	8.9	8.8	9.0	103.6
Montana	.5	.5	.5	.3	.4	.3	.3	.2	.3	.4	.4	.5	4.6
Colorado, Utah, and Wyoming	3.7	3.3	3.5	3.4	3.3	3.6	3.6	3.8	3.9	4.4	4.2	4.2	44.9
California	78.8	71.5	76.0	72.8	76.8	74.4	76.1	73.8	68.9	78.5	79.1	83.8	910.5
Total United States	418.3	381.4	394.9	384.2	395.2	394.0	396.4	407.5	397.1	426.6	422.0	443.4	4,861.0
Daily average	13.5	13.6	12.7	12.8	12.7	13.1	12.8	13.1	13.2	13.8	14.1	14.3	13.3
1947 [1]													
West New York and west Pennsylvania	1.3	1.2	1.4	1.3	1.2	.8	.8	.7	.9	1.0	1.3	1.3	13.2
West Virginia	11.2	12.3	13.5	11.7	11.5	10.4	10.1	11.3	11.1	13.1	14.5	16.1	146.8
Ohio	.8	.7	.8	.6	.5	.4	.4	.4	.4	.6	.7	.8	7.1
Illinois	14.0	12.9	14.2	13.6	14.2	13.4	13.9	13.3	13.3	13.5	13.3	13.3	162.9
Kentucky	5.5	3.2	4.6	5.3	4.8	4.8	4.9	4.8	4.6	5.4	6.1	6.2	60.2
Michigan	.4	.3	.4	.4	.4	.4	.5	.4	.3	.3	.3	.2	4.3
Kansas	9.1	9.2	8.9	8.8	8.3	7.8	7.4	7.3	7.6	7.9	8.7	9.2	100.2
Oklahoma	36.6	34.7	39.3	36.8	37.2	33.9	35.7	36.5	36.5	38.7	39.1	40.9	445.9
Texas:													
Gulf	52.0	49.1	53.7	52.9	51.0	49.0	53.7	54.4	51.5	56.6	57.7	60.4	642.0
East Texas	27.1	27.6	29.9	30.7	32.8	32.3	33.3	33.4	32.4	34.0	29.9	28.5	371.9
Panhandle	51.6	50.5	54.7	52.7	27.9	45.5	47.1	44.4	50.7	53.1	55.9	58.2	592.3
Rest of State	75.5	71.0	79.5	83.8	83.4	84.9	88.5	89.8	88.0	90.5	87.9	90.9	1,013.7
Total Texas	206.2	198.2	217.8	220.1	195.1	211.7	222.6	222.0	222.6	234.2	231.4	238.0	2,619.9
Arkansas	8.2	7.9	8.5	7.5	7.3	7.0	7.5	7.6	7.5	7.6	8.1	8.5	93.2
Louisiana:													
Gulf	30.5	23.8	32.9	28.5	30.4	27.1	29.6	29.2	27.1	26.9	30.1	27.9	344.0
Inland	21.5	19.1	19.7	19.5	21.0	20.1	21.6	28.7	25.9	28.7	29.6	30.9	286.3
Total Louisiana	52.0	42.9	52.6	48.0	51.4	47.2	51.2	57.9	53.0	55.6	59.7	58.8	630.3
Mississippi	----	----	----	----	----	----	----	----	----	----	7.5	9.6	17.1
New Mexico	8.3	7.8	8.8	8.9	9.7	10.1	10.8	11.3	10.3	9.9	8.9	9.1	113.9
Montana	.4	.4	.4	.4	.4	.4	.4	.4	.5	.5	.6	.8	5.6
Colorado, Utah, and Wyoming	4.3	4.2	4.6	3.6	3.8	3.8	3.8	4.0	4.5	5.1	5.0	5.8	52.5
California	85.7	78.4	84.2	84.6	88.6	87.0	90.7	92.7	90.8	95.3	94.6	98.3	1,070.9
Total United States	444.0	414.3	460.0	451.6	434.4	439.1	460.7	470.6	463.9	488.7	499.8	516.9	5,544.0
Daily average	14.3	14.8	14.8	15.1	14.0	14.6	14.9	15.2	15.5	15.8	16.7	16.7	15.2

[1] Subject to revision.

Other States.—Significant gains, amounting to 20 percent or more, were made in production in West Virginia and Kansas, canceling previous losses and establishing new records. Production of light products was begun in Mississippi upon completion of a large cycle plant in the Cranfield area.

YIELDS, PROCESSES, AND NUMBER OF PLANTS

Cycle Plants.—Approximately 1,515 million gallons of liquid products were recovered at cycle plants in 1947 from 960 billion cubic feet of processed natural gas, an indicated yield of 1.58 gallons per thousand cubic feet. The production was approximately 27 percent natural gasoline, 27 percent LP-gases, and the remaining 46 percent other products, including 18 percent finished gasoline and naphtha.

Yields.—The average yield of all light products was a trifle higher in 1947 than in 1946. Preliminary figures show the recovery as 1.35 gallons per thousand cubic feet of gas processed as against 1.33 gallons in the preceding year, and only 1.29 gallons in 1945. The yield of natural gasoline declined from 0.73 gallon in 1946 to 0.67 gallon in 1947 but the average for LP-gases rose from 0.38 to 0.46 gallon and for other light products from 0.21 to 0.22 gallon per thousand feet of raw gas. Especially notable was the large increase in the recovery of propane. Whereas the yield of butanes at plants with suitable fractionating equipment was already high, propane yields have heretofore ranged much lower because it was not considered

Natural gasoline and allied products produced in the United States, by States and by methods of manufacture,[1] in 1946

State	Number of plants operating				Production (thousands of gallons)			
	Compression [2]	Absorption [3]	Cycling [4]	Total	Compression [2]	Absorption [3]	Cycling [4]	Total
Arkansas		11		11		84,507		84,507
California	2	74	2	78	12,757	768,867	128,914	910,538
Colorado						[5] 840		840
Illinois	16	6		22	497	161,063		161,560
Kansas	2	12		14	1,242	81,349		82,591
Kentucky	2	3		5	853	53,009		53,862
Louisiana	2	25	4	31	17,283	136,049	413,464	566,796
Michigan		2		2		12,337		12,337
Montana		1		1		4,597		4,597
New Mexico	3	6		9	4,301	99,341		103,642
New York	1			1	9			9
Ohio	2	7		9	1	6,252		6,253
Oklahoma	20	74		94	19,086	395,905		414,991
Pennsylvania	34	7		41	903	10,100		11,003
Texas	24	119	30	173	133,354	1,374,157	775,468	2,282,979
Utah						[5] 578		578
West Virginia	49	22		71	46,986	73,458		120,444
Wyoming	2	4		6	1,323	42,183		43,506
Total: 1946	159	373	36	568	238,595	3,304,592	1,317,846	4,861,033
1945	181	387	38	606	246,157	3,208,289	1,249,727	4,704,173

[1] Figures for 1947 not yet available.
[2] Includes 20 plants manufacturing LP-gases.
[3] Includes combination of absorption process with compression and charcoal processes. Includes 185 plants manufacturing LP-gases; and 3 charcoal plants in West Virginia with 1,638,000 gallons produced in 1946 and 3 charcoal plants with 1,461,000 gallons in 1945.
[4] Includes 26 plants manufacturing LP-gases.
[5] Drip gasoline.

worthwhile to undertake the additional investment for equipment necessary to increase recovery.

The average value of light products recovered per thousand cubic feet of natural gas processed rose from approximately 5 cents in 1946 to 7 cents in 1947, reflecting higher prices of all products as well as better average yields. Natural gasoline continued to be the most valuable of the products recovered, contributing almost 4 cents per thousand cubic feet of raw gas treated. LP-gases accounted for 1.7 cents and other products 1.4 cents. Dollarwise the relative contributions of these classes of products were, in ratio, 57 percent, 24 percent, and 19 percent in 1947, compared with 61 percent, 20 percent, and 19 percent in 1946.

Production by Processes.—Owing to the growing concentration of the industry in larger plants, the number of operating establishments has been progressively reduced. At the end of 1946 the total was only 568 as against 606 at the end of 1945 and 1,078 in 1928. Since 1935 the number of compression-type plants has decreased from 312 to 159. Absorption-type plants have been reduced from 393 to 373 and charcoal process plants from 10 to 3. No cycle plants were in existence in 1935, but the number of plants of this type declined to 36 in 1946 after increasing from 35 in 1944 to 38 in 1945.

On January 1, 1948, there were 510 natural-gasoline and 39 cycle plants. The average actual daily output per operating plant in 1946 was 23,400 gallons of light products, compared with 27,900 gallons in 1947.

New construction and expansion of existing plants in Texas is expected by 1949 to give that State 60 percent of the total national capacity. Already the South Central States—including Texas, Louisiana, and Oklahoma—have approximately 64 percent of the total capacity for recovering light liquid hydrocarbons from natural gas. A certain amount of decentralization is in progress, however, as evidenced by the rapid expansion in California and certain Eastern States. In 1935, States east of the Mississippi River had 38 percent of all plants in the United States but produced only 4 percent of the total output of light products. In 1946 the 151 plants still operating in this area represented only 27 percent of the total number of plants, but their output was 8 percent of the total. In 1947 it was slightly more than 7 percent, owing to the fact that production has been increasing more rapidly in Illinois, Kentucky, and West Virginia than in the country as a whole.

Technologic Trends.—As a result of the emphasis on expansion of production of LP-gases, the number of plants recovering these products has been increasing. They rose from 202 in 1944 to 231 in 1945 and 243 in 1948. These liquefied gases represented only 21 percent of the total gallonage of the natural-gasoline industry in 1941; but in 1946, the first full peacetime year, they comprised 29 percent. In 1947 they contributed 34 percent of the total quantity and 24 percent of the value of the industry's output.

While the demand for gasoline continues active, more butane will be mixed with gasoline, and research may lead to a relatively larger employment of natural gasoline and butanes in motor fuel. This is only one objective, however. Probably the main problem in the industry is to balance the highly seasonal character of present-day demand. Progress has been made in developing agricultural uses—such as flame weeding, flame ripening, dehydration, water pumping, etc.—but so long as the winter peak of demand for domestic and general heating exceeds the capacity of producing plants or of railroad cars to carry the fuel to consuming areas, the emphasis is on developing more dealer and consumer storage capacity.

The National Board of Fire Underwriters Pamphlet 58 has now become the accepted basis for laws and regulations in 35 States. The full title of this pamphlet is "Standards for the Design, Installation and Construction of Containers, and Pertinent Equipment for Storage and Handling of Liquefied Petroleum Gases as Recommended by the National Fire Protection Association."

As a contribution to the transportation problem, a dry-cargo ship was recently converted to a tank ship for carrying propane from the Gulf to the Atlantic seaboard. For overseas shipments skid tanks are employed as deck cargo. Other exports are made in steel cylinders.

Current trends toward thermal and catalytic cracking processes for increasing the antiknock rating of gasoline may increase the LP-gas fractions from oil refineries enough to offset increased chemical and refinery uses.

Four objectives of the uses of LP-gas in city gas plants were summarized:[3] (1) Cold enrichment of water gas for B. t. u. control; (2) production of gas-air mixtures for peak shaving; (3) production of gas-air mixtures for summer-gravity control; and (4) re-forming of LP-gases in water-gas sets, using only light gas-oil for increasing capacity. Butane, he reports, is more satisfactory than propane for re-forming. Owing to its hydrogen content, it gives more cracked gas and is more easily cracked than the lighter propane.

Mixtures of 40 percent butane-air of 800 B. t. u. and 60 percent carburetted water gas are reported[4] to give satisfactory appliance performance, provided the gases are uniformly blended. In an address before the Petroleum Division of the National Association of Credit Men, Francis E. Drake, of the Pacific Gas Corp., stated that propane-air of 1,300 to 1,400 B. t. u. is interchangeable with natural gas without so much as an air-shutter adjustment.

All over the country many gas utilities are adding LP-gas departments to serve suburban customers beyond reach of their mains. In Texas and most Southwestern States, rural space-heating load is now carried largely by LP-gases. Already some 4,500,000 homes are estimated as using LP-gas for household purposes, or about 20 percent of all homes using gas. Many industrial concerns that normally use manufactured or natural gas are installing stand-by storage for LP-gas to satisfy their industrial needs in winter when the heating load causes the gas companies to curtail supplies to industrial consumers.

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[3] McCarthy, C. J., Four-Way Augmentation with LP-gas: Gas, vol. 24, No. 2, February 1948, pp. 38–39.
[4] Barry, James D., Peak Shaving with Propane Air: Gas, vol. 23, No. 8, August 1947, p. 28.

According to Cook,[5] an LP-gas stand-by plant requiring, for example, 15 days of peak-load gas may be installed for $60 or up per thousand cubic feet of daily make, whereas carburetted water-gas or oil-gas plants will cost $200. Moreover, the LP-gas plant can be run intermittently and does not require a highly trained crew. On a B. t. u. basis, costs may be higher, but the difference in operating cost may be more than offset by the smaller capital charges.

MARKET DEMAND—SHIPMENTS

The total demand for light liquid products of natural-gasoline and cycle plants expanded in 1947 even faster than production. The new record, as shown in the subjoined table, was 5,693 million gallons—15 percent above the 1946 total. Deliveries of natural gasoline were up 5 percent; for LP-gases, the increase was 30 percent and for other products, 21 percent. The figures for LP-gases in this table do not include LR-gas. However, production and sales of this material, which originates in the petroleum refineries, also increased. Approximately 29 percent of the products originating at field plants were delivered by tank car, 19 percent by tank truck, 47 percent by pipe line, and 4 percent by barge in 1947 compared to 26 percent by tank car, 17 by tank truck, 48 by pipe line, and 8 by barge in 1946.

Shipments to Refineries.—Notwithstanding a 6-percent increase in actual volume, shipments to refineries represented only 60 percent of total demand on the industry in 1947, compared with 65 percent in 1946 and 74 percent in 1945. There has been some relative as well as a large actual increase in shipments to jobbers and retail trade outlets, but the outstanding feature of the new demand pattern has been the expansion in sales of LP-gases for domestic and other fuel uses. Refinery takings of these gases, however, increased 7 percent, after registering a slight decline in the preceding year. This increase occurred largely in California and was confined principally to butane and isobutane as demands for unspecified LP-gases continued their downward trend. Shipments of condensate increased substantially during the last 4 months (although not as rapidly as production), and the total for the year was up 20 percent. The increase in refinery shipments of the major-product natural gasoline to a new maximum of 2,555 million gallons also lagged a little behind the increase in production.

The percentage of natural gasoline and allied products in refinery gasoline varies greatly in different parts of the country, being highest in California and inland areas in Texas and Louisiana, but the national average, after rising to a wartime peak of 10.3 percent in 1943, diminished gradually to 8.4 percent, then rose fractionally to 8.7 percent in 1947.

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[5] Cook, Marshall, Liquefied Petroleum Gas—Ally of the Gas Industry: Gas, vol. 23, No. 7, July 1947, p. 37.

Supply and distribution at plants of natural gasoline and allied products in the United States, 1946–47, by months, in thousands of gallons

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1946													
Production:													
Natural gasoline and natural-gasoline mixtures	221,515	204,806	219,310	221,595	226,929	232,328	231,124	232,681	224,282	231,327	220,900	224,204	2,691,001
Raw condensate	37,875	33,993	30,547	30,304	30,624	26,161	27,152	24,639	22,535	28,429	27,651	30,273	350,183
Liquefied petroleum gases:													
Commercial butane-propane mixture	41,419	36,398	35,273	30,162	29,933	26,841	27,409	31,030	30,933	40,444	42,801	47,878	420,521
Normal butane	27,379	28,267	29,667	25,600	22,604	28,835	25,677	28,619	30,942	29,558	31,834	30,550	339,532
Propane	25,990	22,305	22,625	22,007	24,024	23,266	26,642	27,857	29,071	32,230	34,835	36,311	327,163
Other mixture (LP-gases)	13,505	12,342	11,002	10,193	9,573	8,476	7,312	9,134	7,556	9,586	10,480	12,720	121,879
Isobutane	13,793	12,133	11,626	12,573	16,082	13,615	14,291	13,553	12,687	14,106	13,503	16,053	164,015
Isopentane	3,271	2,266	3,319	2,998	4,546	2,519	2,552	4,507	2,733	3,028	1,929	2,567	36,235
Finished gasoline and naphtha	29,706	25,060	27,438	24,962	26,524	27,481	29,280	30,413	31,627	32,940	32,771	36,911	355,113
Other products	3,887	3,830	4,061	3,843	4,385	4,440	5,007	5,026	4,689	4,905	5,337	5,981	55,391
Total	418,340	381,400	394,868	384,237	395,224	393,962	396,446	407,459	397,055	426,553	422,041	443,448	4,861,033
Receipts from outside sources	10,969	7,417	9,370	9,654	10,674	9,445	11,553	11,541	10,871	8,470	10,813	8,073	118,850
Stock change at plants and terminals	+21,386	+26,709	+30,938	+4,542	−139	+15,968	+1,688	−10,009	+2,324	−17,853	−21,751	−19,807	+33,996
Total supply	407,923	362,108	373,300	389,349	406,037	387,439	406,311	429,009	405,602	452,876	454,605	471,328	4,945,887
Shipments to refineries:													
Natural gasoline and natural-gasoline mixtures	192,965	171,821	185,785	187,602	196,994	196,309	202,449	213,989	219,119	226,235	223,151	221,997	2,438,416
Condensate	35,815	29,515	27,810	29,069	28,635	25,712	25,632	24,200	21,649	27,538	25,852	29,807	331,234
Normal butane	8,391	8,961	10,727	9,896	8,658	7,321	7,208	5,311	6,152	6,217	6,161	6,147	91,150
Isobutane	12,843	11,407	10,360	12,742	15,183	13,417	14,009	10,917	12,177	11,958	11,518	15,750	152,281
Isopentane	2,837	2,421	2,322	3,675	3,354	2,847	2,921	4,704	2,445	2,873	2,462	3,108	35,969
Other LP-gases	11,256	10,395	11,121	10,749	11,846	9,457	10,298	9,981	2,782	3,480	5,278	5,132	101,775
Finished gasoline and naphtha	7,551	6,421	7,182	7,245	7,739	5,871	6,775	6,049	6,425	6,736	6,741	6,936	81,671
Shipments to jobbers and trade outlets:													
Natural gasoline	12,298	10,287	10,035	15,559	12,330	15,299	15,651	12,030	13,856	13,761	14,151	12,266	157,523
Condensate	1,371	2,237	1,487	1,246	1,120	480	612	385	725	703	483	356	11,205
Finished gasoline and naphtha	22,573	18,218	16,787	20,118	17,776	18,121	22,779	27,666	18,424	26,300	27,160	29,897	265,819
Liquefied petroleum gases:													
For fuel	77,027	67,514	62,925	58,671	59,952	55,668	63,730	71,000	69,421	83,268	90,556	102,497	[1] 862,229
For chemical manufacture	16,827	16,219	16,299	15,941	18,884	18,083	17,196	16,784	17,581	18,984	18,612	17,984	209,394
Transfers of cycle products	3,344	3,728	3,930	3,647	3,331	4,558	4,466	4,537	5,115	5,601	4,842	5,891	52,990
Exports and losses	2,825	2,964	6,530	13,189	20,235	14,296	12,585	21,456	9,731	19,222	17,638	13,560	154,231
Total demand at plants and terminals	407,923	362,108	373,300	389,349	406,037	387,439	406,311	429,009	405,602	452,876	454,605	471,328	4,945,887

1947 [2]													
Production:													
Natural gasoline and natural-gasoline mixtures	216,157	194,771	218,848	222,327	235,321	236,004	242,788	241,954	237,568	241,696	225,638	230,765	2,743,837
Raw condensate	31,096	26,906	32,855	31,417	31,734	29,844	33,450	33,730	35,015	36,223	44,092	43,689	410,051
Liquefied petroleum gases:													
Commercial butane-propane mixture	43,215	43,231	43,935	37,250	32,886	29,781	32,888	37,721	38,080	43,167	45,538	50,019	477,711
Normal butane	36,284	41,157	41,369	38,966	30,011	30,660	29,042	33,534	35,627	39,080	44,590	42,213	442,533
Propane	45,225	43,332	45,466	40,198	36,811	36,615	40,602	46,111	45,628	50,468	59,635	66,712	556,803
Other mixtures (LP-gases)	11,804	10,006	14,785	14,794	12,688	13,238	13,564	13,954	13,296	14,363	16,078	17,455	166,025
Isobutane	14,470	13,569	18,345	20,943	13,581	22,765	24,169	17,134	15,861	16,859	13,919	14,569	206,184
Isopentane	3,886	2,183	3,359	2,551	2,718	2,690	3,187	2,727	3,736	3,546	5,586	4,099	40,268
Finished gasoline and naphtha	35,808	33,925	35,221	37,328	32,403	31,480	34,575	37,154	33,490	37,051	38,789	40,978	428,202
Other products	6,026	5,229	5,823	5,852	6,236	6,028	6,441	6,553	5,647	6,226	5,977	6,392	72,430
Total	443,971	414,309	460,006	451,626	434,389	439,105	460,706	470,572	463,948	488,679	499,842	516,891	5,544,044
Receipts from outside sources	10,574	9,563	10,961	13,253	4,116	10,856	8,577	9,223	13,628	12,231	6,302	13,421	122,705
Stock change at plants and terminals	−3,597	+5,817	−3,628	19,189	−12,008	−8,124	−271	−6,269	−9,743	−10,496	7,990	−5,341	−26,481
Total supply	458,142	418,055	474,595	445,690	450,513	458,085	469,554	486,064	487,319	511,406	498,154	535,653	5,693,230
Shipments to refineries:													
Natural gasoline and natural-gasoline mixtures	209,032	179,718	201,654	198,348	206,471	214,410	216,071	231,029	233,823	235,387	212,905	215,810	2,554,658
Condensate	31,021	25,775	32,010	29,002	30,453	29,076	32,710	32,665	34,761	34,977	42,730	42,527	397,707
Normal butane	6,257	9,760	8,147	6,078	6,222	7,165	8,819	8,964	10,197	12,962	11,368	12,346	108,285
Isobutane	11,619	10,772	14,670	20,633	13,238	21,346	23,327	15,255	15,648	15,702	11,734	15,104	189,048
Isopentane	3,034	2,000	2,910	2,511	3,392	2,517	3,540	3,925	2,856	3,776	5,477	3,003	38,941
Other LP-gases	5,660	3,155	3,500	5,619	4,916	6,124	6,194	5,901	7,840	6,388	7,330	8,578	71,205
Finished gasoline and naphtha	5,879	5,775	6,514	5,251	5,714	6,022	6,377	6,356	6,151	6,586	5,123	12,943	78,691
Shipments to jobbers and trade outlets:													
Natural gasoline	11,840	11,156	16,072	12,630	17,548	16,147	14,371	15,048	14,811	15,466	15,056	17,703	177,848
Condensate	379	456	758	1,620	1,154	313	430	349	325	203	567	577	7,131
Finished gasoline and naphtha	28,791	27,317	30,359	29,695	31,818	33,526	27,410	29,737	28,261	31,511	29,767	28,584	356,776
Liquefied petroleum gases:													
For fuel	112,496	106,378	116,502	96,678	83,826	81,262	87,182	95,113	96,144	105,344	119,913	137,351	[3] 1,238,189
For chemical manufacture	19,737	16,738	20,067	20,800	16,812	19,150	21,086	20,463	19,919	22,037	22,151	23,320	242,280
Transfers of cycle products	6,682	4,979	6,266	5,649	5,949	5,118	6,159	6,753	5,587	6,155	5,496	6,783	71,576
Exports and losses	5,715	14,076	15,166	11,176	23,000	15,909	15,878	14,506	10,996	14,912	8,537	11,024	160,895
Total demand at plants and terminals	458,142	418,055	474,595	445,690	450,513	458,085	469,554	486,064	487,319	511,406	498,154	535,653	5,693,230

[1] Includes exports from terminals of 1,610,000 gallons that cannot be segregated by months.

[2] Subject to revision.

[3] Includes exports from plants and terminals of 28,108,000 gallons that cannot be segregated by months.

Natural gasoline and allied products utilized at refineries in the United States, 1946–47, by districts and months, in thousands of gallons

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
1946													
East Coast	3,234	3,612	2,730	2,016	4,158	3,108	1,596	5,838	3,780	6,384	7,434	5,712	49,602
Appalachian	2,394	1,848	1,470	1,260	1,302	1,386	1,176	1,806	2,352	2,184	1,890	2,142	21,210
Indiana, Illinois, Kentucky, etc	20,706	20,202	19,110	20,622	22,008	25,200	28,644	29,484	28,476	27,762	29,148	25,998	297,360
Oklahoma, Kansas, and Missouri	21,672	15,078	16,254	14,406	14,532	15,120	17,094	19,740	22,008	27,636	26,040	25,368	234,948
Texas:													
Gulf Coast	67,788	42,672	47,334	47,796	47,040	48,888	50,736	60,270	56,406	63,126	66,654	58,254	656,964
Inland	24,654	35,322	37,380	37,422	42,252	39,186	38,598	42,546	37,968	36,582	43,890	45,276	461,076
Total Texas	92,442	77,994	84,714	85,218	89,292	88,074	89,334	102,816	94,374	99,708	110,544	103,530	1,118,040
Louisiana-Arkansas:													
Louisiana Gulf Coast	8,820	5,670	5,082	8,232	8,526	9,114	8,316	9,198	10,458	9,156	10,920	12,894	106,386
Arkansas and Louisiana Inland	7,182	6,342	4,956	3,360	3,780	4,032	3,822	4,200	4,998	5,418	4,830	4,662	57,582
Total Louisiana-Arkansas	16,002	12,012	10,038	11,592	12,306	13,146	12,138	13,398	15,456	14,574	15,750	17,556	163,968
Rocky Mountain	4,200	3,360	3,528	2,982	2,856	2,562	2,898	3,528	3,444	4,746	4,452	4,410	42,966
California	50,904	52,710	56,154	50,358	58,044	58,884	66,738	65,898	56,490	69,972	66,486	59,430	712,068
Total United States	211,554	186,816	193,998	188,454	204,498	207,480	219,618	242,508	226,380	252,966	261,744	244,146	2,640,162
1947 [1]													
East Coast	6,216	5,082	3,402	3,528	756	714	3,276	420	1,344	3,948	4,662	3,738	37,086
Appalachian	2,394	1,848	2,226	1,890	1,722	1,806	1,764	1,512	1,806	1,638	1,638	2,016	22,260
Indiana, Illinois, Kentucky, etc	27,678	23,982	24,444	26,376	25,662	28,182	27,678	31,122	30,156	31,920	32,088	30,408	339,696
Oklahoma, Kansas, and Missouri	25,410	21,798	20,916	17,262	17,514	18,312	17,010	19,656	23,688	24,738	23,520	22,260	252,084
Texas:													
Gulf Coast	55,440	43,386	53,256	52,752	59,976	57,582	69,300	64,596	64,260	61,404	65,100	63,798	710,850
Inland	37,968	32,172	41,622	46,536	29,358	49,434	40,572	47,166	47,544	44,436	42,378	41,076	500,262
Total Texas	93,408	75,558	94,878	99,288	89,334	107,016	109,872	111,762	111,804	105,840	107,478	104,874	1,211,112
Louisiana-Arkansas:													
Louisiana Gulf Coast	12,600	9,366	9,450	11,718	11,802	9,828	11,256	12,474	12,306	10,332	10,248	8,820	130,200
Arkansas and Louisiana Inland	3,864	3,948	3,402	3,276	2,982	3,360	3,402	3,360	3,108	3,402	2,982	2,814	39,900
Total Louisiana-Arkansas	16,464	13,314	12,852	14,994	14,784	13,188	14,658	15,834	15,414	13,734	13,230	11,634	170,100
Rocky Mountain	3,948	3,528	3,444	3,528	2,814	2,016	1,806	2,478	4,368	3,192	3,318	4,116	38,556
California	70,560	61,026	59,220	69,090	70,014	76,482	83,328	89,250	84,966	81,900	79,632	72,702	898,170
Total United States	246,078	206,136	221,382	235,956	222,600	247,716	259,392	272,034	273,546	266,910	265,566	251,748	2,969,064

[1] Subject to revision.

Percentage of natural gasoline and allied products in refinery gasoline in the United States, 1943–47, 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
1943	1.1	1.9	6.0	8.6	21.2	14.2	18.3	12.9	4.0	15.0	10.3
1944	2.3	1.7	6.3	7.1	17.8	11.6	12.6	16.5	5.7	13.6	9.3
1945	1.7	1.7	5.8	7.3	20.5	10.9	7.5	19.3	6.9	14.2	9.1
1946	1.2	1.9	5.0	7.9	22.7	8.8	5.1	16.6	4.7	15.4	8.4
1947 [1]	.8	2.0	5.5	7.7	22.6	8.8	5.3	10.3	3.9	17.4	8.7

[1] Subject to revision.

"Direct" Sales.—Sales to jobbers and other trade outlets of natural gasoline and of finished gasoline and naphtha increased 13 and 34 percent, respectively, in 1947. The latter has recently become an item of considerable importance, representing 66 percent of total sales in 1947, whereas natural gasoline (formerly the dominant product) accounted for 33 percent and condensate only 1 percent of sales to this marketing group.

Sales of LP-gases for fuel in 1947 ran far ahead of those for corresponding months in any preceding year, and seasonal fluctuations were less severe. During the minimum month (June), shipments were 59 percent as large as during the maximum month (December), whereas in 1946 the ratio was only 54 percent. This comparison is distorted by the growth factor, however. On the basis of January shipments, the summer slump was down only to 72 percent in both years. Shipments of these gases to chemical plants increased somewhat irregularly, amounting to a total of 242 million gallons (a gain of 16 percent), whereas the increase in domestic fuel uses from 861 to 1,210 million gallons amounted to over 40 percent.

SALES OF LIQUEFIED PETROLEUM GASES

An increase by a third in domestic sales of LP-gases realized in 1946 was repeated in 1947, when deliveries of 2,209,797,000 gallons were 30 percent above a revised total of 1,704,262,000 for 1946. Added supplies of LP-gases from petroleum refineries, natural-gasoline plants, and cycle plants, as well as additional equipment for transportation, storage, and use made possible another big expansion in sales of this fuel in 1947. Records compiled by the Bureau of the Census, United States Department of Commerce, show exports of 53,233,000 gallons of LP-gases in 1947 compared with 49,091,000 in 1946—a nominal gain of 8 percent compared with outstanding increases of 88 percent in 1946 and 79 percent in 1945.

Quantities of LP-gases reported for domestic fuel, gas manufacturing, and chemical raw material showed important gains in 1947 over 1946, while only moderate increases were indicated for industrial use and internal-combustion-engine fuel. A smaller quantity of LP-gases was sold for synthetic rubber components in 1947 than in 1946. LP-gases delivered for domestic consumption totaled 1,150,538,000 gallons in 1947—a quantity more than 50 percent above the 1946 total of 758,466,000 gallons. The remarkable growth in the demand for LP-gases for household consumption is evident when it is noticed that the total sold for this particular use in 1947 was above that delivered for all purposes as recently as 1944. It can be added also that the proportion of this fuel sold for domestic use has risen from 42 percent of all requirements in 1945 to 45 percent in 1946 and then to 52 percent of total sales in 1947. LP-gases delivered to manufactured-gas companies for enriching manufactured gas, for direct distribution through mains, and for stand-by purposes has mounted sharply in recent years. The 1947 quantity of 169,332,000 gallons delivered for these purposes was nearly double 1946 requirements of 86,660,000, which in turn was over 60 percent above the 1945 total. The proportion of LP-gases going to manufactured-gas companies has increased from 4 percent of all sales in 1944 and 1945 to 5 percent in 1946 and to nearly 8 percent in 1947.

Sales of LP-gases in the United States, by uses, methods of transportation, and regional distribution, 1943–47, in thousands of gallons

	Butane	Propane	Butane-propane mixtures	Total	
				Quantity	Percent of total
1943 [1]	140,122	218,273	312,683	[2] 675,233	100.0
1944 [1]	122,870	324,355	450,846	898,071	100.0
1944	273,116	335,884	451,156	1,060,156	100.0
1945	325,140	444,581	507,045	1,276,766	100.0
1946 [3]					
By uses:					
Domestic	45,285	310,040	403,141	758,466	44.5
Gas manufacturing	25,682	41,199	19,779	86,660	5.1
Industrial fuel	48,100	91,033	19,982	159,115	9.3
Synthetic rubber components	271,925	19,631	2,336	293,892	17.3
Chemical manufacturing	45,959	81,727	183,813	311,499	18.3
Internal-combustion-engine fuel	4,467	7,605	82,520	94,592	5.5
All other uses		15	23	38	
	441,418	551,250	711,594	1,704,262	100.0
Percent of total	25.9	32.3	41.8	100.0	
Regional distribution:					
Pacific coast area	31,286	75,818	130,013	237,117	13.9
All other areas	410,132	475,432	581,581	1,467,145	86.1
Total 1946	441,418	551,250	711,594	1,704,262	100.0
1947 [4]					
By uses:					
Domestic	62,092	503,448	584,998	1,150,538	52.1
Gas manufacturing	58,424	77,110	33,798	169,332	7.7
Industrial fuel	61,901	83,108	28,592	173,601	7.8
Synthetic rubber components	187,733	4,558	9,244	201,535	9.1
Chemical manufacturing	18,796	182,388	213,083	414,267	18.8
Internal-combustion-engine fuel	9,662	12,595	77,529	99,786	4.5
All other uses	27	479	232	738	
	398,635	863,686	947,476	2,209,797	100.0
Percent of total	18.0	39.1	42.9	100.0	
Regional distribution:					
Pacific coast area	29,997	115,916	148,326	294,239	13.3
All other areas	368,638	747,770	799,150	1,915,558	86.7
Total 1947	398,635	863,686	947,476	2,209,797	100.0

[1] Excludes synthetic rubber components.
[2] Includes 4,155,000 gallons of pentane in 1943. Corresponding figures for later years not available.
[3] Revised.
[4] Subject to revision.

The use of LP-gases as fuel by industrial plants has not expanded at the high rates noted for some of the other fuels because of the lack of adequate equipment for distribution and use, and also because of competitive market requirements. Sales of LP-gases intended for industrial fuel increased from 159,115,000 gallons in 1946 to 173,601,000 in 1947—a gain of 9 percent in contrast to a slight decline in volume for 1946. The industrial fuel item represented about 9 percent of total sales in 1946 and 8 percent in 1947. LP-gases sold for internal-combustion-engine fuel rose by 6 percent in 1947 in contrast to gains of about 1 percent for both 1945 and 1946. The quantities reported for engine fuel were 99,786,000 gallons in 1947 compared with 94,592,000 in 1946; these totals accounted for about 5 percent of the market in both years.

LP-gases sold for nonfuel uses showed a net gain of about 10,000,000 gallons in 1947. However, the quantity reported for synthetic rubber components dropped sharply as deliveries for use as chemical raw material continued the strong upward trend of recent years. Purchases of LP-gases by the synthetic rubber industry increased over 40 percent in 1946; but, the 1947 quantity (201,535,000 gallons) was a third less than the 293,892,000 reported for 1946. Material diverted for synthetic rubber components declined from 17 percent of all sales in 1946 to a 9-percent share in 1947. Chemical plants have about tripled their requirements for LP-gases for use as raw material since 1944, and the 1947 total of 414,267,000 gallons was 33 percent over the comparative item for 1946 of 311,499,000 gallons. These quantities accounted for about 19 percent of the total market for LP-gases during the 2 years.

The proportionate share of butane in total sales of LP-gases dropped noticeably in 1947, while that for propane rose almost correspondingly, as available supplies of the latter increased and as more high-pressure equipment for handling, storing, and using propane came on the market. Butane has satisfied about 26 percent of the demand for LP-gases in recent years; however, in 1947, the butane share in sales dropped to 18 percent of the total. Quantitatively, deliveries of butane declined from 441,418,000 gallons in 1946 to 398,635,000 in 1947—a shrinkage of about 10 percent. There was a pronounced turn to propane for fuel and chemical raw material in 1947 with the result that sales mounted from 551,250,000 gallons in 1946 to 863,686,000 in 1947—a gain of 57 percent. Viewed in another way, the proportionate share for propane in total deliveries increased from 32 percent in 1946 to 39 percent in 1947. There was also an active demand for butane-propane mixtures in 1947 when sales of 947,476,000 gallons were 33 percent over the 1946 total of 711,594,000 gallons. The market share for butane-propane mixtures increased from 42 percent of all requirements in 1946 to 43 percent in 1947.

Butane sold for synthetic rubber components and chemical raw material dropped sharply in 1947, while all other uses showed gains. Deliveries to synthetic-rubber plants of 271,925,000 gallons in 1946 and representing 62 percent of all butane sales declined to 187,733,000 in 1947 or to only 47 percent of the market. There were 18,796,000 gallons of butane sold for chemical raw material in 1947, a drop of 59 percent compared with 45,959,000 reported for 1946.

Butane sold for domestic or household consumption increased from 45,285,000 gallons in 1946 to 62,092,000 in 1947—a gain of 37 percent—

and the total for 1947 accounted for 16 percent of the butane market compared with a 10-percent share in 1946. Manufactured-gas companies purchased 58,424,000 gallons of butane in 1947 or more than double their 1946 requirements of 25,682,000 gallons. Butane delivered to industrial plants for fuel also showed an important increase from 48,100,000 gallons in 1946 to 61,901,000 in 1947. Butane used for fuel in internal-combustion engines increased from 4,467,000 gallons in 1946 to 9,662,000 in 1947.

Less propane was used as fuel by industrial plants and as raw material for the making of synthetic rubber in 1947; however, all other principal demands showed important increases during the year. About three-fifths of all propane was reported for domestic or household consumption in both 1946 and 1947, and quantitatively the volume of sales rose from 310,040,000 gallons in 1946 to 503,448,000 in 1947—a gain of over 60 percent for this particular demand. Propane delivered to chemical plants for raw material increased from 81,727,000 gallons in 1946 to 182,388,000 in 1947. Manufactured-gas companies have increased their purchases of propane nearly fivefold since 1944, and the 1947 quantity of 77,110,000 gallons was 87 percent over the 1946 total of 41,199,000 gallons. Only small quantities of propane are used as fuel in internal-combustion engines; however, the demand rose from 7,605,000 gallons in 1946 to 12,595,000 in 1947. Propane has never been important as a synthetic rubber component and requirements dropped sharply from 19,631,000 gallons in 1946 to 4,558,000 in 1947. Industrial plants turned more to butane and butane-propane mixtures for fuel in 1947 as competitive demands for propane developed, and consequently their purchases of the latter gas declined from 91,033,000 gallons in 1946 to 83,108,000 in 1947—a 9-percent decline.

The quantities of butane-propane mixtures sold for various uses all increased noticeably in 1947 except the demand for internal-combustion-engine fuel, which dropped moderately. More than half of the butane-propane mixtures are reported for domestic fuel and this total rose from 403,141,000 gallons in 1946 to 584,998,000 in 1947—a gain of 45 percent. Chemical plants take about one-quarter of the butane-propane mixtures for raw material, and their requirements have about tripled in volume since 1944. Butane-propane mixtures credited to chemical plants of 213,083,000 gallons in 1947 were 16 percent over the 1946 quantity of 183,813,000 gallons. Only small amounts of mixtures go into synthetic rubber; however, this demand increased from 2,336,000 gallons in 1946 to 9,244,000 in 1947. Manufactured-gas companies greatly increased their purchases of LP-gases in 1947, and their demand for butane-propane mixtures expanded from 19,779,000 gallons in 1946 to 33,798,000 in 1947. The increase in volume for mixtures delivered to industrial plants for fuel was 28,592,000 gallons in 1947 compared with 19,982,000 in 1946. Most of the LP-gases used as fuel in internal-combustion engines is reported as butane-propane mixtures; however, the quantity declined from 82,520,000 gallons in 1946 to 77,529,000 in 1947, while substantial increases were indicated for both butane and propane.

Pertinent data regarding the distribution of LP-gases by manufactured-gas companies, according to the American Gas Association, are as follows:

Liquefied petroleum gas, as of July 1, 1948, was being delivered through mains to 301,650 consumers in 419 communities by 188 companies in 39 states.

Butane-air gas and propane-air with heating value ranging from 525 to 1,600 B. t. u. per cu. ft. was supplied 336 communities in 37 states.

A mixture of undiluted butane and propane gas with heating value of 2,800 to 3,550 B. t. u. per cu. ft. was supplied 22 communities in Arizona, California, Nevada, New Jersey, and New Mexico.

Undiluted propane gas with heating value of 2,515 to 2,550 B. t. u. per cu. ft. was supplied 61 communities in Iowa, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Mexico, North Carolina, North Dakota, Virginia, and Wisconsin.

E. T. Knudsen, of the Los Angeles office of the Bureau of Mines, provided the statistics covering sales of LP-gases in the Pacific coast marketing area (California, Oregon, Washington, Arizona, and Nevada). Deliveries of LP-gases in these States increased from a revised total of 237,117,000 gallons in 1946 to 294,239,000 in 1947—a gain of 24 percent. The totals for the Pacific coast represented about 14 percent of the national demand in 1946 and 13 percent in 1947. The market for LP-gases in other areas of the country rose from a revised total of 1,467,145,000 gallons in 1946 to 1,915,558,000 in 1947—an expanison of over 30 percent in volume.

STOCKS

The carry-over of stocks from 1946 was the highest in years, totaling 209,000,000 gallons. This increased to 235,000,000 gallons by April 30, after which it declined almost steadily so that the closing inventory on December 31, 1947, was only 180,000,000 gallons, considered a normal figure in earlier years when consumption was on a much smaller scale. Stocks at refineries were only 60,000,000 gallons, far below the level of recent years.

At current rates of consumption, total stocks at the end of 1947 represented only 16 days' supply of natural gasoline, 6 days' supply of LP-gas, and 13 days' supply of other products.

Stocks of natural gasoline and allied products in the United States, 1943–46, and 1947, by months, in thousands of gallons

Date	Natural gasoline		LP-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	Grand total
Dec. 31:									
1943	61,488	68,922	15,750	29,274	10,332	4,956	87,570	103,152	190,722
1944	60,060	54,642	17,262	29,190	11,046	6,384	88,368	90,216	178,584
1945	67,412	34,314	22,255	17,262	22,840	17,430	112,507	69,006	181,513
1946	97,339	41,328	20,882	11,382	28,282	9,996	146,503	62,706	209,209
1947									
Jan. 31	95,050	42,084	18,288	8,568	29,568	7,770	142,906	58,422	201,328
Feb. 28	94,723	43,092	23,396	9,282	30,604	9,324	148,723	61,698	210,421
Mar. 31	91,934	55,650	25,276	10,332	27,885	10,038	145,095	76,020	221,115
Apr. 30	106,177	52,080	27,584	9,954	30,523	9,030	164,284	71,064	235,348
May 31	100,545	60,690	26,542	10,458	25,189	10,332	152,276	81,480	233,756
June 30	101,992	61,572	24,402	9,072	17,758	14,196	144,152	84,840	228,992
July 31	108,510	61,698	17,104	6,762	18,267	8,946	143,881	77,406	221,287
Aug. 31	100,656	54,768	17,952	7,182	19,004	11,172	137,612	73,122	210,734
Sept. 30	92,517	44,856	18,186	7,938	17,166	6,510	127,869	59,304	187,173
Oct. 31	80,535	42,798	20,607	7,938	16,231	9,156	117,373	59,892	177,265
Nov. 30	76,967	39,396	27,555	6,468	20,841	7,938	125,363	53,802	179,165
Dec. 31	75,338	43,008	24,723	5,502	19,961	11,886	120,022	60,396	180,418

PRICES

The average value of natural gasoline as reported to the Bureau of Mines by producers increased to 5.92 cents in 1947 compared with 4.15 cents in 1946 and 4.48 cents in 1945. The averages reported for LP-gases were 3.61 cents in 1947, 2.56 cents in 1946, and 2.97 cents in 1945. Corresponding figures for other products were 6.20 cents, 4.52 cents, and 4.24 cents, respectively. For all light products, the 1947 average rose to 5.18 cents from the 1946 average of 3.75 and the 1945 average of 3.99 cents.

Following several increases during the year the spot prices of the 26–70 grade of Mid-Continent (Group 3) natural gasoline was 8.50 cents a gallon on December 31, 1947. This compares with 5 cents at the end of 1946. The all-time low price for this grade was 1.5 cents in June 1940 which was less than one-third the then prevailing price for regular grade gasoline in the same area. The wartime ceiling price of the Office of Price Administration was 4.75 cents; but after October 8, 1943, the trend was generally downward to a low of 2.75 cents in February 1946. This proved to be the turning point; but the yearly average price in 1946 was only 3.84 cents, compared with 4.56 cents in 1945. Confirming the active demand, the trend continued upward in the early months of 1948.

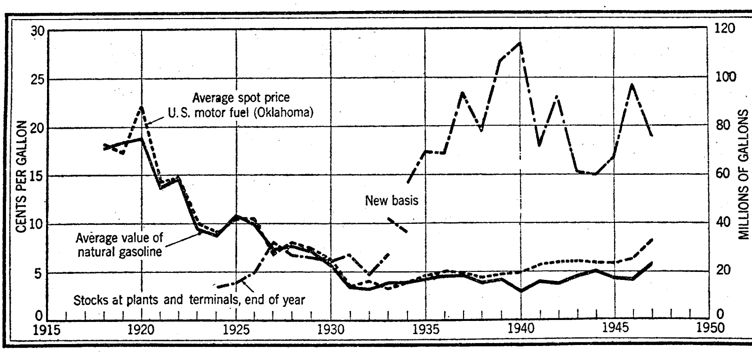

FIGURE 2.—Trends in average value of natural gasoline, spot price of gasoline, and stocks of natural gasoline, 1918–47.

Rising prices for natural gasoline followed the upward trend in the market for all motor fuels. During the first quarter of 1947 the Oklahoma spot price of 73–75 octane gasoline advanced from 7.25 cents a gallon to 8 cents, and later in the year rose rapidly to above 10 cents. The quotation at the end of December was 10.5 to 11.75 cents a gallon, or 23 to 38 percent above the price of natural gasoline as against a 45-percent differential at the end of 1946. Based on yearly average prices, the premium in 1946 was 64 percent, but in 1945 it was only 29 percent.

Heretofore, LP-gas has been sold wholesale almost exclusively under contract, but in 1947 it began to be quoted on the "open spot" market by suppliers. Although prices of crude oil doubtless will continue to influence this market as they do the prices of other petroleum products, LP-gas prices, according to Lamm,[6] are no longer tied to a price of crude oil by an escalator clause in supplier-distributor contracts.

Monthly average prices of LP-gases, f. o. b. refineries in the United States, 1947, in cents per gallon

[Platt's Oil Price Handbook]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.
New York Harbor:													
Commercial propane	6.00	6.00	6.13	6.50	6.50	6.50	6.50	6.50	6.50	6.54	7.50	7.83	6.58
Commercial butane	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	7.50	7.88	6.49
New Orleans, La.: Commercial propane	3.25	3.25	3.33	3.50	3.50	3.93	4.00	4.00	4.00	4.09	5.00	5.27	3.93
Hastings, W. Va.:													
Commercial propane	5.25	5.25	5.25	5.25	5.25	5.65	5.75	5.75	5.75	5.84	6.75	7.02	5.73
Commercial butane	4.50	4.50	4.50	4.50	4.50	4.90	5.00	5.00	5.00	5.09	6.00	6.27	4.98

FOREIGN TRADE [7]

Exports of light products increased notably following their phenomenal jump in 1946. Shipments of natural gasoline to foreign countries soared to 202.9 million gallons valued at $17,111,425 compared with 128.9 million gallons valued at $7,506,921 in 1946, and 36.9 million gallons worth $2,293,000 in 1945. As in previous years, over half of the 1947 total exports were shipped to the United Kingdom (103 million gallons). Canada was the second largest consumer, with shipments amounting to 67.2 million gallons, followed by Curaçao, with 21.5 million gallons. France, normally third, received only 5.25 million gallons and Australia 3.5 million, the remainder being divided among eight smaller countries of destinaton.

Exports of LP-gases originating at plants of the natural-gasoline industry and at petroleum refineries increased moderately to 53.2 million gallons worth $4,571,236 compared with 49.1 million gallons worth $3,319,013 in the preceding year and 26.1 million gallons worth $1,589,000 in 1945. In both 1947 and 1946, Canada received about 60 percent of all the exports in this classification and Mexico over 30 percent.

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[6] Lamm, E., Rapid Growth of L. P. G. Industry Opens New Market Fields: Nat. Petrol. News, vol. 39, No. 27, July 2, 1947, pp. 26-28.

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

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LP-gases exported from the United States, by countries, 1943–47, in thousands of gallons [1]

[U. S. Department of Commerce]

Country	1943	1944	1945	1946	1947
Bermuda	59	86	103	147	198
Brazil	----------	----------	63	289	1,570
Canada	4,499	7,507	15,044	30,379	31,591
France	----------	----------	----------	1,941	2,082
Mexico	5,374	6,743	10,615	15,955	16,471
Philippines, Republic of the	----------	----------	12	101	402
United Kingdom	----------	1	----------	----------	446
Other countries	130	220	222	279	473
Total	10,062	14,557	26,059	49,091	53,233

[1] Converted from pounds to gallons at 4.5 pounds per gallon.

Nickel

By HUBERT W. DAVIS

GENERAL SUMMARY

CONSUMPTION of nickel in the United States in 1947 was only slightly greater than in 1946, and this gain was more than offset by smaller sales to the Government strategic stock pile. As a consequence, imports of nickel into the United States were 13 percent lower than in 1946. Receipts of nickel at consumers' plants were less than consumption; as a result, there was a 41-percent reduction in inventories, undoubtedly in anticipation of the lower rate of duty.

Output of nickel in Canada was 23 percent greater in 1947 than in 1946; but production in Cuba, because of suspension of operations on March 31, was 82 percent smaller. Domestic output of nickel was, as heretofore, small in 1947.

Salient statistics for nickel, 1943–47

	1943	1944	1945	1946	1947
United States:					
Production:					
Primary short tons	642	988	1,155	352	646
Secondary do	6,917	4,321	6,483	8,248	9,541
Imports (gross weight)[1] do	141,249	134,932	122,528	104,734	88,408
Exports (gross weight)[2] do	9,464	7,931	3,876	7,977	12,037
Consumption do	(3)	(3)	96,252	80,105	80,757
Price per pound[4] cents	31½	31½	31½	31½–35	35
Canada:					
Production short tons	144,009	137,299	122,565	96,062	117,781
Imports do	545	424	762	(3)	(3)
Exports do	135,547	133,599	108,222	111,422	117,056
World production do	184,000	173,000	160,000	136,000	152,000

[1] Excludes "All other manufactures of nickel"; weight not recorded.
[2] Excludes "Manufactures"; weight not recorded.
[3] Not available.
[4] Price quoted by International Nickel Co., Inc., for electrolytic nickel in carlots f. o. b. Port Colborne, Ontario, including duty of 2½ cents a pound.

The steel industry continued to be the chief consumer of nickel in the United States, taking 41 percent of the total in 1947. However, because of a 15-percent decline in usage of nickel in stainless steels, the quantity of nickel utilized by the steel industry in 1947 was 3 percent less than in 1946. The use of nickel in cast irons in 1947 was 32 percent more than in 1946 and was the highest since this development was begun some 20 years ago.

Imports of nickel (in all forms) were 13 percent less than in 1946.

Effective January 1, 1948, the rate of duty on refined nickel imported into the United States was reduced 1¼ cents a pound (a 50-

percent reduction), and a corresponding decrease in price for refined nickel in the United States was made by the International Nickel Co., Inc.; the new price is 33¾ cents a pound.

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. Domestic primary nickel was recovered in 1947 as a byproduct in copper refining at Baltimore, Md.; Carteret and Perth Amboy, N. J.; Laurel Hill, N. Y.; and Tacoma, Wash. Although all the nickel recovered as a byproduct of copper refining is credited to domestic production, an indeterminable portion is recovered from imported blister copper. There was no domestic production of nickel from ore or as a byproduct of talc in 1946 and 1947.

In addition to the nickel sulfate produced as a byproduct of copper refining, 4,252,903 pounds of nickel in salts (chiefly nickel sulfate) were produced in the United States from cobalt-nickel ore and nickel-sulfate residues from Canada and from other materials, such as oxide, shot, and scrap. Thus, the total production of nickel salts in the United States in 1947 was 5,544,366 pounds (nickel content), of which about 87 percent was for electroplating, 12 percent for catalysts, and 1 percent for ceramics.

Nickel produced in the United States, 1943–47

Year	Primary (short tons)[1]		Secondary[2]	
	Byproduct in copper refining[3]	Other[4]	Short tons	Value
1943	642		6,917	$4,841,900
1944	697	291	4,321	3,024,700
1945	719	436	6,483	4,538,100
1946	352		8,248	5,801,600
1947	646		9,541	7,188,189

[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.

CONSUMPTION AND CONSUMERS' STOCKS

The accompanying tables give data on consumption and consumers' stocks of nickel. The data cover all known consumers of nickel in the form of primary, secondary, and oxide. The figures for nickel salts, however, fall far short of the total and probably represent only about one-fourth of it.

Nickel (exclusive of scrap) consumed and in stock in the United States, 1946–47, by forms, in pounds of nickel

Form	1946 Consumption	1946 Stocks at consumers' plants Dec. 31 [1]	1946 In transit to consumers' plants Dec. 31	1947 Consumption	1947 Stocks at consumers' plants Dec. 31	1947 In transit to consumers' plants Dec. 31
Primary	122, 292, 187	17, 267, 049	834, 059	117, 120, 883	11, 200, 642	1, 052, 069
Secondary (remelted from scrap)	154, 717	69, 315				
Matte	19, 115, 689	5, 975, 787		23, 711, 215	1, 280, 670	2, 267, 131
Oxide	17, 696, 534	2, 241, 911	749, 950	19, 331, 904	2, 425, 152	105, 274
Salts	951, 647	467, 273	842	1, 349, 857	464, 315	5, 930
	160, 210, 774	26, 021, 335	1, 584, 851	161, 513, 859	15, 370, 779	3, 430, 404

[1] Revised figures (except for matte).

Nickel (exclusive of scrap) consumed in the United States, 1946–47, by uses

Use	Pounds of nickel 1946	Pounds of nickel 1947
Ferrous:		
Stainless steels	35, 986, 164	30, 700, 270
Other steels	31, 193, 998	34, 758, 963
Cast irons	5, 973, 919	7, 905, 576
Nonferrous (comprises copper-nickel alloys, nickel-silver, brass, bronze, beryllium, magnesium, and aluminum alloys, and Monel, Inconel, and malleable nickel)	51, 819, 728	55, 136, 503
High-temperature and electrical-resistance alloys	13, 596, 601	10, 249, 545
Electroplating:		
Anodes	17, 059, 306	17, 975, 335
Solutions	[1] 566, 916	1, 218, 268
Catalysts	544, 093	489, 828
Ceramics	387, 655	385, 112
Other uses	[1] 3, 082, 394	2, 694, 459
	160, 210, 774	161, 513, 859

[1] Revised figure.

FOREIGN TRADE [1]

The quantity of nickel imported into the United States declined for the fourth successive year and was 13 percent less in 1947 than in 1946. Imports in 1947 comprised chiefly metallic nickel, matte, oxide, and nickel-sulfate residues. As heretofore, Canada was the chief source of the imports; it supplied 112,967,111 pounds of metallic nickel, 29,272,226 pounds of matte (averaging about 69 percent nickel), 16,843,337 pounds of oxide (averaging about 75 percent nickel), 35 pounds of nickel-silver, and an undetermined quantity of nickel-sulfate residues. The matte is refined to "Monel" metal at the plant of the International Nickel Co., Inc., at Huntington, W. Va. In 1947 Cuba furnished 13,282,551 pounds of oxide (averaging 77 percent nickel), the United Kingdom supplied 21,798 pounds of oxide, 723,851 pounds of metallic nickel, 1,516 pounds of bars, rods, etc., and 288 pounds of nickel-silver; Sweden, Norway, and the U. S. S. R. contributed 62,823, 3,508,903, and 110,243 pounds, respectively, of

[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.

metallic nickel; and Switzerland supplied 21,476 pounds of nickel-silver.

The nickel content of the unmanufactured nickel products imported into the United States is estimated at 161,435,000 pounds in 1947, compared with 185,000,000 pounds (revised figure) in 1946.

The rate of duty on refined nickel imported into the United States was reduced 50 percent to 1¼ cents a pound, effective January 1, 1948. Nickel ore, matte, and oxide entered the United States duty-free.

Exports of nickel comprise largely products manufactured from imported raw materials. Exports of alloys and scrap (including Monel metal), which comprise the bulk of the foreign shipments, were 51 percent larger in 1947 than in 1946; those of metallic nickel, nickel-chrome electric-resistance wire, and nickel-silver were 44, 70, and 53 percent, respectively, greater.

The United Kingdom (12,615,446 pounds), Canada (2,760,216 pounds), India (1,797,755 pounds), and France (571,526 pounds) were the chief markets for nickel, Monel metal, alloys, and scrap in 1947.

Nickel products (excluding residues) imported for consumption in the United States, 1945–47, by classes

Class	1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured:						
Nickel ore and matte	50,077,170	$8,223,086	38,092,080	$5,263,584	29,272,226	$3,750,870
Nickel pigs, ingots, shot, etc.	156,804,166	42,813,780	142,324,523	38,657,205	117,372,931	35,368,075
Nickel bars, rods, tubes, etc.	51	56	512	960	1,516	1,455
Nickel oxide	38,174,845	7,727,872	29,041,940	5,927,731	30,147,686	6,458,240
Manufactured:						
Nickel-silver, or German silver in sheets, strips, rods, and wire	408	194	9,762	4,697	21,799	11,095
All other manufactures of nickel	(1)	122,670	(1)	3,529	(1)	5,834
		58,887,658		49,857,706		45,595,569

[1] Quantity not recorded.

Nickel products exported from the United States, 1945–47, by classes

Class	1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value
Ore, concentrates, and matte	15	$38	21,083	$12,832	1,510	$861
Alloys and scrap containing nickel (including Monel metal)	4,573,476	1,502,874	11,194,004	4,005,090	16,848,166	6,287,395
Metal in ingots, bars, sheets, etc.	1,614,045	740,088	1,883,881	994,470	2,712,787	1,528,451
Manufactures	(1)	824,322	(1)	647,736	(1)	1,119,984
Nickel-chrome electric-resistance wire	971,549	1,370,410	817,003	1,247,861	1,386,457	2,021,879
Nickel-silver or German silver, crude, scrap, or bars, rods, etc.	267,145	68,972	2,037,788	500,132	3,125,017	1,197,860
Nickel salts and compounds	326,749	105,469	(2)	(2)	(2)	(2)
		4,612,173		7,408,121		12,156,430

[1] Quantity not recorded.
[2] Beginning Jan. 1, 1946, not separately classified.

WORLD REVIEW

The accompanying table shows world production of nickel by countries, 1939–47, insofar as statistics are available. Despite the fact that nickel is produced in many countries, four—Canada, Cuba, New Caledonia, and the U. S. S. R.—have accounted for about nine-tenths of world output in recent years and one country—Canada—has supplied 70 to 80 percent of the total.

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 Ontario. Two companies—International Nickel Co. of Canada, Ltd., and Falconbridge Nickel Mines, Ltd.— are the principal producers. Nickel production in Canada was 117,781 short tons in 1947, compared with 96,062 tons in 1946. Exports of nickel from Canada were 117,056 short tons in 1947, compared with 111,422 tons in 1946.

World production of nickel (content of ore), 1939–47, by countries, in metric tons

[Compiled by B. B. Mitchell]

Country	1939	1940	1941	1942	1943	1944	1945	1946	1947
Brazil	25	(1)	(1)	1	-------	6	(1)	(1)	(1)
Burma	913	745	[2] 471	(1)	(1)	(1)	(1)	(1)	(1)
Canada	102, 559	111, 383	128, 029	129, 369	130, 642	124, 555	111, 189	87, 146	106, 849
Cuba	-------	-------	-------	(1)	2, 430	4, 679	10, 900	11, 241	2, 014
Finland	(1)	(1)	97	1, 630	8, 970	313	900	600	(1)
Germany	500	729	674	577	951	(1)	(1)	(1)	(1)
Greece	1, 336	575	185	706	495	(1)	-------	-------	-------
Iran	[3] 21	[3] 9	[3] 7	(1)	(1)	[3] 5	(1)	(1)	(1)
Italy [4]	100	87	91	74	(1)	(1)	(1)	(1)	(1)
Japan [5]	876	825	2, 311	1, 252	1, 613	1, 720	650	(1)	(1)
Morocco, French	(1)	(1)	(1)	(1)	45	47	(1)	(1)	(1)
Netherlands Indies	[4] 753	2, 222	[4] 1, 200	[4] 1, 200	[4] 1, 200	(1)	(1)	(1)	(1)
New Caledonia	10, 625	10, 535	10, 395	9, 415	7, 374	8, 115	4, 328	2, 779	3, 345
Norway	1, 106	1, 007	907	911	577	529	516	55	(1)
Southern Rhodesia	[4] 490	(1)	(1)	(1)	-------	-------	-------	(1)	(1)
Sweden	-------	-------	101	377	702	698	390	-------	(1)
Union of South Africa	398	416	581	449	343	481	499	483	258
U. S. S. R.[4]	(1)	8, 650	13, 600	(1)	11, 160	(1)	13, 400	20, 000	25, 000
United States [6]	357	503	599	555	582	896	1, 048	319	586
Total (estimate)	122, 000	140, 000	162, 000	158, 000	167, 000	157, 000	145, 000	123, 000	138, 000

[1] Data not available; estimate by author of chapter included in total.
[2] Figure covers 9 months ended Mar. 31, 1942.
[3] Fiscal year ended Mar. 20 of year following that stated.
[4] Estimate.
[5] Preliminary data for year ended Mar. 31 of year following that stated.
[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.

Sales of nickel in all forms by the International Nickel Co. of Canada, Ltd., in 1947 were the highest of any peacetime year except 1937; they were 205,278,868 pounds in 1947 compared with 201,103,234 pounds in 1946.[2] Ore mined was 10,406,644 short tons in 1947 compared with 7,736,334 tons in 1946. Underground development totaled 54,790 feet in 1947, bringing the total footage to 1,239,508 at the year end. Proved ore reserves at the end of 1947 were 221,843,000 short tons containing 7,171,000 tons of nickel-copper, compared with 217,142,000 tons containing 6,861,000 tons of nickel-copper at the end of 1946.

[2] International Nickel Co. of Canada, Ltd., Annual Report: 1947, 15 pp.

Falconbridge Nickel Mines, Ltd.,[3] operated its larger furnace throughout 1947, whereas its smaller furnace was operated the greater part of 1946. As a result of the increased operations, 731,925 short tons of ore were treated in 1947 compared with 486,516 tons in 1946. Production of nickel-copper matte in 1947 was approximately 45 percent greater than in 1946, when it was 12,780 short tons. The company McKim property, on which drilling has disclosed substantial tonnages of good nickel ore, was in process of being opened for production. Active exploration was carried on in the Lynn Lake area, northern Manitoba, from January to October 1947. Known ore reserves of the company were 14,188,000 tons averaging 1.75 percent nickel on December 31, 1947.

The Sherritt Gordon Mines, Ltd.,[4] continued its program of exploration and development of nickel-copper ores in the Lynn Lake area of northern Manitoba in 1947. The work consisted chiefly of geophysical exploration, diamond drilling, and limited construction. The construction was in preparation for sinking two shafts during 1948.

Cuba.—Production of nickel oxide in Cuba was discontinued on March 31, 1947, and the United States Government-owned nickel mining and processing facilities were declared surplus and transferred to the War Assets Administration on July 11, 1947. The facilities had not been disposed of as of June 1, 1948. Output of oxide was 2,885 short tons (2,219 tons nickel content) in 1947 compared with 16,040 tons (12,391 tons nickel content) in 1946. Exports of oxide from Cuba were 6,615 short tons (5,100 tons nickel content) in 1947 compared with 13,953 tons (10,742 tons nickel content) in 1946. Commercial production of nickel in Cuba was begun the latter part of 1943; from that date through March 31, 1947, the total nickel content in the oxide produced was about 63,569,000 pounds.

New Caledonia.—Because of the shortage of coal, Société le Nickel suspended output of nickel matte on July 18, 1946; limited production was resumed in April 1947. Consequently, outputs of matte were only 1,782 and 1,774 metric tons, respectively, in 1947 and 1946. Chiefly because of the curtailed operations, outputs of ore were 95,570 and 107,944 metric tons, respectively, in 1947 and 1946 compared with an average of 243,619 tons in the 5 years 1941–45. The nickel ore contains 2.5 to 7 percent nickel.

Norway.[5]—The Falconbridge nickel refinery at Kristiansand was operated continuously during 1947; however, an unusually low rainfall in the summer and a power shortage in the fall caused a reduction in production towards the year end. The refinery operates chiefly on matte from the Falconbridge smelter in Canada but some custom matte is also refined.

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[3] Falconbridge Nickel Mines, Ltd., 19th Annual Report: 1947, 12 pp.
[4] Sherritt Gordon Mines, Ltd., Annual Report: 1947, pp. 14–15.
[5] Falconbridge Nickel Mines, Ltd., 19th Annual Report: 1947, pp. 2, 10.

Nitrogen Compounds

By BERTRAND L. JOHNSON [1]

GENERAL SUMMARY

THE critical world shortage of nitrogenous fertilizers continued unabated throughout 1947. The deficiency was at least a million tons; and, as requirements have been increasing rapidly, the world shortage is expected to be substantially greater in 1948. Production was only a few percent above prewar level, while consumption requirements have been estimated at 35 percent greater than actual prewar consumption.

The present supply of nitrogen in this country is insufficient to meet the demand from both agricultural and industrial consumers. Although farmers consumed record quantities of fertilizer nitrogen, more could have been sold, if available, in all sections of the country. The Department of the Army shipped a large tonnage to occupied areas abroad, and additional quantities are required to fulfill our international commitments. Industrial consumption of nitrogen is large, and many process industries require nitrogen chemicals in increasing quantities.

The International Emergency Food Council stated on March 12, 1947, that, because of the critical world shortage of nitrogen-bearing materials, allocation recommendations for distributing the world supply of nitrogenous fertilizers would be continued in the fertilizer year commencing July 1, 1947. The only United States controls over nitrogen in 1947 were on exports. There was no allocation or distribution of nitrogen fertilizer for domestic agriculture.

Five countries only—Belgium, Canada, Chile, Norway, and the United Kingdom—produce more nitrogen than they need in their own agriculture. The United States is a net importer of nitrogen but, owing to the nature of world trade, usually exports some nitrogen. Imports of the nitrogen-deficient nations involved in the present allocations will be supplied by these countries. The United States is obligated to ship 61,000 tons of commercial nitrogen during the 1947–48 year. Not included in this distribution are the Allied occupation zones of Germany, Japan, and Korea. The United States Army ordnance plants are producing nitrogen for these areas, and plans called for shipping about 230,000 tons of nitrogen to those areas in 1947–48.

[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 production of nitrogen compounds in the United States, 1945–47, in short tons

Production of—	1945	1946	1947
Ammonia (NH_3):			
Synthetic plants: Anhydrous ammonia [1]	548,655	725,537	1,117,212
Byproduct coking plants (NH_3 content):			
Aqua ammonia	27,607	24,991	25,718
Ammonium sulfate	191,073	160,938	202,360
Total	218,680	185,929	228,078
Ammonium sulfate:			
Synthetic plants [1]	88,863	156,653	197,027
Byproduct coking plants	764,293	643,752	809,440
Total	853,156	800,405	1,006,467
Ammonium nitrate, original solution 100 percent NH_4NO_3 [1]	421,487	724,899	1,047,792

[1] Data from Bureau of Census monthly Facts for Industry series.

Salient statistics on nitrogen compounds imported into and exported from the United States, 1944–47, in short tons

[U. S. Department of Commerce]

	1944	1945	1946	1947
Imports:				
Industrial chemicals:				
Anhydrous ammonia	-	4	7	-
Ammonium nitrate	(1)	(1)	-	27
Fertilizer materials:				
Ammonium nitrate mixtures:				
Containing less than 20 percent nitrogen	-	-	-	92
Containing 20 percent or more nitrogen	317	655	1,105	-
Ammonium sulfate	103,628	118,890	101,558	114,398
Calcium cyanamide	101,886	141,057	163,093	153,764
Nitrogenous materials, n. s. p. f.	112,616	135,010	126,029	9,687
Ammonium phosphates	91,943	92,757	91,113	105,189
Potassium nitrate, crude	-	-	-	(1)
Sodium nitrate	713,004	849,888	529,677	556,525
Sodium-potassium nitrate	9,407	-	4,400	2,500
Exports:				
Industrial chemicals:				
Anhydrous ammonia	3,623	4,312	6,159	6,062
Aqua ammonia	2,499	2,715	(2)	(2)
Ammonium nitrate	13,454	9,845	(2)	(2)
Fertilizer materials:				
Ammonium sulfate	10,615	20,752	25,256	88,601
Calcium cyanamide	(1)	(1)	(2)	(2)
Nitrogenous chemical materials, n. e. s.	11,175	83,974	(2)	(2)
Sodium nitrate	11,597	12,229	16,180	19,920

[1] Less than 1 ton.
[2] Beginning Jan. 1, 1946, not separately classified by U. S. Department of Commerce.

INORGANIC NITROGEN COMPOUNDS

NATURAL NITRATES

Domestic Nitrate Deposits.—Deposits of soluble nitrate minerals are scattered throughout the United States. Many of these have been described. (*See* Nitrogen Compounds chapter, Minerals Yearbook 1942, p. 1522.) None of them, however, have as yet proved of sufficient size and grade to serve as a basis for a domestic natural nitrate industry, and consequently little attention has been paid to them in recent years.

Chilean Nitrate.—Large quantities of natural sodium nitrate continue to be imported from Chile. The amount brought into the

United States in 1947—a little over one-half million tons—was slightly larger than in 1946 (the lowest in several years) but still much below imports during the war years. The value of imports in 1947 increased nearly $4,000,000 over 1946. Imports of sodium–potassium nitrate fell from 4,400 short tons in 1946 to 2,500 tons in 1947. The imports of these two commodities for 1943–47 are shown in the accompanying table.

Sodium nitrate and sodium-potassium nitrate imported for consumption in the United States, 1943–47 [1]

[U. S. Department of Commerce]

Year	Sodium nitrate		Sodium-potassium nitrate		Year	Sodium nitrate		Sodium-potassium nitrate	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1943	761,165	$15,188,787	19,767	$580,760	1946	529,677	$11,448,232	4,440	$146,312
1944	713,004	15,346,426	9,407	278,534	1947	556,525	15,153,889	2,500	64,968
1945	849,888	18,558,959	--------	----------					

[1] All from Chile.

In August 1947 it was stated that 92,800 metric tons of nitrogen in the form of nitrate of soda had been allotted by the International Emergency Food Council to the United States from Chile for delivery in the 1947–48 fertilizer year. This is about 102,000 short tons of nitrogen or 637,500 tons of nitrate, which considerably exceeds the 532,285 tons of nitrate imported in the 1946–47 season.

At the beginning of 1947 prices for imported Chilean nitrate of soda were $38.50 per short ton in bulk and $41.50 per ton in bags. In August 1947 an advance of $4 per ton in the price of Chilean nitrate was announced, bringing the price for bulk nitrate to $42.50 per ton and the bagged price to $45.50 at the usual ports of importation. Still higher prices became effective on December 17, 1947. Bulk was priced at $44.50 per ton, carlots, f. o. b. cars at port warehouse, plus loading and terminal charges, and charges for fertilizer tax tags and attaching if required. The bagged material became $48 per ton, $3.50 per ton over the bulk quotation, instead of the usual $3 per ton spread, owing to the higher cost of labor and materials in bagging the product.

A heavy domestic demand for Chilean sodium nitrate prevailed in 1947, with insufficient supplies, and these conditions continued in 1948.

A new process has been developed for recovering potassium nitrate in Chile. This entails the conversion and concentration of potash present in low-grade nitrate ore. This method is reported as being used with considerable success at the Victoria plant of the Compania Salitrera Tarapaca y Antofagasta and may be installed at the factories of the Compania Salitrera Iquique.

SYNTHETIC NITROGEN COMPOUNDS

Ammonia and Its Compounds.—Our domestic production of ammonia and its compounds consists principally of ammonia solutions, including liquid anhydrous ammonia, ammonium sulfate, sodium nitrate, and ammonium nitrate. Most of the export nitrogen is in the form of ammonium sulfate and ammonium nitrate. In the United States the tonnage of fertilizer nitrogen in liquid form moving to consuming points exceeds any of the solid forms by a wide margin, and anhydrous ammonia is being applied directly to the soil in increasing amounts over an expanding area. Ammonia solutions are the cheapest form of nitrogen available for fertilizer use. The unit cost for ammonia solutions is about $1.07 compared with $2.65 per unit of nitrogen for Chilean nitrate of soda and $1.85 for coke-oven ammonium sulfate. Their cost is also less than that of ammonium nitrate.

Considerable quantities of domestic commercial ammonium nitrate are to be exported to other countries under the recommended IEFC allocations. The allocation of ammonium nitrate for export was certified to April 1, 1947, by the Secretaries of State and Commerce, as necessary to meet international commitments of the United States, this material being in short world supply and subject to allocation recommendation of the IEFC. Later the certification was broadened to include the other nitrogenous fertilizer materials. Following the Texas City, Tex., disaster, the United States Coast Guard forbade the loading of ammonium nitrate to Europe at ports other than those under Army control. This order was not relaxed until near the close of 1947.

The Army synthetic-nitrogen-producing ordnance plants sold or leased by the Government to private industry in 1946 were in operation in 1947, and enlarged or added facilities for ammonia oxidation and ammonium nitrate graining were being installed in some of them. At the beginning of 1947 the Army was operating four war-built synthetic-ammonia plants in a program to supply the occupied zones of Germany, Japan, and Korea with fertilizer as long as the need lasts. The Missouri Ordnance Works was later closed. The plants at Etter, Tex., Henderson, Ky., and Morgantown, W. Va., continued operation.

Synthetic Sodium Nitrate.—The synthetic sodium nitrate consumed in the United States in 1947 was produced domestically. There were no imports. The domestic production came entirely from the Hopewell, Va., plant of the Allied Chemical & Dye Corp. Domestic production was limited during the year by a scarcity of basic materials, but it was reported that this plant produced 210,000 tons of synthetic sodium nitrate in 1947 and that it was expected to yield the same tonnage in 1948. Most of this is expected to go into the chemical industry rather than to be used as fertilizer.

On January 1, 1947, the Barrett Division, Allied Chemical & Dye Corp., announced a price of $32 per ton, bulk, carlots, f. o. b. Hopewell, Va., for the domestic synthetic "Arcadian" brand nitrate of soda, with a price of $35.50 for the bagged material. On October 1, 1947, the price for bulk nitrate of soda was raised $5 per ton to $37 and the bagged material to $40.50 for carlot shipments. No change in price of the synthetic material was made during the remainder of the year.

Peat

By J. A. CORGAN and GOLDEN V. CHIRIACO

GENERAL SUMMARY

ACCORDING to reports received by the Bureau of Mines, 136,232 short tons of peat were produced in the United States in 1947—a decrease of 3 percent from the 1946 output of 140,707 tons but substantially greater than in any other year. The peat produced in 1947 was valued at $868,979, compared with $1,006,231 in 1946.

Imports of peat moss, which have been increasing steadily since 1940, dropped to 79,567 short tons in 1947, a decrease of 5 percent from the 84,078 tons imported in 1946. As in the past, no exports of peat were reported, making the quantity available for domestic consumption in 1947, 215,799 tons. Approximately 99 percent of the peat sales in 1947 was for soil improvement and for use in mixed fertilizers.

Reserves.—Peat, an integral part of the natural resources of the country, is found in about half of the States. Reserves were estimated in 1922 at 13,827,000,000 tons (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

Forty-five producers operating in 19 States accounted for the 1947 production of 136,232 short tons. Seven plants producing peat in 1946 were reported inactive in 1947. High cost of labor and prevailing prices were the principal reasons for inactivity. Two plants idle in 1946 resumed operations in 1947.

The average value per ton in 1947 was $6.38, an 11-percent decrease from the 1946 value of $7.15. Production and value for 1944–47 are shown in the accompanying table.

[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.

Peat produced in the United States, 1944–47

Year	Short tons	Value	
		Total	Average per ton
1944 (estimated)	97,000	$878,000	$9.05
1945 (estimated)	107,000	821,000	7.67
1946	140,707	1,006,231	7.15
1947	136,232	868,979	6.38

Florida was the largest peat-producing State in 1947, followed in order of output by New Jersey, Ohio, Illinois, Minnesota, Connecticut, Michigan, Pennsylvania, Indiana, California, Maine, Washington, Georgia, Wisconsin, Iowa, Colorado, Texas, New York, and Massachusetts.

Reed or sedge peat, produced in 10 States, comprised 40 percent of the total production in 1947; peat humus produced in 15 States, 39 percent; and moss peat, produced in 9 States, 21 percent.

USES

Peat is used principally in this country for soil improvement. In 1947, 78 percent was used for soil improvement, 21 percent for mixed fertilizers, and 1 percent for other purposes, including litter for barns and poultry yards, in nurseries, and greenhouses and as packing material for perishable and fragile articles. No sales of peat for fuel were reported in 1947.

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 Bureau of Federal Supply, United States Department of the Treasury, Washington 25, D. C.

IMPORTS [2]

Imports of peat in 1947 (97 percent of which came from Canada), totaled 79,567 short tons valued at $2,698,622. 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 average value per short ton of imported peat was $33.92 in 1947 compared with $32.17 in 1946.

[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, 1943–47

[U. S. Department of Commerce]

Year	Short tons	Value	Year	Short tons	Value
1943	59,427	$1,577,388	1946	84,078	$2,704,803
1944	64,383	1,916,794	1947	79,567	2,698,622
1945	77,673	2,393,214			

Peat moss imported for consumption in the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	Poultry and stable grade					
	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada	44,289	$1,465,531	42,536	$1,484,118	33,647	$1,239,459
Denmark					67	1,434
Netherlands			496	14,016	280	7,253
Norway					1	30
Sweden					6	283
	44,289	1,465,531	43,032	1,498,134	34,001	1,248,459

Country	Fertilizer grade					
	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada	33,384	$927,683	40,452	$1,191,243	43,377	$1,391,074
Denmark					72	1,984
Eire					22	750
Germany					75	1,867
Netherlands			594	15,426	1,990	53,733
Poland and Danzig					(1)	26
United Kingdom					30	729
	33,384	927,683	41,046	1,206,669	45,566	1,450,163

Less than 1 ton.

WORLD PRODUCTION

Data on production of peat in foreign countries are shown in the accompanying table.

World production of peat, 1941–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1941	1942	1943	1944	1945	1946	1947
Canada:							
Fuel	322	156	709	584	107	132	----------
Peat moss	25,222	48,540	58,386	72,979	76,170	87,850	76,156
Denmark	4,700,000	4,800,000	6,200,000	5,800,000	5,685,000	3,705,180	5,168,139
Eire [2]	5,398,274	4,312,738	4,954,895	5,302,477	5,086,734	4,826,238	(3)
Finland	10,982	8,659	2,364	2,840	7,280	6,846	(3)
France	83,560	209,740	190,210	112,619	92,000	78,000	85,800
Hungary	11,720	16,710	28,640	(3)	(3)	(3)	(3)
Iceland	18,003	(3)	11,560	11,973	11,000	[4] 10,500	[4] 6,600
Italy	19,510	134,463	[5] 59,204	(3)	(3)	(3)	(3)
Netherlands	748,810	712,935	648,800	535,550	386,050	571,940	(3)
Norway	312,086	323,300	334,688	296,974	269,648	(3)	(3)
Portugal	(3)	(3)	(3)	(3)	2,322	2,456	(3)
Sweden:							
Fuel	248,297	637,568	978,269	774,612	1,049,089	703,000	(3)
Litter, baled	118,599	112,400	110,000	105,310	101,420	106,000	(3)
Litter and "Mull," unbaled	3,649	2,060	1,395	1,303	1,075		
"Mull," baled	26,420	14,987	15,948	16,600	14,629		
Switzerland	[4] 40,000	[4] 200,000	[4] 430,000	[4] 310,000	497,429	100,000	40,000
U. S. S. R.	(3)	(3)	(3)	(3)	[4] 19,760,000	(3)	(3)
United States [6]	78,000	65,000	54,000	88,000	97,000	127,647	123,587

[1] In addition to countries listed, Argentina, Austria, Germany, and Poland produce peat, but data of production are not available.
[2] Figures for 1941–42 relate to production by holders of agricultural land only; those for 1943–46 cover total production.
[3] Data not available.
[4] Estimate.
[5] January to June, inclusive.
[6] Data for 1941–43 are as reported to the Bureau of Mines by producers and probably represent only about ⅔ of total production. Data for 1944–47 believed to represent reasonably complete coverage.

Petroleum and Petroleum Products

By A. G. WHITE, F. S. LOTT, A. T. COUMBE, AND A. L. CLAPP

GENERAL SUMMARY

THE outstanding feature of 1947 was the record increase in oil demand to a much higher level than had been anticipated. The total demand for all oils rose to 2,153 million barrels—a gain of 11 percent compared with 1946. Exports increased about 11 million barrels or 7 percent. Domestic demand in continental United States amounted to 1,989 million barrels—an increase of 196 million barrels or 11 percent. Compared with 1946, the domestic demand for motor fuel rose 8 percent, for residual fuel oil 8 percent, for distillate fuel oil 23 percent, for kerosine 15 percent, and for all other products 12 percent.

Total exports in 1947 amounted to 164.4 million barrels and total imports to 159.6 million barrels. The net export was reduced to only about 5 million barrels compared with 15 million in 1946. As the total change in all stocks was a decline of 5 million barrels, the total new production of crude petroleum and natural gasoline and related products (1,989 million barrels in 1947) represented almost exactly the domestic demand for all oils in that year. The upward trend in imports, particularly of crude oil, indicates the probability of a substantial net import in 1948.

In general, the postwar adjustments in demand resulted in a small gain in domestic demand in 1946, when a sharp drop had been considered probable, and a much larger gain in 1947 than had been anticipated. The sharp upward trend in demand indicated the necessity for a major program of expansion of refinery capacity and transportation facilities. The necessity of operating refineries close to maximum capacity left little elasticity in seasonal operations; if demand proved greater than anticipated, it would result in drastic seasonal shifts in refinery yields or abnormal seasonal changes in the stocks of refined products.

Demand for all oils in the United States, 1938–47

[Millions of barrels]

Year	Domestic demand	Exports	Total demand	Year	Domestic demand	Exports	Total demand
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	1,772.7	183.0	1,955.7
1941	1,485.8	108.8	1,594.6	1946	1,792.8	153.1	1,945.9
1942	1,449.9	116.9	1,566.8	1947 [1]	1,989.0	164.4	2,153.4

[1] Subject to revision.

To meet the large increase in demand for oil in 1947, the total domestic production of all oils was expanded by 7.4 percent, including an increase of 7 percent in crude-oil production and a gain of 13 percent in the production of light oils derived from natural gas. The relative gain in total production was less than the relative gain in demand, owing to the fact that over 43 million barrels were added to total stocks in 1946, whereas total stocks declined 5 million barrels in 1947. Furthermore, total imports increased 22 million barrels or a gain of almost 16 percent.

The large gain in required supply created material problems in expanding the capacity of refineries and in increasing available transportation facilities to move crude petroleum and products. The balance between supply and demand was so close that the cold winter of 1947–48 created temporary and local shortages in heating oils and required emergency measures to transport and distribute available supplies.

The total reported crude-oil capacity of refineries rose from 5,569,000 barrels daily on January 1, 1947, to 6,034,000 barrels daily by the end of the year.

Crude runs to stills averaged 5,075,000 barrels daily in 1947 compared with an average of 4,740,000 barrels daily for 1946—a gain of over 7 percent. The monthly ratio of actual crude runs to stills to the total capacity reported monthly by operating refineries ranged from a low of 94 percent to a high of 99 percent and was sustained at about 98 percent during the latter half of 1947.

Stocks of refined products declined 4.8 million barrels in 1947 compared with an increase of 35.9 million barrels in 1946. The most significant change during 1947 was the decrease of 8.5 million barrels in the stocks of distillate fuel oil, including a decline of 7.1 million barrels in the East Coast district and a decline of 5.5 million in the Gulf Coast district.

The domestic production of crude petroleum set a new record in 1947, increasing 7 percent from a total of 1,734 million barrels in 1946 to 1,856 million in 1947. Of the total increase of 122.2 million barrels in 1947, the chief gains were 59.2 million barrels for Texas, 18.4 million for California, 16.6 million for Louisiana, 10.7 million for Mississippi, 8.1 million for Kansas, 6.2 million for Oklahoma, and 5.3 million barrels for Wyoming. The largest decline was 8.8 million barrels for Illinois. The average value of crude petroleum at the wells increased from $1.41 per barrel in 1946 to $1.93 per barrel in 1947. General price increases went into effect, of 25 cents per barrel in March, 20 cents in October, and 50 cents in November-December. The last Government premium-price payments were eliminated early in March.

The demand for domestic crude petroleum rose from 4,735,000 barrels daily in 1946 to 5,084,000 barrels daily in 1947—a gain of 7.4 percent. The increase in 1947 totaled 127.5 million barrels. The amount of domestic crude run to stills increased 109.1 million barrels, exports were 3.7 million barrels larger, reported transfers to fuel oils increased 4.1 million barrels, and other fuel and losses were 10.3 million barrels greater.

The total demand for all oils increased from 1,946 million barrels in 1946 to 2,153 million in 1947—a gain of 11 percent. Total exports amounted to 153 million barrels in 1946 and over 164 million in 1947. Crude exports increased from 42.4 million barrels to 46.1 million, while exports of refined products rose from 110.7 million barrels in 1946 to 118.3 million in 1947. The principal gains in refined exports in 1947 compared with 1946 were 3.2 million barrels for lubricating oils, 2.2 million for motor fuel, 1.6 million for residual fuel oil, and 0.2 million for petroleum coke. Kerosine was the only product showing a decline, exports being reduced 1.4 million barrels.

Domestic demand for all oils in continental United States rose from 1,793 million barrels in 1946 to 1,989 million in 1947—a gain of almost 11 percent. Compared with 1946, the domestic demand for motor fuel increased 8 percent, for residual fuel oil 8 percent, for distillate fuel oil almost 23 percent, and for kerosine 15 percent.

This variation in the relative growth in demand for the various products is reflected in variations in refinery yields and other factors in supply that will be noted in the following discussions of individual products.

The domestic demand for all oils in continental United States was stimulated by the increasing availability of new motor vehicles and heating oil installations.

The domestic demand for motor fuel rose from 735.4 million barrels in 1946 to 794.8 million in 1947. The domestic demand for aviation gasolines rose from 12.9 million barrels in 1946 to 21.6 million in 1947, with about one-third of the total sales in 1947 representing military purchases and two-thirds civilian usage. According to the Public Roads Administration, the highway use of motor fuel rose from 610.7 million barrels in 1946 to 671.8 million in 1947—a gain of 10 percent.

The domestic demand for residual fuel oil increased from 480.0 million barrels in 1946 to 518.4 million in 1947—a gain of 8 percent. Military purchases declined from 35.8 million barrels in 1946 to 19.1 million in 1947, and total railroad use dropped from 100.3 million barrels in 1946 to 97.5 million in 1947. All other uses showed substantial gains.

The domestic demand for distillate fuel oil rose from 242.9 million barrels in 1946 to 298.2 million in 1947—a gain of almost 23 percent.

Salient statistics of crude petroleum, refined products, and natural gasoline in the United States, 1943–47

	1943	1944	1945	1946	1947 [1]
Crude petroleum:					
Domestic production.....thousands of barrels [2]..	1,505,613	1,677,904	1,713,655	1,733,939	1,856,107
World production....do....	2,256,625	2,592,511	2,594,914	2,746,680	3,022,030
United States proportion of world production percent..	67	65	66	63	61
Imports [3]....thousands of barrels [2]..	13,833	44,805	74,337	86,066	97,532
Exports [3]....do....	41,342	34,238	32,998	42,436	46,117
Stocks, end of year:					
Gasoline-bearing crude....do....	242,132	[4] 220,663	218,763	224,473	224,929
California heavy crude....do....	7,272	6,107	4,496	5,703	5,725
Runs to stills....do....	1,429,738	1,665,684	1,719,534	1,730,197	1,852,246
Total value of domestic production at wells thousands of dollars..	1,809,020	2,032,960	2,094,250	2,442,550	[5] 3,548,266
Average price per barrel at wells....	$1.20	$1.21	$1.22	$1.41	$1.91
Total producing oil wells in the United States, Dec. 31....	407,170	412,220	415,750	421,460	[6]
Total oil wells completed in the United States during year....	9,717	13,029	14,297	15,851	17,999
Refined products:					
Imports [7]....thousands of barrels [2]..	49,579	47,506	39,282	51,610	62,063
Exports [7]....do....	108,615	173,378	149,985	110,687	118,346
Stocks, end of year....do....	229,362	245,868	235,998	271,937	267,103
Output of motor fuel....do....	608,180	739,340	798,194	776,583	839,886
Yield of gasoline....percent..	37.1	39.4	40.9	39.6	40.2
Completed refineries, end of year....	452	413	393	399	390
Daily crude oil capacity of refineries thousands of barrels [2]..	5,093	5,301	5,316	5,569	6,034
Average dealers' net price (excluding tax) of gasoline in 50 United States cities cents per gallon [8]..	10.45	10.49	10.33	10.40	12.33
Natural gasoline:					
Production....thousands of barrels [2]..	87,716	100,046	112,004	115,739	132,000
Stocks, end of year....do....	4,541	[4] 4,451	4,322	4,981	4,296

[1] Subject to revision.
[2] 42 gallons to the barrel.
[3] As reported to Bureau of Mines; export data from U. S. Department of Commerce, April-December 1947.
[4] Figure on new basis and comparable with those of succeeding years. Figures for 1944 on the old basis and comparable with preceding years are as follows: Gasoline-bearing crude, 220,862 and natural gasoline, 4,252.
[5] Estimated.
[6] Figure not available when table was compiled.
[7] U. S. Department of Commerce; exports include shipments to noncontiguous Territories.
[8] American Petroleum Institute.

Military purchases declined from 9.4 million barrels in 1946 to 5.2 million in 1947. All other uses showed substantial gains, including an increase of almost 28 percent for heating oils.

The domestic demand for kerosine increased from 89.1 million barrels in 1946 to 102.5 million in 1947—a gain of 15 percent. The principal increases in the use of kerosine are for range oil and small space-heating units.

The domestic demand for all other products rose from 245.4 million barrels in 1946 to 275 million in 1947—a gain of 12 percent. The largest increase in this group was the rise in the demand for liquefied gases from 39.7 million barrels in 1946 to 52.7 million in 1947—an increase of almost 33 percent.

The quarterly trends in 1947 reflected the rapid expansion in demand during the year.

Crude runs to stills averaged 4,800,000 barrels daily in the first quarter, 4,925,000 barrels daily in the second quarter, 5,268,000 barrels daily in the third quarter, and 5,298,000 barrels daily in the fourth quarter.

Refined stocks during 1947 declined 30.9 million barrels in the first quarter, gained 7.5 million in the second quarter, increased 29.9 million

Supply and demand of all oils in the United States in 1946–47, by months, in thousands of barrels

[Including wax, coke, asphalt, and still gas]

	1946 [1]													1945 (total)
	January	February	March	April	May	June	July	August	September	October	November	December	Total	
New supply:														
Domestic production:														
Crude petroleum	143,660	132,263	136,869	140,180	148,229	146,989	152,541	149,859	143,703	148,325	144,659	146,662	1,733,939	1,713,655
Natural gasoline	9,961	9,081	9,401	9,149	9,410	9,380	9,439	9,701	9,454	10,156	10,049	10,558	115,739	112,004
Benzol	240	240	240	150	150	150	150	150	150	150	150	150	2,070	2,880
Total production	153,861	141,584	146,510	149,479	157,789	156,519	162,130	159,710	153,307	158,631	154,858	157,370	1,851,748	1,828,539
Imports:														
Crude petroleum [2]	6,917	6,787	6,812	7,466	7,508	6,880	6,978	8,296	7,508	7,001	6,852	7,061	86,066	74,337
Refined products [3]	4,662	4,166	3,665	2,530	4,909	4,525	4,508	4,600	4,835	3,731	4,215	5,264	51,610	39,282
Total new supply	165,440	152,537	156,987	159,475	170,206	167,924	173,616	172,606	165,650	169,363	165,925	169,695	1,989,424	1,942,158
Change in stocks	−2,336	+3,186	−285	+2,433	+4,439	+8,939	+10,816	+10,796	+13,976	+6,378	+1,121	−15,948	+43,515	−13,510
Demand:														
Total demand	167,776	149,351	157,272	157,042	165,767	158,985	162,800	161,810	151,674	162,985	164,804	185,643	1,945,909	1,955,668
Exports:														
Crude petroleum [2]	2,332	2,397	2,970	3,818	3,914	3,459	4,290	4,368	4,152	4,244	3,325	3,167	42,436	32,998
Refined products [3]	10,173	9,087	10,640	9,901	10,309	11,135	8,915	10,166	8,873	5,876	6,680	8,932	110,687	149,985
Domestic demand:														
Motor fuel	51,746	47,654	56,703	62,111	66,800	63,247	69,076	66,729	62,268	66,637	61,345	61,101	735,417	696,333
Kerosine	11,167	9,585	7,958	5,994	6,338	5,185	5,338	4,321	5,288	7,502	8,899	11,513	89,088	75,573
Distillate fuel oil	29,453	25,321	19,701	18,063	18,306	14,850	15,161	13,828	14,520	18,131	23,110	32,450	242,894	226,084
Residual fuel oil	45,160	39,691	42,693	38,142	39,588	39,570	37,112	38,307	33,850	37,014	41,497	47,405	480,029	523,423
Lubricating oil	2,692	2,278	2,564	3,061	2,867	2,714	3,049	3,235	3,095	3,536	2,900	2,900	34,891	35,334
Miscellaneous	15,053	13,338	14,043	15,952	17,645	18,825	19,859	20,856	19,628	20,045	17,048	18,175	210,467	215,938
Total domestic demand	155,271	137,867	143,662	143,323	151,544	144,391	149,595	147,276	138,649	152,865	154,799	173,544	1,792,786	1,772,685
Stocks:														
Gasoline-bearing crude	223,442	227,220	221,400	222,480	221,592	223,140	224,351	224,157	222,417	222,177	226,453	224,473	224,473	218,763
Heavy crude petroleum in California	4,554	4,607	4,528	4,533	4,913	4,921	4,968	5,066	5,401	5,483	5,335	5,703	5,703	4,496
Natural gasoline	5,034	5,843	6,658	6,982	7,004	7,343	7,334	6,943	7,060	6,312	5,487	4,981	4,981	4,322
Refined products	228,213	226,759	231,558	232,582	237,507	244,551	254,118	265,401	280,665	287,949	285,767	271,937	271,937	235,998
Total stocks	461,243	464,429	464,144	466,577	471,016	479,955	490,771	501,567	515,543	521,921	523,042	507,094	507,094	463,579

See footnotes at end of table.

Supply and demand of all oils in the United States in 1946–47, by months, in thousands of barrels—Continued

[Including wax, coke, asphalt, and still gas]

	1947 [4]													1946 (total) [1]
	January	February	March	April	May	June	July	August	September	October	November	December	Total	
New supply:														
Domestic production:														
Crude petroleum	144,800	134,693	152,160	149,228	156,024	152,978	159,237	160,365	157,530	164,913	158,736	165,443	1,856,107	1,733,939
Natural gasoline	10,571	9,864	10,953	10,753	10,342	10,455	10,969	11,204	11,046	11,635	11,901	12,307	132,000	115,739
Benzol	80	80	80	50	50	50	50	50	50	50	50	50	690	2,070
Total production	155,451	144,637	163,193	160,031	166,416	163,483	170,256	171,619	168,626	176,598	170,687	177,800	1,988,797	1,851,748
Imports:														
Crude petroleum [2]	7,763	8,444	9,263	7,276	8,703	7,628	7,294	8,242	8,658	7,761	7,688	8,812	97,532	86,066
Refined products [3]	6,207	5,597	6,146	5,913	5,625	3,711	4,624	3,824	3,902	4,757	5,631	6,126	62,063	51,610
Total new supply	169,421	158,678	178,602	173,220	180,744	174,822	182,174	183,685	181,186	189,116	184,006	192,738	2,148,392	1,989,424
Change in stocks	−13,958	−10,579	−1,289	+2,036	+7,800	+5,557	+3,223	+10,772	+2,665	+920	+1,838	−14,026	−5,041	+43,515
Demand:														
Total demand	183,379	169,257	179,891	171,184	172,944	169,265	178,951	172,913	178,521	188,196	182,168	206,764	2,153,433	1,945,909
Exports:														
Crude petroleum [2]	2,872	2,440	3,424	3,842	4,789	3,758	5,184	4,139	4,087	3,699	3,844	4,039	46,117	42,436
Refined products [3]	7,457	10,967	10,754	11,248	9,523	10,637	11,606	10,352	9,790	10,181	8,333	7,498	118,346	110,687
Domestic demand:														
Motor fuel	57,057	50,551	59,947	63,406	70,865	71,329	73,441	72,089	71,384	73,295	64,158	67,285	794,807	735,417
Kerosine	12,325	10,532	10,078	8,082	6,068	5,910	5,348	5,447	6,580	8,163	11,070	12,904	102,507	89,088
Distillate fuel oil	35,294	31,687	29,279	21,321	19,262	16,977	16,355	16,093	19,414	23,116	28,997	40,426	298,221	242,894
Residual fuel oil	48,299	43,308	45,852	42,140	40,057	38,237	40,412	39,864	40,677	43,995	43,538	52,015	518,394	480,029
Lubricating oil	2,951	2,680	2,929	3,066	3,104	2,873	3,003	3,051	3,217	3,427	2,917	3,295	36,513	34,891
Miscellaneous	17,124	17,092	17,628	18,079	19,276	19,544	23,602	21,878	23,372	22,320	19,311	19,302	238,528	210,467
Total domestic demand	173,050	155,850	165,713	156,094	158,632	154,870	162,161	158,422	164,644	174,316	169,991	195,227	1,988,970	1,792,786
Stocks:														
Gasoline-bearing crude	223,848	225,121	228,981	235,710	237,768	237,278	230,974	228,523	225,258	226,666	225,462	224,929	224,929	224,473
Heavy crude petroleum in California	5,584	5,790	5,999	5,953	5,825	5,429	5,208	5,320	5,194	5,275	5,623	5,725	5,725	5,703
Natural gasoline	4,794	5,010	5,265	5,604	5,566	5,452	5,269	5,017	4,456	4,221	4,266	4,296	4,296	4,981
Refined products	258,910	246,636	241,023	236,037	241,945	248,502	258,433	271,796	278,413	278,079	280,728	267,103	267,103	271,937
Total stocks	493,136	482,557	481,268	483,304	491,104	496,661	499,884	510,656	513,321	514,241	516,079	502,053	502,053	507,094

[1] Final figures.
[2] As reported to Bureau of Mines; export data from U. S. Department of Commerce April-December 1947.
[3] U. S. Department of Commerce.
[4] Subject to revision.

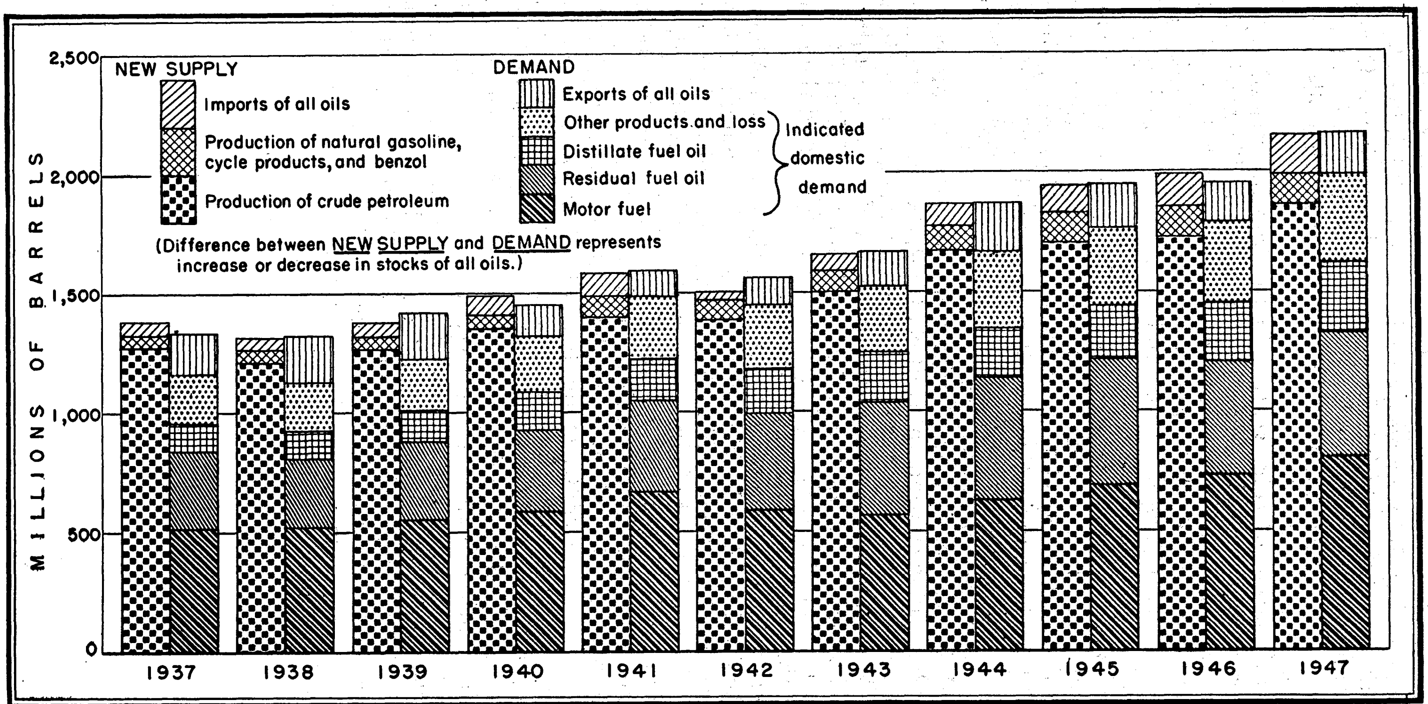

FIGURE 1.—Supply and demand of all oils in the United States 1937–47.

in the third quarter, and declined 11.3 million in the fourth quarter. The change during the year was a decline of 4.8 million barrels. The most significant change during the year was the decline in December of 13.6 million barrels in total refined stocks with the advent of unusually cold weather and a larger demand for heating oils than had been anticipated.

The continuation of cold weather in the first quarter of 1947 led to temporary and local shortages in heating oils. To meet this demand, crude runs to stills were pushed up to 5,372,000 barrels daily in the first quarter of 1948, refinery operations were adjusted to maximum distillate fuel-oil yields, and restrictions were imposed on exports of refined oils.

As a whole, the domestic demand for all oils averaged 5,449,000 barrels daily for 1947 or almost 11 percent greater than in 1946. Domestic demand averaged 5,496,000 barrels daily in the first quarter, 5,160,000 barrels daily in the second quarter, and 5,274,000 barrels daily in the third quarter, and rose to the record level of 5,865,000 barrels daily in the fourth quarter.

Demand in Noncontiguous Territories.—In order to arrive at a domestic demand in continental United States, the shipments from the United States to the Territories is included in exports, and any imports from foreign countries to the Territories are deleted from total imports. The major part of the shipments from the United States to Territories goes to Hawaii, Alaska, and Puerto Rico, and the latter is normally the chief importer of foreign oils.

A special table has been prepared to show the amount of shipments to the Territories from the United States and the amount of foreign imports received by them. No crude oil is involved in these movements. The receipts of products from the United States plus the imports indicate the total supply available in the Territories and, less some minor reexports, indicates their total demand.

The figures for 1947 indicate that the total shipments to the Territories from the United States amounted to 12,572,000 barrels and that total direct imports from foreign countries were 2,708,000 barrels, making a total new supply of 15,280,000 barrels. Reexports to foreign countries amounted to 194,000 barrels (see table of exports by countries of destination in the following section of this chapter). These figures indicate a total net demand for oil products in the noncontiguous Territories of about 15.1 million barrels in 1947 compared with a similarly computed figure of 15.9 million in 1946. If these figures are added to the domestic demand figures for continental United States the sum will show the total domestic demand within the political boundaries of the United States.

Exports and imports of crude petroleum and petroleum products [1]

[Thousands of barrels]

Product	Exports					
	1946			1947		
	Foreign	Noncontiguous Territories	Total	Foreign	Noncontiguous Territories	Total
Motor fuel	41,841	3,493	45,334	42,568	4,977	47,545
Kerosine	8,157	480	8,637	6,696	568	7,264
Distillate fuel oil	27,146	2,341	29,487	25,900	4,029	29,929
Residual fuel oil	5,812	3,376	9,188	8,203	2,542	10,745
Lubricating oil	10,923	128	11,051	14,027	209	14,236
Wax	718		718	1,108		1,108
Coke	1,930	3	1,933	2,088	14	2,102
Asphalt	2,179	119	2,298	3,023	206	3,229
Miscellaneous	2,020	21	2,041	2,161	27	2,188
Total	100,726	9,961	110,687	105,774	12,572	118,346
Crude petroleum [2]	42,436		42,436	46,117		46,117

Product	Imports					
	1946			1947		
	Continental United States	Noncontiguous Territories	Total	Continental United States	Noncontiguous Territories	Total
Gasoline	1	131	132	358	21	379
Kerosine						
Distillate fuel oil	5,204	4,066	9,270	4,175	135	4,310
Residual fuel oil	44,647	1,932	46,579	54,250	2,547	56,797
Lubricating oil	88	1	89	44		44
Wax	1		1	4		4
Coke						
Asphalt	691	7	698	1,353	5	1,358
Other unfinished oils	978		978	1,879		1,879
Total	51.610	6,137	57,747	62,063	2,708	64,771
Crude petroleum [3]	86,066		86,066	97,532		97,532

[1] U. S. Department of Commerce: 1946 final data; 1947 preliminary data.
[2] Bureau of Mines data for 1946 and January to April 1947; U. S. Department of Commerce data May to December 1947.
[3] Bureau of Mines data.

World Oil Supply.—World production of crude petroleum in 1947 again exceeded all previous records, increasing from 2,747 million barrels in 1946 to 3,022 million in 1947. The total increase of 275 million barrels (10 percent) included gains of 122 million for the United States (7 percent), 46 million for Venezuela (12 percent), 30 million for Saudi Arabia (50 percent), and 30 million for Russia (19 percent). The United States produced 63 percent of the world total in 1946 and 61 percent in 1947.

RESERVES

The committee on petroleum reserves, American Petroleum Institute, estimated proved reserves of crude oil in the United States on December 31, 1947, at 21,488 million barrels compared with 20,874 million barrels on December 31, 1946, These estimates refer solely to proved or blocked-out reserves, including only oil recoverable under existing economic and operating conditions.

The increase in total net crude reserves in 1947 was 614 million barrels. In reaching this net figure, the total of estimated new reserves added in 1947 was 2,464 million barrels—including an upward revision of previous estimates of 749 million, reserves from the extensions of old pools of 1,270 million, and new reserves from pools discovered in 1947 of 445 million barrels. From this estimate of total reserves added in 1947 was deducted an estimate of 1,850 million barrels for the production of crude oil in 1947.

The net increase in reserves for 1947 included gains of 139 million barrels for Louisiana, 130 million for Texas, 90 million for Wyoming, 82 million from Colorado, 55 million for Oklahoma, 34 million for Mississippi, 30 million for Arkansas, 25 million for Pennsylvania, and 18 million for Kansas. The only important decline was 14 million barrels for New Mexico.

Estimates of proved oil reserves in the United States, by States, on December 31, 1941–47 [1]

[Millions of barrels]

State	1941	1942	1943	1944	1945	1945 [2]	1946	1947
Eastern States:								
Illinois	334	307	295	321	350	350	351	355
Indiana	23	32	31	31	41	41	44	46
Kentucky	36	35	35	41	57	57	59	65
Michigan	56	64	55	65	64	64	69	70
New York	60	54	90	86	81	81	76	71
Ohio	37	35	33	32	30	30	29	29
Pennsylvania	171	153	137	123	110	110	98	123
West Virginia	50	47	44	41	39	39	36	36
	767	727	720	740	772	772	762	795
Central and Southern States:								
Arkansas	295	300	297	293	304	288	267	297
Kansas	690	687	646	602	542	542	545	563
Louisiana	1,330	1,442	1,484	1,573	1,690	1,559	1,652	1,791
Mississippi	80	41	39	209	267	257	270	304
New Mexico	675	677	654	563	512	512	544	530
Oklahoma	1,036	969	909	970	890	889	898	953
Texas	10,976	11,546	11,325	11,375	11,470	10,835	11,647	11,777
	15,082	15,662	15,354	15,585	15,675	14,882	15,823	16,215
Mountain States:								
Colorado	23	39	45	89	260	260	300	382
Montana	86	86	108	112	108	108	104	115
Wyoming	304	371	499	582	600	600	589	679
	413	496	652	783	968	968	993	1,176
Pacific Coast States: California	3,323	3,196	3,337	3,344	3,410	3,318	3,294	3,295
Other States	4	2	1	1	2	2	2	7
Total United States	19,589	20,083	20,064	20,453	20,827	19,942	20,874	21,488

[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.

[2] New basis; excludes condensate.

CRUDE PETROLEUM

SUPPLY AND DEMAND

The total demand for crude petroleum in 1947 again exceeded all previous records, amounting to 1,953.2 million barrels—a gain of 140.1 million barrels or 8 percent compared with 1946. The demand for domestic crude petroleum showed an increase of 127.5 million barrels, and the demand for foreign crude oil gained 12.6 million barrels.

The new supply of crude petroleum included a record domestic production of 1,856.1 million barrels and an import of 97.5 million barrels. Compared with 1946, production increased 7 percent and imports 13 percent. Total stocks of crude oil increased only 0.5 million barrels in 1947 compared with 6.9 million in 1946.

Since stocks of refined products declined by 4.8 million barrels in 1947 compared with an increase of 35.9 million in 1946, it is evident that the indicated demand for crude oil did not quite meet oil-consumption requirements in 1947, whereas in 1946 it exceeded actual oil consumption and provided for a substantial increase in refined stocks.

The total increase in the indicated demand for crude petroleum in 1947—140.1 million barrels—included gains of 122 million barrels in total runs to stills, 3.7 million in crude exports, 4.1 million in transfers of crude oil to fuel oils, and 10.3 million in losses and unaccounted-for crude oil.

Supply of and demand for crude petroleum in the United States, 1943–47

[Thousands of barrels]

	1943	1944	1945	1946	1947 [1]
Production	1,505,613	1,677,904	1,713,655	1,733,939	1,856,107
Imports [2]	13,833	44,805	74,337	86,066	97,532
Changes in stocks [3]	+6,041	−22,435	−3,511	+6,917	+478
Total supply	1,513,405	1,745,144	1,791,503	1,813,088	1,953,161
Runs to stills:					
Domestic	1,417,559	1,622,514	1,645,862	1,645,845	1,754,987
Foreign	12,179	43,170	73,672	84,352	97,259
Exports [2]	41,342	34,238	32,998	42,436	46,117
Transfers to fuel oil:					
Distillate	3,070	3,242	3,047	3,123	3,263
Residual	24,087	28,515	20,727	23,142	27,091
Other fuel and losses	15,168	13,465	15,197	14,190	24,444
Total demand	1,513,405	1,745,144	1,791,503	1,813,088	1,953,161

[1] Subject to revision.
[2] As reported to Bureau of Mines; export data from U. S. Department of Commerce April–December 1947.
[3] Inclusive of heavy crude in California.

PRODUCTION

GENERAL

Production of crude oil in the United States set a new record of 1,856,107,000 barrels in 1947—a gain of 122.2 million barrels or 7 percent compared with 1946.

The principal gains in production in 1947 compared with 1946 were 59.2 million barrels for Texas, 18.4 million for California, 16.6 million for Louisiana, 10.7 million for Mississippi, 8.1 million for Kansas, 6.2 million for Oklahoma, and 5.3 million for Wyoming. The largest decline was 8.8 million barrels for Illinois.

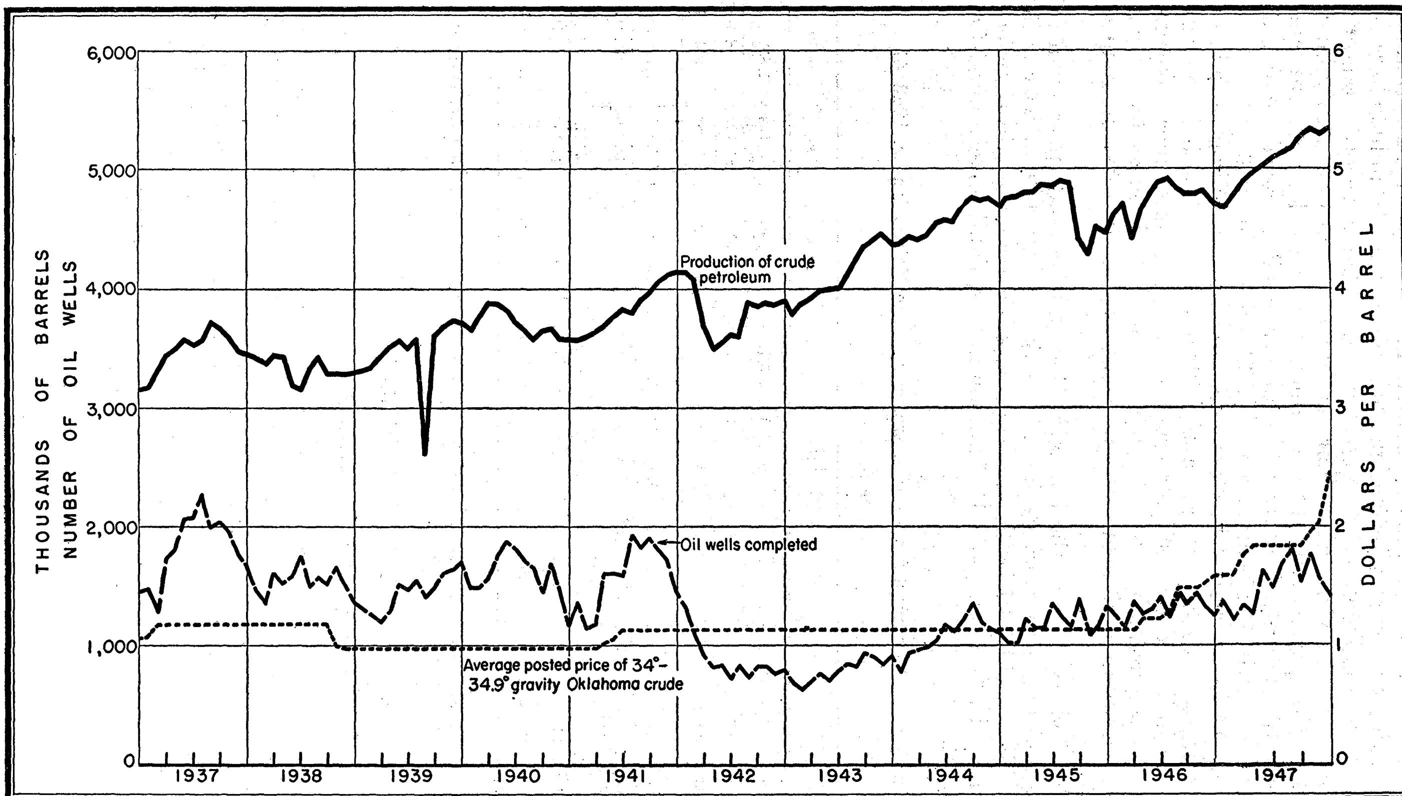

Figure 2.—Daily average production of crude petroleum, total number of wells completed, and average posted price per barrel of a selected grade of Oklahoma crude petroleum in the United States, 1937–47, by months.

Six States produced over 87 percent of the crude petroleum output in 1947. Texas ranked first, with 44.1 percent of the total; California second, with 17.9 percent; Louisiana third, with 8.6 percent; Oklahoma fourth, with 7.6 percent; Kansas fifth, with 5.7 percent; and Illinois sixth, with 3.6 percent.

Seven other States produced a total of 195 million barrels of crude in 1947, representing 10.5 percent of the total production compared with 9.8 percent in 1946. Mississippi, Wyoming, New Mexico, Colorado, and Arkansas increased their output, while Michigan and Pennsylvania showed a decline.

Petroleum produced in the United States, 1943–47, and total, 1859–1947, by States [1]

[Thousands of barrels]

State	1943	1944	1945	1946	1947 [2]	1859–1947 (total)
Production:						
Alabama		43	181	380	396	1,000
Arkansas	27,600	29,418	28,613	28,375	29,990	703,368
California	284,188	311,793	326,482	314,713	333,102	7,618,945
Colorado	2,320	3,083	5,036	11,856	15,748	82,288
Florida	4	12	30	57	259	362
Illinois	82,260	77,413	75,094	75,297	66,459	1,314,979
Indiana	5,283	5,118	4,868	6,726	5,853	173,112
Kansas	106,178	98,762	96,415	97,218	105,346	[3] 1,805,730
Kentucky	7,883	9,621	10,325	10,578	9,397	[4] 224,261
Louisiana	123,592	129,645	131,051	143,669	160,291	1,979,930
Michigan	20,768	18,490	17,267	17.074	16,215	[5] 273,033
Mississippi	18,807	16,337	19,062	24,298	35,017	162,188
Montana	7,916	8,647	8,420	8,825	8,693	141,593
Nebraska	635	417	305	293	229	5,292
New Mexico	38,896	39,555	37,351	36,814	41,127	[6] 539,615
New York	5,059	4,697	4,648	4,863	4,762	[7] 153,412
Ohio	3,322	2,937	2,828	2,908	3,108	610,533
Oklahoma	123,152	124,616	139,299	134,974	141,019	5,764,395
Pennsylvania	15,757	14,118	12,515	12,996	12,690	1,099,673
Texas	594,343	746,699	754,710	760,215	819,427	11,243,870
West Virginia	3,349	3,070	2,879	2,929	2,617	432,621
Wyoming	34,253	33,356	36,219	38,977	44,238	750,711
Other States [8]	48	57	57	84	124	1,598
Total United States	1,505,613	1,677,904	1,713,655	1,733,939	1,856,107	35,082,509
Value at wells:						
Total (thousands of dollars)	1,809,020	2,032,960	2,094,250	2,442,550	3,548,266	43,315,895
Average per barrel	$1.20	$1.21	$1.22	$1.41	$1.91	$1.23

[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 1925–47 production only; earlier years included under "Other States."
[6] Figures represent 1924–47 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, 1900–19; Missouri, 1899–1911, 1913–16, 1919–23, 1932–47; New Mexico, 1913, 1919–23; Tennessee, 1916–47; Utah, 1907–11, 1920, 1924–41; Virginia 1943–47.

Production of crude petroleum in the United States in 1946,[1] by districts, States, and months

[Thousands of barrels]

District and State	January	February	March	April	May	June	July	August	September	October	November	December	Total
DISTRICT													
Pennsylvania Grade	1,878	1,670	1,853	1,931	1,967	1,895	1,795	1,960	1,857	2,001	1,808	1,848	22,463
Other Appalachian [2]	958	920	1,022	1,004	1,043	998	1,018	1,000	959	966	898	931	11,717
Lima-Northeastern Indiana-Michigan	1,447	1,254	1,498	1,495	1,519	1,440	1,501	1,517	1,429	1,454	1,349	1,379	17,282
Illinois-Southwestern Indiana	6,874	6,384	7,040	6,835	7,190	6,775	7,029	6,803	6,757	7,128	6,523	6,661	81,999
Mid-Continent:													
North Louisiana, Arkansas, Alabama and Mississippi	6,415	5,855	6,444	6,442	6,887	6,753	7,124	7,384	7,279	7,661	7,660	8,013	83,917
West Texas and Southeastern New Mexico	18,608	17,114	16,766	17,998	19,449	20,893	21,327	19,512	18,795	19,409	19,343	19,446	228,660
East Texas	9,896	8,980	9,851	11,185	12,071	9,853	9,907	9,854	9,765	9,827	9,828	9,772	120,789
Oklahoma, Kansas, North Texas, etc	37,231	33,964	34,837	35,299	37,083	36,380	38,254	38,135	36,179	37,427	36,242	36,684	437,715
Gulf Coast	29,845	28,133	26,280	27,241	29,252	30,773	32,142	31,438	29,668	30,406	29,958	29,440	354,576
Rocky Mountain	4,536	4,269	4,873	4,954	5,070	5,098	5,424	5,386	5,055	5,240	4,965	5,238	60,108
California [3]	25,972	23,720	26,405	25,796	26,698	26,131	27,020	26,870	25,960	26,806	26,085	27,250	314,713
Total 1946	143,660	132,263	136,869	140,180	148,229	146,989	152,541	149,859	143,703	148,325	144,659	146,662	1,733,939
STATE													
Alabama	27	28	34	33	36	34	35	33	29	32	30	29	380
Arkansas	2,381	2,153	2,352	2,317	2,418	2,323	2,418	2,407	2,337	2,434	2,377	2,458	28,375
California [3]	25,972	23,720	26,405	25,796	26,698	26,131	27,020	26,870	25,960	26,806	26,085	27,250	314,713
Colorado	724	679	798	834	927	1,013	1,150	1,172	1,106	1,160	1,123	1,170	11,856
Florida	4	3	3	5	7	8	6	4	6	-------	2	9	57
Illinois	6,394	5,882	6,443	6,232	6,581	6,200	6,453	6,237	6,214	6,550	6,006	6,105	75,297
Indiana	482	504	599	605	611	577	578	568	545	580	519	558	6,726
Kansas	7,866	7,134	7,778	7,719	8,180	7,959	8,486	8,651	8,229	8,624	8,192	8,400	97,218
Kentucky	866	835	929	907	940	897	922	906	866	875	812	823	10,578
Louisiana	11,654	10,640	11,649	11,192	11,942	11,647	12,381	12,433	12,107	12,724	12,447	12,853	143,669
Michigan	1,430	1,238	1,482	1,474	1,501	1,423	1,483	1,498	1,412	1,435	1,335	1,363	17,074
Mississippi	1,697	1,554	1,663	1,707	1,918	1,921	1,981	2,220	2,207	2,384	2,425	2,621	24,298
Montana	734	667	751	776	790	766	777	765	728	733	637	701	8,825
Nebraska	28	22	25	27	29	26	27	26	22	23	20	18	293
New Mexico	3,037	2,743	3,063	3,006	3,127	2,967	3,129	3,176	3,057	3,216	3,101	3,192	36,814
New York	418	370	398	416	424	405	404	416	397	428	383	404	4,863
Ohio	234	214	242	248	260	245	238	243	242	260	235	247	2,908
Oklahoma	12,050	10,929	11,139	11,123	11,530	11,118	11,630	11,598	10,639	11,103	10,795	11,140	134,794
Pennsylvania	1,074	956	1,066	1,120	1,134	1,092	1,049	1,132	1,082	1,160	1,056	1,075	12,996
Texas	63,288	58,871	56,514	61,070	65,590	66,695	68,704	65,813	63,092	64,225	63,677	62,676	760,215
West Virginia	254	225	250	256	259	259	208	274	235	258	225	226	2,929
Wyoming	3,039	2,890	3,280	3,311	3,321	3,277	3,456	3,411	3,184	3,309	3,168	3,331	38,977
Other States	7	6	6	6	6	6	6	6	7	6	9	13	[4] 84
Total: 1946	143,660	132,263	136,869	140,180	148,229	146,989	152,541	149,859	143,703	148,325	144,659	146,662	1,733,939
1945	147,446	133,463	148,935	144,219	151,180	145,783	151,803	151,198	132,690	132,800	135,511	138,627	1,713,655
Daily average, 1946	4,634	4,724	4,415	4,673	4,782	4,900	4,921	4,834	4,790	4,785	4,822	4,731	4,751

[1] Final figures. [2] Includes Florida, Kentucky, Tennessee, and Virginia. [3] American Petroleum Institute. [4] Missouri (51), Tennessee (10), and Virginia (23).

Production of crude petroleum in the United States in 1947,[1] by districts, States, and months

[Thousands of barrels]

District and State	January	February	March	April	May	June	July	August	September	October	November	December	Total
DISTRICT													
Pennsylvania Grade	1,903	1,573	1,775	1,833	1,853	1,835	1,928	1,831	1,875	1,974	1,722	1,925	22,027
Other Appalachian [2]	894	760	882	896	895	871	940	895	926	964	877	935	10,735
Lima-Northeastern Indiana-Michigan	1,335	1,218	1,304	1,317	1,338	1,314	1,416	1,394	1,408	1,482	1,378	1,475	16,379
Illinois-Southwestern Indiana	6,521	5,776	6,306	6,108	6,175	5,845	6,092	5,922	5,806	6,047	5,664	6,026	72,288
Mid-Continent:													
North Louisiana, Arkansas, Alabama, and Mississippi	8,099	7,368	8,281	7,997	8,449	8,180	8,587	8,670	8,646	9,142	9,095	9,472	101,986
West Texas and Southeastern New Mexico	18,750	17,284	19,556	19,229	21,085	21,372	23,319	24,429	23,856	24,974	24,338	25,416	263,608
East Texas	9,361	9,267	9,644	10,081	10,566	10,085	10,156	10,060	9,708	10,135	9,177	9,283	117,523
Oklahoma, Kansas, North Texas, etc.	36,565	34,101	38,965	37,984	39,246	38,509	39,700	39,678	39,336	41,414	39,641	41,575	466,714
Gulf Coast	28,747	27,295	32,039	31,156	32,413	31,956	32,752	33,008	32,461	33,864	32,837	34,116	382,644
Rocky Mountain	5,216	4,828	5,387	5,438	5,720	5,585	5,882	6,030	6,066	6,352	6,120	6,477	69,101
California [3]	27,409	25,223	28,021	27,189	28,284	27,426	28,465	28,448	27,442	28,565	27,887	28,743	333,102
Total 1947	144,800	134,693	152,160	149,228	156,024	152,978	159,237	160,365	157,530	164,913	158,736	165,443	1,856,107
STATE													
Alabama	31	26	32	21	37	34	35	32	32	40	36	40	396
Arkansas	2,452	2,246	2,544	2,382	2,514	2,422	2,538	2,512	2,520	2,626	2,564	2,670	29,990
California [3]	27,409	25,223	28,021	27,189	28,284	27,426	28,465	28,448	27,442	28,565	27,887	28,743	333,102
Colorado	1,164	1,021	1,162	1,165	1,267	1,265	1,452	1,496	1,437	1,486	1,405	1,428	15,748
Florida	7	5	20	15	21	31	31	31	28	23	24	23	259
Illinois	5,985	5,302	5,776	5,588	5,657	5,346	5,578	5,421	5,376	5,602	5,247	5,581	66,459
Indiana	538	476	532	522	520	501	516	503	432	447	419	447	5,853
Kansas	8,346	7,610	8,656	8,631	8,936	8,749	9,163	9,155	8,913	9,336	8,842	9,009	105,346
Kentucky	800	679	774	787	781	752	814	777	803	842	772	816	9,397
Louisiana	12,847	11,747	13,073	12,857	13,411	12,945	13,612	13,742	13,322	14,124	13,967	14,644	160,291
Michigan	1,322	1,204	1,292	1,302	1,326	1,298	1,398	1,379	1,394	1,469	1,367	1,464	16,215
Mississippi	2,720	2,352	2,655	2,613	2,829	2,832	2,976	3,073	3,082	3,326	3,250	3,309	35,017
Montana	691	640	677	717	732	716	740	769	745	771	729	766	8,693
Nebraska	23	18	18	17	17	18	19	17	21	20	20	21	229
New Mexico	3,156	2,969	3,295	3,200	3,315	3,248	3,389	3,663	3,591	3,808	3,643	3,850	41,127
New York	419	349	384	395	400	400	424	393	402	416	359	421	4,762
Ohio	236	201	244	266	256	264	282	259	274	291	250	285	3,108
Oklahoma	11,272	10,396	11,766	11,399	11,753	11,364	12,049	11,904	11,836	12,571	12,018	12,691	141,019
Pennsylvania	1,110	920	1,017	1,069	1,081	1,057	1,110	1,056	1,072	1,120	994	1,084	12,690
Texas	60,703	57,980	66,489	65,356	68,979	68,515	70,763	71,777	70,720	73,713	70,776	73,656	819,427
West Virginia	227	183	220	202	211	209	218	219	229	253	208	238	2,617
Wyoming	3,329	3,134	3,501	3,521	3,685	3,575	3,655	3,730	3,850	4,055	3,953	4,250	44,238
Other States	13	12	12	14	12	11	10	9	9	9	6	7	[4] 124
Total: 1947	144,800	134,693	152,160	149,228	156,024	152,978	159,237	160,365	157,530	164,913	158,736	165,443	1,856,107
1946	143,660	132,263	136,869	140,180	148,229	146,989	152,541	149,859	143,703	148,325	144,659	146,662	1,733,939
Daily average, 1947	4,671	4,810	4,908	4,974	5,033	5,099	5,137	5,173	5,251	5,320	5,291	5,337	5,085

[1] Subject to revision. [2] Includes Florida, Kentucky, Tennessee, and Virginia. [3] American Petroleum Institute. [4] Missouri (55), Tennessee (8), and Virginia (61).

Percentage of total crude petroleum produced in the United States, 1938–47, by principal States

State	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947 [1]
Texas	39.2	38.2	36.4	36.1	34.8	39.5	44.5	44.0	43.8	44.1
California	20.6	17.7	16.6	16.4	17.9	18.9	18.6	19.1	18.2	17.9
Louisiana	7.8	7.4	7.7	8.3	8.3	8.2	7.7	7.7	8.3	8.6
Oklahoma	14.4	12.7	11.5	11.0	10.2	8.2	7.4	8.1	7.8	7.6
Kansas	5.0	4.8	4.9	5.9	7.0	7.0	5.9	5.6	5.6	5.7
Illinois	2.0	7.5	10.9	9.4	7.7	5.5	4.6	4.4	4.3	3.6
Wyoming	1.6	1.7	1.9	2.1	2.4	2.3	2.0	2.1	2.2	2.4
New Mexico	2.9	3.0	2.9	2.8	2.3	2.6	2.4	2.2	2.1	2.2
Mississippi	------	------	.3	1.1	2.1	1.2	1.0	1.1	1.4	1.9
Arkansas	1.5	1.7	1.9	1.9	1.9	1.8	1.8	1.7	1.6	1.6
Michigan	1.5	1.8	1.5	1.2	1.6	1.4	1.1	1.0	1.0	.9
Colorado	.1	.1	.1	.2	.1	.2	.2	.3	.7	.9
Pennsylvania	1.4	1.4	1.3	1.2	1.3	1.0	.8	.7	.8	.7
All other	2.0	2.0	2.1	2.4	2.4	2.2	2.0	2.0	2.2	1.9
Total	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, 1946–47, and total production since discovery, in thousands of barrels

[Oil and Gas Journal]

Field	State	1946	1947	Total since discovery [1]
East Texas	Texas	120,581	118,643	2,476,091
Wilmington	California	40,244	47,698	368,608
Panhandle	Texas	29,662	31,443	601,163
Coalinga	California	29,198	30,575	560,761
Wasson	Texas	21,299	26,121	149,473
Conroe	do	20,718	22,018	249,241
Hastings	do	19,355	21,391	147,360
Webster	do	18,708	21,112	104,985
Slaughter	do	20,858	18,485	112,358
Huntington Beach	California	17,144	18,318	396,333
Ventura Avenue	do	16,899	17,713	337,827
Buena Vista	do	14,762	17,257	347,397
Hawkins	Texas	14,786	17,083	78,813
T-X-L	do	5,323	16,768	22,673
Yates	do	13,555	16,559	331,825
Thompson	do	9,361	15,673	114,109
Midway-Sunset	California	13,469	15,667	720,866
Bradford-Allegany [2]	Pennsylvania-New York	15,602	15,151	557,952
Seeligson	Texas	13,065	15,027	48,201
West Edmond	Oklahoma	23,565	14,936	73,443
Keystone	Texas	15,754	14,742	50,983
Kettleman North Dome	California	13,867	13,475	337,316
Fullerton	Texas	10,930	13,290	34,706
Rangely	Colorado	8,018	11,680	23,320
Trapp	Kansas	11,042	11,371	95,309
Anahuac	Texas	10,127	10,693	76,459
McElroy	do	9,784	10,489	175,058
Van	do	10,690	10,446	182,927
Oklahoma City	Oklahoma	10,693	9,670	652,218
Santa Maria Valley	California	11,944	9,560	84,153
Goldsmith	Texas	8,838	9,076	82,092
North Cowden	do	10,098	8,939	66,539
Coles Levee	California	7,119	8,902	46,403
Talco	Texas	8,741	8,896	101,898
Long Beach	California	9,107	8,605	726,425
Velma	Oklahoma	2,457	8,153	19,709
Louden	Illinois	8,243	7,385	136,840
Foster	Texas	5,383	7,320	44,219
Seminole	do	7,486	7,316	39,977
Coyote	California	7,330	7,271	209,420
West Ranch	Texas	7,079	7,060	47,341
Old Ocean	do	6,107	6,853	36,832
Tinsley	Mississippi	8,090	6,749	100,993
Monument	New Mexico	6,565	6,541	86,952
K-M-A	Texas	7,861	6,346	137,540
Lake St. John	Louisiana	4,356	6,092	13,350
Santa Fe Springs	California	6,113	5,896	517,355

See footnotes at end of table.

Production of crude petroleum in leading fields and districts in the United States, 1946–47, and total production since discovery, in thousands of barrels—Con.

Field	State	1946	1947	Total since discovery [1]
Elk Basin	Wyoming-Montana	5,838	5,877	34,435
Eunice	New Mexico	6,007	5,796	98,140
Cymric	California	3,111	5,572	28,683
Cranfield	Mississippi	4,457	5,540	12,654
Dominguez	California	5,876	5,441	173,208
Todd	Texas	2,420	5,259	8,942
Salem	Illinois	5,967	5,239	203,367
Silica	Kansas	5,195	5,195	77,354
Heidelberg	Mississippi	4,084	5,052	13,496

[1] Includes revisions. [2] Bureau of Mines.

PRODUCTION BY STATES

Alabama.—Crude production increased from 380,000 barrels in 1946 to 396,000 in 1947. In general, activity increased during the year; however, no additional fields were discovered. The Gilbertown field in Choctaw County remained the only producing area within the State, with 33 producing wells in 1947. Drilling increased sharply from 16 completions in 1946 to 29 in 1947, resulting in 5 producing wells in the Gilbertown field and 24 failures.

Arkansas.—Production increased from 28.4 million barrels in 1946 to 30 million in 1947. Output of the Wesson, Village, Dorcheat-Macedonia, McKamie, and Midway fields gained, but elsewhere moderate declines were the rule.

A more vigorous search was made for new oil and gas reserves in 1947 than was undertaken in 1946. Drilling increased from 183 wells in 1946 to 329 in 1947, of which 182, including 4 wildcat discoveries, were oil producers. One hundred and seventy-four wells were completed in the old producing fields, and 8 wells were drilled in Sandy Bend, Mars Hill, Cypress Lake, and Locust Bayou fields, all discovered during the year.

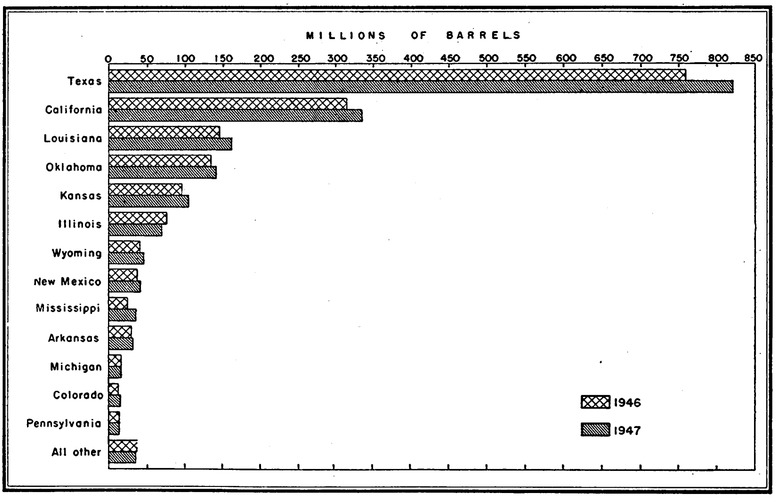

FIGURE 3.—Production of crude petroleum in the United States, 1946–47, by States.

859140—49——3

Production of crude petroleum in Arkansas, 1943–47, by fields

[Thousands of barrels]

Year	Atlanta	Dorcheat-Macedonia	McKamie	Magnolia	Midway	Schuler	Smackover	Stephens	Urbana [1]	Village	Wesson	Other fields [2]	Total
1943	956	1,602	360	6,041	2,168	5,520	4,458	1,485	1,058	439	------	3,513	27,600
1944	1,164	2,345	1,107	5,592	2,382	5,105	4,280	1,828	1,019	568	------	4,028	29,418
1945	1,329	1,759	1,064	4,951	2,641	4,733	4,146	2,035	817	816	9	4,313	28,613
1946	1,578	1,446	1,062	4,718	2,646	4,419	4,092	1,866	652	1,230	622	4,044	28,375
1947 [3]	1,472	1,503	1,175	4,648	2,703	4,022	3,983	1,475	601	1,791	1,793	4,824	29,990

[1] Includes New London.
[2] Includes oil consumed on leases and net change in stocks held on leases for entire State.
[3] Subject to revision.

California.—With demand at a peacetime "peak" in 1947, crude production of 333.1 million barrels in California was 18.4 million above the 1946 total and 6.6 million barrels over the previous record established in 1945. This higher level of production was realized as most of the fields within the State showed increases over 1946. The producing areas in the Los Angeles Basin led with a gain of 8.1 million barrels over 1946 and were followed by those in the San Joaquin district with an increase of 6.7 million barrels and those in the Coastal district with a gain of 3.6 million barrels.

California drilling continued at a high level during 1947. Oil-well completions increased from 1,375 in 1946 to 1,639 in 1947. The most active fields, with completions in each, were as follows: Wilmington 253, Kern River 122, Huntington Beach 114, and Lost Hills 100.

Eleven new oil fields were discovered in California in 1947 compared with 14 in 1946. In addition, 23 new oil zones were discovered in old fields in 1947 compared with 16 in 1946. Probably the most important discovery was the completion at Kettleman Middle Dome, Kings County, which found production in the Eocene formation.

Production of crude petroleum in California, 1943–47, by districts and fields, in thousands of barrels

[American Petroleum Institute]

District and field	1943	1944	1945	1946	1947 [1]
San Joaquin Valley:					
Belridge	4,543	6,340	6,959	5,862	4,488
Buena Vista	5,274	6,896	15,772	14,756	17,264
Canal	1,446	1,297	1,244	867	739
Coalinga	31,386	35,410	31,681	32,105	33,755
Coles Levee [2]	5,906	6,692	7,030	6,335	7,225
Edison	900	1,051	2,166	5,316	4,124
Elk Hills	5,373	7,719	15,805	3,668	2,334
Fruitvale	2,571	3,043	3,096	2,723	2,391
Greeley	4,819	5,219	5,062	3,923	4,288
Helm	166	499	1,211	1,580	1,553
Kern River—Kern Front	7,274	8,440	8,210	6,826	6,979
Kettleman North Dome	15,300	15,133	14,357	13,849	13,480
Lost Hills	1,328	1,284	1,228	1,315	1,922
McKittrick	1,719	1,851	2,043	5,409	9,959
Midway-Sunset	14,953	15,169	14,334	15,318	15,660
Mountain View	1,394	1,156	1,024	1,369	1,890
Mount Poso	8,432	8,025	6,717	5,930	5,151
Raisin City	382	936	1,163	988	963
Rio Bravo	5,446	5,920	5,743	4,883	4,576
Riverdale	590	1,517	1,540	1,481	1,546
Round Mountain	4,150	3,932	3,507	3,352	3,085

See footnotes at end of table.

Production of crude petroleum in California, 1943–47, by districts and fields, in thousands of barrels—Continued

District and field	1943	1944	1945	1946	1947 [1]
San Joaquin Valley—Continued					
Tejon Ranch	4	60	161	487	1,188
Ten Section	6,558	4,624	4,095	3,229	2,829
Other San Joaquin Valley	3,125	5,281	6,983	7,625	[3] 8,478
Total San Joaquin Valley	133,039	147,494	161,131	149,196	[3] 155,867
Coastal district:					
Aliso Canyon	755	1,100	1,156	1,098	1,219
Capitan	1,178	1,079	794	1,265	1,091
Del Valle	923	1,481	1,969	2,355	3,069
Elwood	1,668	2,133	2,172	2,454	2,576
Gato Ridge	1,295	1,777	1,615	1,421	1,314
Newhall-Potrero	1,954	1,906	1,996	2,111	2,397
Padre Canyon	343	474	753	904	1,179
Rincon	1,210	1,501	1,689	1,627	1,344
San Miguelito	1,614	2,111	1,940	1,835	1,874
Santa Maria	3,791	4,892	5,038	4,921	7,938
Santa Maria Valley	8,303	11,358	13,489	11,929	9,518
Ventura Avenue	15,461	17,504	17,701	16,906	17,754
Ventura-Newhall	1,685	2,227	2,285	2,542	3,369
Other Coastal	341	460	1,242	1,154	1,489
Total Coastal	40,521	50,003	53,839	52,522	56,131
Los Angeles Basin:					
Brea Olinda	4,252	4,304	4,195	3,945	4,449
Coyote	6,502	6,434	7,105	7,315	7,273
Dominguez	9,118	7,879	6,726	5,875	5,436
Huntington Beach	13,239	17,162	17,587	17,084	18,313
Inglewood	6,913	6,467	5,624	4,720	4,330
Long Beach	11,641	10,862	9,851	9,055	8,596
Montebello	3,966	3,932	3,665	3,129	2,696
Newport	4	7	[4] 385	1,894	2,630
Richfield	2,689	2,564	2,741	2,595	2,413
Rosecrans	2,215	2,238	2,095	1,840	1,684
Santa Fe Springs	7,307	6,838	6,278	6,117	5,914
Seal Beach	2,867	2,835	3,426	3,693	4,042
Torrance	2,874	3,186	3,241	3,126	2,938
Wilmington	34,349	36,929	36,192	40,171	47,674
Other Los Angeles Basin	2,692	2,659	2,401	2,436	2,716
Total Los Angeles Basin	110,628	114,296	111,512	112,995	121,104
Total California	284,188	311,793	326,482	314,713	333,102

[1] Subject to revision.
[2] Includes Tupman.
[3] Includes adjustment of 62,000 barrels not yet distributed by fields and districts.
[4] Includes Costa Mesa.

Colorado.—Production of 15.7 million barrels of crude petroleum in 1947 compared with 11.9 million in 1946 reflected the expansion of the great Rangely field, whose output increased 3.5 million barrels in 1947, while that for most of the other fields increased only slightly. (See table on following page.)

Oil-well completions in 1947 continued to advance to a new record total of 152, of which 144 were in the Rangely field. A new discovery of oil was made at Chromo, Archuleta County, with a reported initial production of over 200 barrels per day, which, however, declined rapidly. The only other discovery was at Maudlin Gulch northwest of the Wilson Creek field in Moffat County. It resulted from reconditioning of a well drilled to 6,350 feet in the Entradu sandstone in 1945.

Florida.—Production of crude petroleum, all from the Sunniland field in Collier County, increased sharply from 57,000 barrels in 1946 to 259,000 in 1947. Two producing oil wells were completed in this field in 1947, and 27 exploratory wells were unsuccessful.

Production of crude petroleum in Colorado, 1943–47, by fields

[Thousands of barrels]

Year	Fort Collins-Wellington	Hiawatha	Iles	Moffat	Price	Powder Wash	Rangely	Tow Creek	Walden	Wilson Creek	Other fields [1]	Total
1943	102	164	480	118	253	44	285	46	-------	760	68	2,320
1944	96	100	454	112	247	50	393	44	38	1,401	148	3,083
1945	143	66	429	105	238	67	1,565	38	158	2,053	174	5,036
1946	135	45	441	93	239	24	8,128	39	188	2,381	143	11,856
1947 [2]	133	51	541	91	195	29	11,600	39	179	2,705	185	15,748

[1] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.
[2] Subject to revision.

Illinois.—Crude production in 1947 decreased to the lowest level since 1938, and the total of 66.5 million barrels for the year represented a decrease of 8.8 million from the 1946 output. There was a lower production for all fields except Dundas, Keensburg, and Rural Hill.

Production of crude petroleum in Illinois, 1943–47, by fields, in thousands of barrels

[Oil and Gas Journal]

Field	1943	1944	1945	1946	1947
Albion	405	858	1,234	898	663
Benton	2,534	1,655	1,217	927	773
Bible Grove	763	985	1,757	1,491	1,069
Boyd	---------	135	1,372	1,497	1,313
Bridgeport	1,880	1,932	2,144	2,272	2,267
Centralia	1,683	1,785	1,729	1,887	1,456
Clay City	2,764	4,890	5,104	5,309	4,383
Dale-Hoodville	3,909	3,160	2,022	1,479	1,341
Dundas	1,295	780	873	935	1,022
Johnsonville	2,170	1,460	1,119	1,206	936
Keensburg	1,138	873	757	663	723
Louden	13,702	11,175	9,463	8,243	7,385
Mount Carmel	854	1,330	923	868	617
New Harmony	5,257	4,395	3,429	2,866	2,494
Patoka	774	940	1,574	1,651	1,345
Phillipstown	1,112	985	1,244	1,038	829
Robinson	1,273	1,078	1,095	1,118	1,100
Roland	1,120	760	936	752	641
Rural Hill	1,715	925	679	510	786
Salem	10,220	8,310	6,637	5,967	5,239
Woodlawn	1,446	960	950	792	686
Other fields	24,715	26,451	27,202	32,244	28,392
Total Illinois	80,729	75,822	73,460	74,613	65,460

Oil-well completions in 1947, resulting in the discovery of 28 new pools and 69 extensions, totaled 1,054 compared to 1,344 in 1946. The new fields having the largest number of completed producing wells at the end of 1947 were Herald East 24, Kenner North 23, and Kenner West 21.

Of the total completions in 1947, 97 wildcat operations were successful in obtaining production, while 439 were dry. Wells were drilled in 42 counties in Illinois in 1947, and 83 percent of the total were concentrated in 15 counties. Of the 1,054 successful wells drilled about two-thirds were located in the following 6 counties: Wabash, 175; Wayne, 147; White, 134; Clay, 125; Richland, 68; and Hamilton, 65

Indiana.—Production of petroleum decreased from 6.7 million barrels in 1946 to 5.9 million in 1947. The Griffin pool in Posey and Gibson Counties continues to be the largest producer in the State, with over a million barrels of output.

Oil-well completions also decreased from 330 in 1946 to 312 in 1947, and 24 of the latter were wildcat wells. Drilling activity during the year was centered in Posey, Gibson, Vanderburgh, Pike, and Sullivan Counties. Eleven new pools were developed during the year. The Evansville pool in Vanderburgh County was the largest, with 17 completed wells. The Martin pool was second with five.

Production of crude petroleum in Indiana, 1943–47, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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	425	387	360	359	427	407	428	442	387	417	402	427	4,868
1946	482	504	599	605	611	577	578	568	545	580	519	558	6,726
1947 [1]	538	476	532	522	520	501	516	503	432	447	419	447	5,853

[1] Subject to revision.

Kansas.—The production of Kansas oil fields increased by 8.1 million barrels in 1947 over 1946. The 105.3 million barrels produced in 1947 represented the highest level since 1943, when 106.2 million barrels of crude were reported. Small gains were realized, with no outstanding increase in any one field.

Greater activity in drilling operations in 1947 resulted in 1,303 oil-producing wells, an increase of 248 over the 1946 total. Exploratory drilling was also above that of 1946, as 442 tests were made, 58 of which resulted in oil-producing wells, 12 in gas wells, and 372 were dry holes.

Production of crude petroleum in Kansas, 1943–47, by fields, in thousands of barrels

[Oil and Gas Journal]

Field	1943	1944	1945	1946	1947
Bemis-Shutts	5,764	4,885	5,160	5,305	6,057
Bornholdt [1]	1,830	1,591	1,412	1,057	1,022
Burnett	4,948	3,715	3,189	2,873	3,120
Burrton-Haury [2]	1,740	1,525	1,351	1,209	1,073
Carmi	662	2,067	1,161	986	945
Chase [3]	3,750	3,702	3,076	2,766	2,644
Geneseo-Edwards	3,941	3,268	3,181	3,220	3,733
Gorham	2,528	2,286	2,068	1,891	1,880
Hall-Gurney	3,780	3,750	3,410	3,455	3,414
Kraft-Prusa [4]	4,158	4,086	4,590	5,257	6,425
Morel	570	912	1,076	1,098	1,641
Peace Creek	2,914	1,638	1,305	1,419	1,287
Ray	1,140	1,172	1,147	1,213	1,397
Ritz Canton	960	864	742	721	657
Silica-Raymond	9,825	7,834	6,422	5,691	5,783
Stoltenberg [5]	3,083	2,818	2,740	2,747	2,804
Trapp [6]	10,840	9,347	10,631	11,042	11,371
Zenith	3,765	3,624	2,912	1,521	849
Other fields	39,499	40,773	40,923	43,108	48,226
Total Kansas	105,697	99,857	96,496	96,579	104,328

[1] Included Welch before 1945.
[2] Haury excluded before 1945.
[3] Included Campbell before 1944.
[4] Included Feltes before 1946.
[5] Included Wilkins before 1946.
[6] Included Sellens before 1946.

Rooks County was the most active area in the State in 1947, with 58 tests drilled. However, it also had the highest dry-hole ratio for the more active counties and one of the lowest percentages of successful wildcats in the State. This county also had the record for the greatest number of pools discovered. Nine oil pools were found; three of these were outstanding—Barry East pool, Jelinck pool, and the Paradise Creek pool, in Rooks County.

Kentucky.—Crude production in Kentucky declined from the peak production of 10.6 million barrels in 1946 to 9.4 million in 1947. Western Kentucky continued to be the most important producing area, with about 80 percent of the total, eastern Kentucky followed with 15 percent, and south central Kentucky with 5 percent. Henderson and Union Counties continued to lead in the production, with over 5.2 million barrels credited to their fields in 1947.

The number of oil wells completed in 1947 increased in western and south central Kentucky, but decreased in eastern Kentucky. Of the 289 producing oil wells completed in 1947, about 69 percent were in western Kentucky, 26 percent in south central Kentucky, and 5 percent in eastern Kentucky. Henderson and Clinton Counties had the greatest number of completions. The most important exploratory development in Kentucky in 1947 was the discovery of commercial oil from the Knox dolomite in Laurel County, south central Kentucky. Ten new oil pools were discovered in western Kentucky, of which the Slaughter field in Webster County was the most important.

Production of crude petroleum in Kentucky, 1943–47, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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	911	791	665	837	905	850	893	886	814	898	982	893	10,325
1946	866	835	929	907	940	897	922	906	866	875	812	823	10,578
1947 [1]	800	679	774	787	781	752	814	777	803	842	772	816	9,397

[1] Subject to revision.

Louisiana.—An upward trend in crude-oil production through 1947 raised the total to a record level of 160.3 million barrels, an increase of 16.6 million over the 1946 production of 143.7 million barrels. The greatest increase is found in the Gulf Coast district, where the total of 10.9 million barrels resulted from fair to good gains in 57 fields. The more important increases were in the Bayou Sale, Delta Farms, and Egan fields, where considerable drilling was reported. The northern district, aided by larger production in the Delhi and Lake St. John fields, increased by 5.7 million barrels over the 1946 total of 30.9 million barrels.

Oil-well completions numbered 443 in the Gulf district in 1947, an increase of 80 over the 363 in 1946. The gain was greater in the northern district, where there were 593 new oil wells in 1947 compared to 450 in 1946

Ora, North Louisiana, Holmwood, South Louisiana, and Ship Shoal Area, Bock 32, Gulf of Mexico, are believed to be the most important of the 19 new fields discovered in 1947.

Production of crude petroleum in Louisiana, 1943–47, by districts and fields

[Thousands of barrels]

District and field	1943	1944	1945	1946	1947 [1]
Gulf Coast:					
Anse la Butte	2,191	2,620	2,481	2,448	2,423
Avery Island	180	582	928	1,223	1,601
Barataria	1,129	1,135	1,367	1,523	1,932
Bayou Sale	1,908	3,112	2,903	3,479	4,445
Black Bayou	1,101	1,019	686	723	919
Bosco	1,094	1,046	1,000	1,068	960
Caillou Island	1,829	1,939	1,917	2,054	2,699
Charenton	1,116	1,040	1,048	1,200	1,580
Delta Farms	1,013	2,218	3,372	4,510	5,539
East White Lake	562	1,044	1,219	1,427	1,470
Egan	6	48	417	1,453	2,054
Eola	3,137	3,158	2,467	1,721	1,370
Garden Island	1,357	1,256	1,139	1,168	1,295
Gibson	2,543	3,542	3,384	2,555	2,161
Golden Meadows	3,606	2,796	2,494	2,400	2,666
Good Hope		26	770	1,745	2,178
Grand Bay	2,522	2,724	3,033	3,122	3,433
Grand Lake	951	841	733	666	643
Gueydan	1,504	1,963	2,071	2,200	2,008
Hackberry	3,725	4,057	3,776	3,794	4,000
Iowa	2,928	3,309	2,731	2,486	2,489
Jennings	3,416	2,840	2,442	2,025	1,809
Lafitte	4,688	4,452	4,139	4,374	4,362
Lake Chicot	554	770	773	922	1,349
Lake Pelto	382	645	913	1,302	1,429
Lake Salvador	988	1,554	1,595	1,632	1,623
La Pice	173	391	576	797	1,058
Leeville	1,214	1,421	1,575	1,381	1,580
Neale	1,333	2,342	2,301	1,501	1,280
New Iberia	2,606	2,615	2,152	1,744	1,526
North Crowley	1,699	1,624	1,648	1,526	1,521
Paradis	4,173	4,013	3,652	3,688	3,728
Pine Prairie	1,402	1,944	1,942	1,821	1,546
Port Barre	1,215	1,176	1,008	1,103	1,375
Quarantine Bay	2,567	2,877	2,977	3,227	3,421
Roanoke	600	764	836	924	808
St. Gabriel	1,732	1,957	1,911	1,741	1,786
Sulphur	801	741	792	722	749
Tepetate	912	901	1,931	2,936	3,402
University	2,896	2,338	1,982	1,884	1,976
Venice	2,147	3,334	3,315	3,030	3,638
Ville Platte	4,450	3,642	2,502	2,588	2,238
Vinton	661	1,942	2,703	3,372	3,654
West Bay	878	1,055	1,222	1,246	1,691
West Cote Blanch	602	657	796	971	1,040
West Lake Verrett	837	1,015	1,004	1,136	1,357
White Castle	1,271	1,437	1,250	1,013	1,229
Other Gulf Coast [2]	17,595	17,709	19,508	21,234	24,668
Total Gulf Coast	96,194	105,631	107,381	112,805	123,708
Northern:					
Big Creek			35	908	1,892
Caddo	2,421	2,129	1,950	1,944	2,328
Delhi		2	1,054	5,525	8,041
Haynesville	5,368	3,816	2,356	3,321	3,500
Holly Ridge		749	1,429	1,254	1,162
Homer	1,067	1,019	976	926	924
Lake St. John	306	623	1,882	4,381	5,544
Nebo [3]	3,668	3,466	3,191	2,805	2,922
Olla [4]	4,852	4,221	3,636	3,109	2,921
Rodessa	3,462	2,930	2,515	1,978	1,727
Shreveport	777	690	513	406	301
Urania	739	678	632	615	675
Other Northern [2]	4,738	3,691	3,501	3,692	4,646
Total Northern	27,398	24,014	23,670	30,864	36,583
Total Louisiana	123,592	129,645	131,051	143,669	160,291

[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.

Increased activity in leasing and drilling the Gulf of Mexico tidelands took place in 1947, stimulated by a successful completion on the Kerr-McGee lease. This well, the first commercial production in the Gulf of Mexico, has opened an entirely new field of activity for the petroleum industry. It is anticipated that drilling in the Gulf will increase, in spite of uncertainties attending the controversy over title to offshore lands and minerals between the Federal Government and the States.

Michigan.—Crude production declined slightly for the sixth consecutive year to a little over 16 million barrels in 1947. The Deep River field continued to increase its output to 2.9 million barrels, becoming the major producing field. The Reed City field, heretofore the leading producer, continued to decrease in 1947, while the Coldwater field since its early development in 1944, continued to increase its production.

In all, 312 oil wells were completed in 1947, including 15 wildcats. Exploratory drilling was encouraging since appreciable new reserves were added by the discovery and development of such new fields as Kimball Lake, Newaygo County; Stony Lake, Oceana County; and Mount Forest, Bay County.

Production of crude petroleum in Michigan, 1943–47, by fields, in thousands of barrels

[Michigan Department of Conservation]

Year	Adams	Coldwater	Deep River	Fork	Headquarters	Kawkawlin	Kimball Lake	Porter	Reed City	Winterfield	Other fields	Total
1943	984	-------	-------	805	1,999	689	-------	742	7,847	683	7,019	20,768
1944	1,177	68	736	1,436	1,212	724	-------	626	5,194	377	6,940	18,490
1945	1,196	958	1,460	1,566	461	654	-------	521	4,267	223	5,961	17,267
1946	1,299	1,598	2,409	1,354	226	697	-------	462	3,250	172	5,607	17,074
1947	988	1,746	2,872	752	169	725	868	412	2,209	147	5,327	[1]16,215

[1] Final figure.

Mississippi.—Petroleum production increased for the third consecutive year and exceeded the peak of 1942. Thirty-five million barrels were produced in 1947 compared with 24.3 million in 1946 and the previous peak of 28.8 million barrels in 1942.

Tinsley remained the largest producing field, although its output has declined since 1945 to approximately 7 million barrels in 1947. Other leading fields were Heidelberg, Cranfield, Baxterville, and Brookhaven, which produced over 4 million barrels.

The 319 oil-well completions in 1947 more than doubled the 154 of 1946. All were completed in proved fields, except for four wells. Most of the completions occurred in Brookhaven, Baxterville, La Grange, and Mallalieu fields.

The four wildcat completions opened three new fields—Sandersville (which was abandoned in November 1947); Oldenburg in Franklin County; and Yellow Creek in Wayne County. The latter two were reported as having a good chance of becoming commercially important.

Production of crude petroleum in Mississippi, 1943–47, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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	1,514	1,451	1,582	1,564	1,590	1,553	1,625	1,690	1,556	1,633	1,632	1,672	19,062
1946	1,697	1,554	1,663	1,707	1,918	1,921	1,981	2,220	2,207	2,384	2,425	2,621	24,298
1947 [1]	2,720	2,352	2,655	2,613	2,829	2,832	2,976	3,073	3,082	3,326	3,250	3,309	35,017

[1] Subject to revision.

Montana.—Crude production of 8.7 million barrels in 1947 remained about the same as for 1946 (8.8 million barrels). The steady decline in the Cut Bank field, from 5.4 million barrels in 1944 to 4.2 million in 1947, accounted for most of the drop in production. Conversely, the Elk Basin field production has increased from 243,000 barrels in 1943 to 1.7 million in 1947.

Oil-well completions also declined in 1947, as 152 wells were completed compared with 159 in 1946. Completions in leading fields were: Kevin-Sunburst 86, Cut Bank 57, and Cat Creek 9.

Seven wildcat wells were successful. Among the new oil-field discoveries was that in the Kibbey formation at Ragged Point. This find was the first commercial occurrence of oil in the Big Snowy group, except in the old inactive Devils Basin field. An outstanding new development in Montana was completion of a large oil well in the Madison limestone at Northwest Elk Basin.

Production of crude petroleum in Montana, 1943–47, by fields

[Thousands of barrels]

Year	Cat Creek	Cut Bank	Dry Creek	Elk Basin	Frannie	Gage	Kevin-Sunburst	Pondera	Other fields [1]	Total
1943	120	5,328	97	243	14	--------	1,840	211	63	7,916
1944	116	5,414	92	682	15	98	1,923	241	66	8,647
1945	130	4,876	166	936	19	80	1,912	262	39	8,420
1946	480	4,546	160	1,355	16	104	1,772	306	86	8,825
1947 [2]	586	4,230	130	1,728	18	51	1,625	317	8	8,693

[1] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.
[2] Subject to revision.

Nebraska.—Oil production of 229,000 barrels in 1947 was 22 percent below the 1946 total. Part of this decline can be attributed to the fact that a number of marginal wells were abandoned to make casing available for use at other locations. No new discoveries or extensions of present fields were reported, although there was some renewed interest in western and southeastern Nebraska, principally in Richardson County.

Production of crude petroleum in Nebraska, 1943–47, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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	25	28	21	31	28	26	26	26	22	27	19	26	305
1946	28	22	25	27	29	26	27	26	22	23	20	18	293
1947 [1]	23	18	18	17	17	18	19	17	21	20	20	21	229

[1] Subject to revision.

New Mexico.—Crude production during 1947 set a record high of about 41 million barrels, or 4.3 million over the 1946 output.

The leading fields, with 1947 production in millions of barrels, were Monument, 6.5; Eunice, 5.8; Vacuum, 4.1; Hobbs, 3.6; and Drinkard, 3.3. In 1947, 423 oil wells were completed, of which 7 wildcat operations were successful, resulting in the discovery of 6 new fields. However, all of the finds appear to be small, both in initial production tests and probable areal extent. Drilling was concentrated around the Eunice area, where the lower Permian and Ellenburger pays are being developed rapidly.

Exploratory drilling was 25 percent more active than in 1946, and over half of the tests were in counties having little or no production at present. Total wildcat footage drilled exceeded 1946 by 40 percent owing to the increased depths drilled in search of oil and gas.

Leasing activities for exploratory work centered in the Delaware Basin of Eddy County, the area north of Hobbs in Lea and Roosevelt Counties, and all of the San Juan Basin in northwestern New Mexico. Exploration drilling activity during 1948 will doubtless set a new record.

Production of crude petroleum in New Mexico, 1943–47, by districts and fields, in thousands of barrels

[Oil and Gas Journal]

Year	Southeast									Northwest	Total
	Arrowhead	Eunice	Grayburg-Jackson	Hobbs	Maljamar	Monument	Paddock	Vacuum	Other		
1943	1,703	6,498	1,914	3,780	1,853	7,190	-------	4,953	10,608	425	38,924
1944	1,946	6,470	1,983	4,120	2,117	7,570	-------	5,080	10,017	448	39,751
1945	1,839	5,707	1,952	3,874	[1] 2,086	7,139	65	4,585	9,984	[2] 455	37,686
1946	1,691	6,007	1,811	3,569	2,033	6,565	655	4,054	9,853	[2] 466	36,704
1947	1,547	5,796	1,935	3,562	2,119	6,541	1,298	4,099	13,651	[2] 422	40,970

[1] Oil Weekly.
[2] Bureau of Mines.

New York.—Production of 4.8 million barrels of crude petroleum in 1947 was slightly below the 1946 output of 4.9 million barrels. During 1947, drilling operations for oil in New York were confined almost exclusively to the secondary recovery areas of the 70-year-old oil fields, with completions numbering 780 in 1947 compared with 795 a year earlier, while 751 were water input in 1947.

Production of crude petroleum in New York, 1943–47, by months

[Thousands of barrrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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	363	329	386	382	417	386	395	431	377	421	394	367	4,648
1946	418	370	398	416	424	405	404	416	397	428	383	404	4,863
1947 [1]	419	349	384	395	400	400	424	393	402	416	359	421	4,762

[1] Subject to revision.

Ohio.—Crude production in Ohio increased slightly for the second year, from 2.8 million barrels to 2.9 million in 1946 and 3.1 million in 1947. The continuing increased production of Pennsylvania Grade within the State more than counteracted the declines in other grades, making possible the small net gain for the year.

Oil-well completions in 1947 increased slightly over the previous year, despite the dry-hole ratio of 35 percent compared with 32 percent in 1946.

The 307 completed oil-producing wells showed an average daily initial production of 23 barrels per well, as compared to 18 barrels in 1946. Muskingum and Meigs Counties recorded the largest number of wells completed, with 60 each, followed in order by Perry 49, Monroe 36, and Ashland 21. There were no other outstanding developments.

Production of crude petroleum in Ohio, 1943–47, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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	195	208	258	233	251	246	248	265	229	258	223	214	2, 828
1946	234	214	242	248	260	245	238	243	242	260	235	247	2, 908
1947 [1]	236	201	244	266	256	264	282	259	274	291	250	285	3, 108

[1] Subject to revision.

Oklahoma.—Crude-petroleum production in Oklahoma rose to 141 million barrels in 1947 compared with 134.8 million in 1946 and was the highest for any year since the 154.7 million barrels reported for 1941. Material reductions in 1947 in the State's greatest current sources of oil—the West Edmond and Oklahoma City fields—were offset by many new developments and increased production from other fields, principally the Velma field, whose total output was 5.7 million barrels over the previous year.

The upward trend in oil-well completions continued for the fourth successive year—1,426 in 1945, 1,654 in 1946, and 1,989 in 1947. The more important of the 1947 oil discoveries were: East Cookietown, North Rose Valley, and Southwest Soldier Creek in Cotton County, North Antioch, Northeast Antioch, East Brady, Northeast Elmore, Eola, and East Lindsey in Garvin County. In the Seminole area, 12 new oil pools were discovered during 1947; however, none is considered of major importance. Exploratory drilling was particularly active in the southern part of the State. Cotton County leads in total completions, with 134, and other active counties reported the following number of wells: Tillman, 41; Garvin, 39; Jefferson, 27; Stephens, 25; and Carter, 13. An exploratory test in Caddo County in the Anadarko Basin was abandoned during the year as a dry hole after reaching a total depth of 17,823 feet in rocks of Pennsylvanian age, setting a new record depth. At the end of the year, another test was drilling at at 14,238 feet in Grady County; commercial production was indicated by drillstem test, when the well flowed 27 barrels per hour from the Simpson formation. A successful completion at this depth would make a record deepest producer. Much additional drilling can be expected around the southeastern edge of the Anadarko Basin. Geological information obtained from deeper wells may lead to further development of the deeper zones.

Production of crude petroleum in Oklahoma, 1943–47, by fields, in thousands of barrels

[Oil and Gas Journal]

Field	1943	1944	1945	1946	1947
Allen	1,245	1,285	1,256	[1] 1,120	[1] 1,075
Antioch				607	2,582
Apache	2,309	2,245	2,308	1,591	1,803
Billings	1,706	1,490	1,296	820	543
Burbank	3,251	3,140	3,128	2,927	2,615
Cement	2,564	4,190	5,165	4,801	4,442
Coon Creek				561	1,652
Crescent	752	1,124	1,845	1,557	1,321
Cromwell	1,761	1,512	1,277	1,094	671
Cumberland	3,735	4,414	4,119	3,696	3,948
Cushing [2]	2,991	2,940	2,814	2,792	2,839
Edmond	1,161	1,046	902	583	545
Fitts	2,489	2,150	1,701	1,518	1,287
Glenn [3]	1,856	2,245	2,359	2,418	2,568
Healdton	2,618	2,515	2,423	2,438	2,431
Hewitt	2,382	2,055	1,084	1,698	1,672
Lone Grove		190	984	388	1,497
Lucien	1,575	1,363	994	803	694
Moore		351	1,392	2,276	1,165
Oklahoma City	20,338	16,295	12,968	10,693	9,670
Pauls Valley	1,963	4,200	4,445	2,971	2,399
Ramsey	1,590	1,250	999	799	839
Seminole district:					
Bowlegs	1,721	1,525	1,250	1,169	1,172
Earlsboro	3,253	2,495	1,737	1,095	616
Little River	1,931	1,741	1,492	1,159	1,432
St. Louis [4]	3,828	2,690	1,703	1,500	1,356
Seminole City	2,555	2,240	1,990	1,307	1,271
Sholem-Alechem-Tatums-Tussy	2,275	2,486	2,208	2,160	2,435
South Burbank	2,637	2,500	2,370	1,886	1,455
Velma	602	800	1,024	2,457	8,153
West Edmond	322	7,752	26,548	23,565	14,936
Other fields	45,149	43,207	45,598	52,779	61,010
Total Oklahoma	120,559	123,436	139,379	137,228	142,094

[1] Includes Allen Deep only.
[2] Included Shamrock before 1945.
[3] Included Sapulpa before 1945.
[4] Included Pearson before 1947.

Although new discoveries for 1947 are considerably greater than last year, only a few pools have been worked sufficiently to evaluate their importance. The development of Dornick Hills and Springer sands on the flanks of the old producing areas is expected to figure prominently in the 1948 program.

Pennsylvania.—Crude production of 12.7 million barrels in Pennsylvania in 1947 followed the downward trend, which has been unbroken since 1942 with the exception of 1946, when the total of 13 million barrels was slightly above the 1945 output. About 82 percent of the 1947 production came from the Pennsylvania portion of the Bradford field.

Oil-well drilling in Pennsylvania is mostly limited to shallow wells, of which 208 were completed in 1947. No new pools were discovered. The Coryville oil pool in the northeastern part of McKean County, discovered in 1945, continued to be the scene of active development. About 100 wells were completed in 1947; however, these did not appreciably extend the limits of the pool.

In the Bradford oil field, which includes the Bradford, Guffey, and Burningwell pools, 2,140 new wells were drilled in 1947 (2,503 in 1946), and about half of these were for water intake. Of the new wells drilled in 1947, 1,840 were in the Pennsylvania part of the field.

Production of crude petroleum in Pennsylvania, 1943–47, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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	1,015	919	1,096	1,043	1,109	1,097	1,082	1,111	996	1,089	995	963	12,515
1946	1,074	956	1,066	1,120	1,134	1,092	1,049	1,132	1,082	1,160	1,056	1,075	12,996
1947 [1]	1,110	920	1,017	1,069	1,081	1,057	1,110	1,056	1,072	1,120	994	1,084	12,690

[1] Subject to revision.

Tennessee.—Important developments in Tennessee were reported in 1947, mainly the production of oil in commercial quantities from the Knox dolomite. This success refutes the idea that the Knox does not contain commercial quantities of oil and will undoubtedly stimulate interest in exploring that zone in the State.

At least 30 wells were completed (3 were oil wells) in 1947. One of these, in Giles County was the deepest well ever drilled in Tennessee; it was a dry hole, but it showed that the thickness of the Knox dolomite in that area was almost 5,000 feet. Production in Tennessee in 1947 was about 8,000 barrels.

Texas.—Production of crude petroleum in Texas continued its rapid rise in 1947 to 819.4 million barrels, a total 68 percent above the average 5-year peacetime output in 1938 to 1942. The 1947 total exceeded the previous year by 59.2 million barrels. The principal gain was in West Texas (30.6 million barrels), where crude production has increased continuously over a period of years. The total for the Gulf Coast area (in contrast to 1946, when the production there decreased by 11.2 million barrels) rose in 1947 to the highest level since 1944, increasing by 17.2 million barrels over 1946. Other districts showing gains in their 1947 crude production over 1946 were: South Texas 5.2 million, North Texas 4.1 million, and Central Texas 2.0 million barrels. The East Texas and Panhandle districts maintained their 1947 production at the 1946 level.

Oil-well completions also increased sharply from 4,720 in 1946 to 5,812 in 1947 with all districts except East Texas and Gulf Coast showing an increase, and with West Texas, South Texas, and North Texas leading in completions.

Gulf Coast District.—Moderately higher production was reported in most areas including all the leading fields. Thompson was first with an increase of 2.5 million barrels over the 1946 production. The Gulf Coast district had an over-all increase of 17.2 million barrels over the 1946 output. Oil-well completions decreased from 1,100 wells in 1946 to 909 in 1947. Of the 417 exploratory wells drilled, 100 discovered new oil or condensate areas or extended old fields. Some new productive formations were opened, but none appears to be outstanding.

East Texas.—In East Texas oil production of 171.7 million barrels in 1947 remained at the 1946 level. Hawkins field production in-

Production of crude petroleum in Texas, 1943–47, by districts and fields

[Thousands of barrels]

District and field	1943	1944	1945	1946	1947 [1]
Gulf coast:					
Agua Dulce	1,904	3,511	3,811	3,786	4,227
Amelia	1,668	1,682	1,491	1,493	1,581
Anahuac	8,906	11,932	11,168	10,137	10,663
Barbers Hill	2,340	2,069	1,895	1,853	1,969
Bay City	1,222	1,761	1,425	1,420	1,546
Bonnie View			352	811	1,178
Chocolate Bayou	201	338	629	1,064	1,613
Clear Lake	1,468	1,872	1,424	1,366	1,305
Conroe	19,967	23,231	21,378	20,708	21,950
Dickinson-Gillock	2,128	2,377	2,138	2,077	2,000
Fairbanks	2,802	2,910	2,644	2,287	2,232
Fannette	1,242	1,657	2,692	3,337	2,770
Fig Ridge	862	2,516	2,862	2,614	1,800
Flour Bluff	1,009	1,490	1,435	1,282	1,075
Friendswood	11,420	20,930	20,075	18,781	20,997
Greta	1,499	3,375	3,233	3,448	4,028
Hardin	1,372	1,330	1,157	978	554
Hastings	17,964	22,169	20,961	19,317	21,279
Heyser	3,337	3,338	2,807	2,283	1,984
High Island	805	839	868	971	1,136
Hull	1,879	1,645	1,472	1,231	1,286
La Rosa	676	1,681	1,469	1,340	1,374
Livingston	(2)	659	1,273	1,712	1,895
Lolita	1,887	2,146	2,283	2,307	2,229
Lovell's Lake	2,040	1,891	1,765	1,806	1,556
Luby	1,276	1,581	1,315	1,014	919
Manvel	2,665	3,024	2,824	2,635	2,725
Markham	973	2,409	2,403	1,984	1,783
Midway	1,082	1,198	1,230	1,109	1,597
Old Ocean	4,785	5,517	6,107	6,088	5,473
Oyster Bayou	1,222	2,267	2,088	2,061	2,936
Placedo	1,730	2,265	2,324	2,177	2,222
Raccoon Bend	2,646	3,675	3,375	2,834	2,722
Refugio	1,509	1,839	1,918	2,418	3,203
Richard King	965	1,206	1,198	1,063	1,114
Saxet-Saxet Heights	2,677	2,685	2,142	2,498	2,595
Segno	1,599	1,394	1,355	1,282	1,276
Silsbee	720	746	867	1,137	1,064
Sour Lake	362	528	598	748	969
South Houston	1,586	1,865	1,785	1,558	1,592
Stowell	1,747	5,522	6,330	4,924	4,590
Stratton	1,732	4,090	4,016	3,604	4,344
Sugarland	1,779	3,084	2,448	1,721	1,691
Sugar Valley		3		276	1,479
Thompson	9,993	13,609	13,007	13,136	15,621
Tomball	3,257	3,781	3,728	3,711	3,388
West Columbia	2,041	2,584	2,595	2,314	2,394
West Ranch	6,762	8,102	7,122	7,116	7,043
White Point	3,905	4,537	4,525	3,849	4,563
Withers-Magnet	6,015	6,749	7,391	6,847	5,655
Other Gulf Coast [3]	48,502	59,145	57,571	55,258	61,751
Total Gulf Coast	200,128	260,754	252,969	241,771	258,936
East Texas:					
East Texas proper [4]	129,983	135,184	131,204	120,789	117,523
Cayuga	3,459	2,998	2,633	2,456	2,285
Chapel Hill	1,293	1,245	774	567	520
Hawkins	14,243	13,178	12,436	14,914	17,045
Long Lake	1,558	1,995	2,042	2,072	2,122
New Hope	124	986	1,640	1,284	1,481
Quitman	642	2,083	2,158	2,331	2,933
Rodessa	2,821	2,209	1,716	1,333	1,179
Sulphur Bluff	1,510	1,426	1,338	1,247	1,175
Talco	9,266	8,618	8,248	8,755	8,849
Van	6,411	11,673	10,968	10,625	10,443
Other East Texas	1,515	2,725	3,729	5,039	6,168
Total East Texas	172,825	184,320	178,886	171,412	171,723
Central Texas:					
Darst Creek	2,779	3,438	3,188	2,595	2,541
Luling	1,645	1,551	1,469	1,321	1,455
Mexia-Powell [5]	1,339	1,290	1,209	1,144	1,124
Other Central Texas	3,669	6,136	6,858	8,720	10,653
Total Central Texas	9,432	12,415	12,724	13,780	15,773

See footnotes at end of table.

Production of crude petroleum in Texas, 1943–47, by districts and fields—Con.

[Thousands of barrels]

District and field	1943	1944	1945	1946	1947 [1]
North Texas [6] [7]	50, 159	53, 272	54, 255	57, 204	61, 264
Panhandle [8]	33, 295	33, 435	31, 726	29, 716	29, 589
South Texas [9]	29, 285	41, 498	48, 423	54, 036	59, 239
West Texas:					
Andrews	2, 008	7, 129	14, 383	18, 641	22, 781
Crane-Upton	11, 598	17, 028	18, 476	18, 266	20, 339
Crockett	1, 187	1, 469	2, 020	3, 794	7, 050
Ector [10]	20, 303	33, 635	34, 180	38, 532	50, 392
Fisher	475	434	324	318	512
Gaines-Yoakum	15, 785	33, 785	32, 909	30, 726	35, 915
Garza	7	12	151	1, 215	1, 631
Glasscock-Howard-Mitchell	7, 008	7, 332	7, 599	7, 704	8, 276
Pecos	12, 288	16, 785	17, 238	17, 457	20, 122
Reagan	2, 006	2, 456	3, 011	2, 808	2, 798
Slaughter	11, 267	23, 222	24, 119	21, 444	19, 950
Ward	5, 734	7, 153	6, 919	6, 750	6, 631
Winkler	8, 921	9, 712	13, 787	22, 410	22, 626
Other West Texas	632	853	611	2, 231	3, 880
Total West Texas	99, 219	161, 005	175, 727	192, 296	222, 903
Total Texas	594, 343	746, 699	754, 710	760, 215	819, 427

1 Subject to revision.
2 Included in "Other Gulf Coast" in 1943.
3 Includes crude oil consumed on leases and net change in stocks held on leases for entire district.
4 Joiner, Kilgore, Lathrop, and other pools in Cherokee, Gregg, Rusk, Smith, and Upshur Counties.
5 Includes other fields in Falls, Freestone, Limestone, and Navarro Counties.
6 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.
7 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.
8 Carson, Gray, Hutchinson, Moore, and Wheeler Counties.
9 Includes fields in Brooks, Duval, Hidalgo, Jim Hogg, Jim Wells, La Salle, Live Oak, McMullen, Starr, Webb, and Zapata Counties.
10 Includes the part of Jordan pool in Crane County.

creased 2.1 million barrels over the 1946 total, but a number of other fields decreased. Drilling activity for this district, in general, declined from the preceding year, being restrained somewhat by the steel shortage. Oil-well completions totaled 313. Exploratory activity in the district resulted in the discovery of six oil fields during 1947. These were Blackfoot, Anderson County; Como, Hopkins County; Moody, Freestone County; San Augustine, San Augustine County; Scottsville, Harrison County; and Sherman, Grayson County.

Central Texas.—Production increased by about 2 million barrels over the preceding year. There was a substantial increase in drilling activities resulting in discovery of nine new oil fields.

North Texas.—The North Texas district continued the expansion of recent years, increasing its output by 4 million barrels over 1946 production. Drilling activity continued high, as 1,150 completed oil wells were drilled. In all, 67 new oil pools or extensions to the established areas of production were discovered. The developments were mostly in Archer, Wichita, Young, Cooke, Clay, and Throckmorton Counties. Throckmorton was the county leading in number of discoveries.

Panhandle.—Crude production of 29.6 million barrels in 1947 remained at the 1946 level. Drilling activities in 1947 increased over 1946; no new areas were discovered, but there were some slight extensions in proved fields.

South Texas.—An increase of 5.2 million barrels of crude production over 1946 is reflected by the developments during 1947, leading to the discovery of 67 new fields as compared with 35 in the same area the previous year. Of these discoveries, 32 produced oil, and 35 were classified as gas-condensate fields. At least three of the new discoveries were of major importance. They were Bloomington in Victoria County, Fulton Beach in Aransas County, and Roche in Refugio County. Furthermore, important extensions of the Hoffman field in Duval County and Borregas field in Kleberg County were discovered. Drilling increased during 1947 in South Texas where 1,264 wells were completed; 906 produced oil, 157 were gas-condensate, and 201 were dry holes.

West Texas.—Production in 1947 continued the sharp upward trend of recent years and resulted in the greatest gain (30.6 million barrels) over the previous year and the largest increase for any one district in Texas.

During 1947, the development rate in West Texas was again increased over prior years. A total of 1,973 oil wells were completed, which included 47 wildcats. The greatest number of developments for any one field occurred in the Levelland field in Cochran and Hockley Counties, where 140 were successful; Toborg field, Pecos County, followed with 120, and two other areas in which more than 100 wells were completed during 1947 were the Slaughter and Sharon Ridge fields.

Virginia.—Production of crude petroleum, all from the Ewing-Rose Hill area in Lee County, increased sharply from 23,000 barrels in 1946 to 61,000 in 1947. Eight small producing oil wells were completed in this field in 1947, and four were dry holes.

West Virginia.—Crude-petroleum production continued to decline (with the exception of a slight increase of 50,000 barrels in 1946 over 1945) from 3.6 million barrels in 1942 to 2.9 million in 1946 and 2.6 million in 1947.

The drilling in 1947 was much the same as 1946—93 oil-producing wells were completed, including 1 wildcat discovery. One new Berea sand oil pool was discovered in Jackson County, and 1 "big lime" oil pool was considerably extended in Kanawha County. About 800 acres of new oil territory were proved.

Production of crude petroleum in West Virginia, 1943–47, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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	251	218	261	236	246	238	242	264	223	244	236	220	2,879
1946	254	225	250	256	259	259	208	274	235	258	225	226	2,929
1947 [1]	227	183	220	202	211	209	218	219	229	253	208	238	2,617

[1] Subject to revision.

Wyoming.—Continuing the steady increase of recent years, Wyoming produced 44.2 million barrels of petroleum in 1947, about 5.3 million barrels more than the 1946 total. This gain was due largely to increases in production from Big Sand Draw, Byron-Garland, Hamilton Dome, Lost Soldier–Ferris–Wertz, and Steamboat Butte.

Oil-well completions rose from 109 in 1946 to 172 in 1947. The totals in the most active fields in 1947 were: Hamilton Dome 22, Mush Creek 14, Frannie 14, and Bid Muddy 9.

Thirteen oil wells and 6 gas-well discoveries were made by the 67 exploratory wells drilled. New fields discovered in 1947 were at Cow Gulch, Herrick Lane, Neiber, North Sage Creek, Sand Creek, Seven Mile, and South Fort. The developments at Ant Hills and Mush Creek, together with the reported oil strike at Adon, caused a large leasing play in the northeast quarter of the State, as well as in southeastern Montana.

Production of crude petroleum in Wyoming, 1943–47, by fields

[Thousands of barrels]

Year	Big Muddy	Big Sand Draw	Byron-Garland	Elk Basin	Frannie	Grass Creek	Hamilton Dome	La Barge	Lance Creek	Little Buffalo
1943	382	--------	2,554	2,133	846	1,313	508	655	7,082	--------
1944	504	--------	2,534	2,885	1,092	993	470	585	6,535	--------
1945	549	263	3,752	3,190	1,487	1,016	957	510	5,503	290
1946	568	447	3,814	4,580	1,331	1,094	1,396	461	4,920	574
1947 [1]	668	1,462	4,653	4,696	1,711	1,042	2,196	416	4,294	982

Year	Lost Soldier-Wertz, etc.	Oregon Basin	Pilot Butte	Poison Spider-South Casper	Rock Creek	Salt Creek	Steamboat Butte	Winkleman	Other fields [2]	Total
1943	4,246	5,345	464	262	911	4,820	219	--------	2,513	34,253
1944	3,441	4,388	370	229	935	4,802	601	117	2,875	33,356
1945	3,135	4,454	260	233	841	4,578	1,017	228	3,956	36,219
1946	3,183	4,164	325	274	853	4,642	1,888	385	4,078	38,977
1947 [1]	4,003	4,009	262	314	867	4,566	2,800	507	4,790	44,238

[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, including oil and gas wells and dry holes, increased from 26,991 in 1946 to 30,842 in 1947. Drilling was stimulated by the rapid increase in demand for crude oil and the upward trend in crude-oil prices.

Oil-well completions rose 14 percent from 15,851 in 1946 to 17,999 in 1947, dry holes increased from 8,050 in 1946 to 9,538 in 1947, and the number of gas wells rose from 3,090 in 1946 to 3,305 in 1947. The number of oil wells completed in 1947 represented 58 percent of the total wells drilled, dry holes constituted 31 percent, and gas wells 11 percent.

The increase of 2,148 in total oil wells completed in 1947 compared with 1946 included increases in oil wells completed in Texas of 1,092, in Oklahoma 335, in California 264, in Kansas 248, in Louisiana 223, and in Mississippi 165. Largest declines in number of completions were 290 in Illinois and 208 in the Appalachian States.

The annual survey of the total number of producing oil wells in the United States indicated a total of 421,460 wells on December 31, 1946, compared with a total of 415,750 on December 31, 1945.

859140—49——3

Wells drilled for oil and gas in the United States, 1946–47, by months

[Oil and Gas Journal]

Wells	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
													Number	Percent
1946														
Oil	1,254	1,145	1,375	1,270	1,314	1,418	1,257	1,442	1,362	1,442	1,324	1,248	15,851	58.7
Gas	199	222	250	198	242	244	272	291	289	331	306	246	3,090	11.5
Dry	588	464	672	559	671	746	660	735	695	764	768	728	8,050	29.8
Total	2,041	1,831	2,297	2,027	2,227	2,408	2,189	2,468	2,346	2,537	2,398	2,222	26,991	100.0
1947														
Oil	1,368	1,201	1,330	1,252	1,618	1,470	1,683	1,818	1,527	1,763	1,559	1,410	17,999	58.4
Gas	287	265	261	195	263	258	298	304	288	341	290	255	3,305	10.7
Dry	748	623	686	651	728	776	887	971	797	905	951	815	9,538	30.9
Total	2,403	2,089	2,277	2,098	2,609	2,504	2,868	3,093	2,612	3,009	2,800	2,480	30,842	100.0

Wells drilled for oil and gas in the United States, 1946–47, by States and districts

[Oil and Gas Journal]

State and district	1946				1947			
	Oil	Gas	Dry	Total	Oil	Gas	Dry	Total
Alabama	3		13	16	5		24	29
Arkansas	110	2	71	183	182	10	137	329
California	1,375	65	350	1,790	1,639	45	369	2,053
Colorado	148	1	18	167	152	7	50	209
Illinois	1,344	6	991	2,341	1,054	10	969	2,033
Indiana	330	25	227	582	312	35	334	681
Kansas	1,055	300	657	2,012	1,303	452	912	2,667
Kentucky	299	139	275	713	289	110	261	660
Louisiana:								
Gulf Coast	363	13	208	584	443	15	193	651
Northern	450	102	247	799	593	90	292	975
Total Louisiana	813	115	455	1,383	1,036	105	485	1,626
Michigan	234	107	441	782	312	55	402	769
Mississippi	154	6	100	260	319	29	143	491
Montana	159	71	83	313	152	93	64	309
Nebraska, Missouri, and Iowa	3		15	18			7	7
New Mexico	294	42	75	411	423	60	79	562
Oklahoma	1,654	341	1,001	2,996	1,989	302	1,532	3,823
Pennsylvania, New York, Ohio, and West Virginia	3,044	1,357	602	5,003	2,836	1,435	685	4,956
Texas:								
Gulf Coast	1,100	137	482	1,719	909	111	479	1,499
East Texas	385	149	153	687	313	77	206	596
West Texas	1,462	18	300	1,780	1,973	21	293	2,287
Other districts	1,773	195	1,647	3,615	2,617	328	1,956	4,901
Total Texas	4,720	499	2,582	7,801	5,812	537	2,934	9,283
Wyoming	109	11	48	168	172	19	76	267
Other States	3	3	46	52	12	1	75	88
Total United States	15,851	3,090	8,050	26,991	17,999	3,305	9,538	30,842

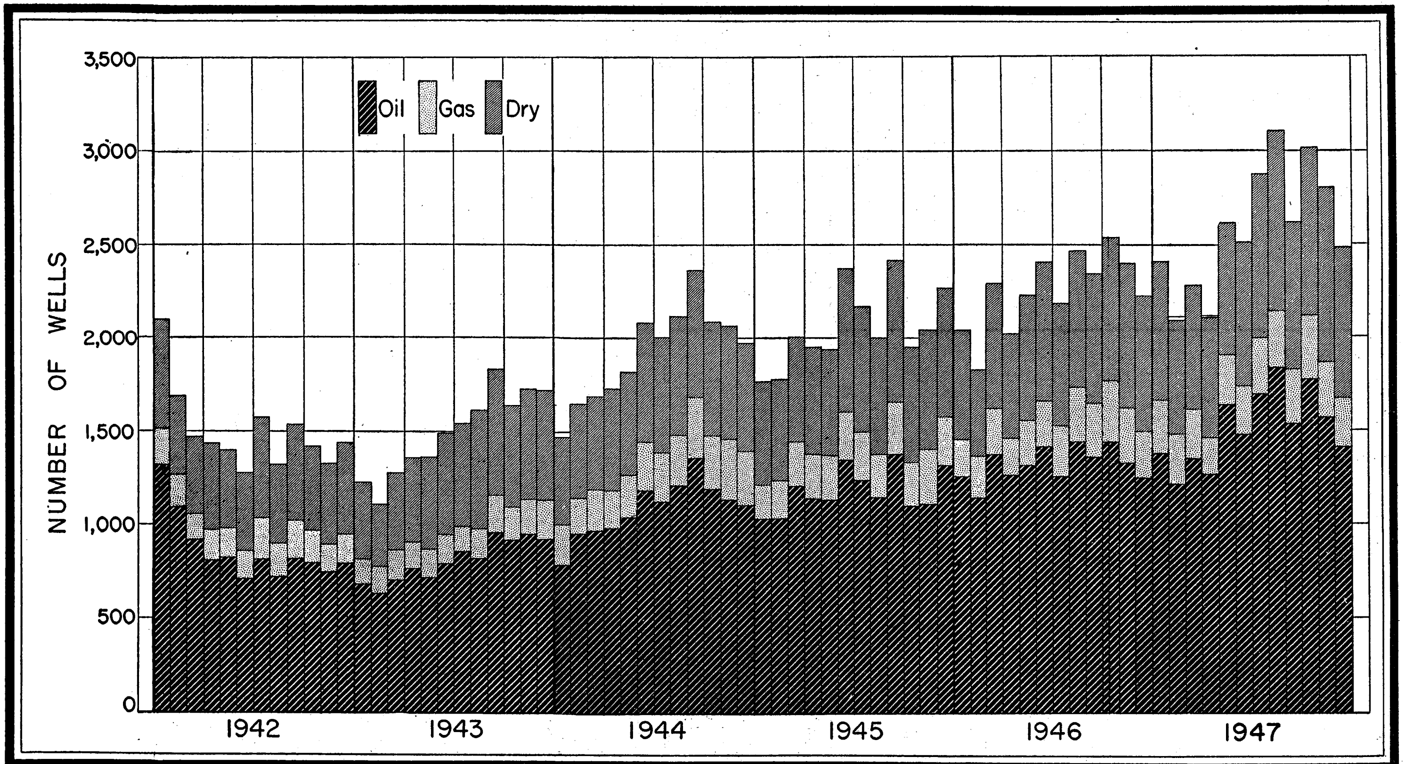

FIGURE 4.—Wells drilled in the United States, 1942–47, by months.

Producing oil wells in the United States and average production per day in 1946, by States and districts

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	3,350	23.6	New York	23,600	0.6
California	23,180	38.0	Ohio	20,480	.4
Colorado	420	91.5	Oklahoma	52,170	7.1
Illinois	25,600	8.2	Pennsylvania	83,200	.4
Indiana	2,100	8.9			
Kansas	26,100	10.3	Texas:		
Kentucky	14,650	2.0	Gulf Coast	14,400	46.5
			East Texas proper	23,500	13.9
Louisiana:			West Texas	19,000	28.5
Gulf Coast	3,600	87.7	Other districts	49,000	11.6
Northern	4,460	19.5			
			Total Texas	105,900	19.8
Total Louisiana	8,060	50.1	West Virginia	16,500	.5
Michigan	3,520	13.2	Wyoming	4,220	25.6
Mississippi	790	92.5	Other States [1]	120	11.8
Montana	2,750	9.0			
Nebraska	60	12.3	Total United States	421,460	11.3
New Mexico	4,690	22.1			

[1] Alabama, Florida, Missouri, Tennessee, and Virginia.

CONSUMPTION AND DISTRIBUTION

The total demand for crude petroleum rose from 1,813 million barrels in 1946 to 1,953 million in 1947, an increase of 7.7 percent. The demand for imported crude oil represented 5 percent of the total crude demand in 1947 compared with 4.7 percent in 1946. About 94.8 percent of the indicated demand for crude oil in 1947 represented crude oil run to stills at refineries, compared with 95.4 percent so used in 1946. Crude oil exported, used for fuel, or lost amounted to 5.2 percent of the total demand in 1947 and 4.6 percent in 1946.

Runs to Stills.—Total crude oil run to stills amounted to 1,852 million barrels in 1947 compared with 1,730 million in 1946—a gain of 122 million barrels or almost 7 percent. Runs of foreign crude amounted to 97 million barrels in 1947 and runs of domestic crude to 1,755 million. The principal increases in total crude run by refinery districts in 1947 were 21.5 million barrels in the Indiana–Illinois–Kentucky district, 20.7 million in the East Coast district, 18.7 million in the Louisiana Gulf Coast, 16.5 million in the California district, and 12.4 million barrels in the Texas Gulf Coast. All other districts showed substantial gains. The large gain in the total demand for all oils in 1947 necessitated the maximum use of refinery capacity.

Distribution.—The total demand for domestic crude petroleum set a new record of 1,856 million barrels in 1947—a gain of almost 128 million barrels or 349,000 barrels daily average. This demand was met by a production of domestic crude oil of 1,856 million barrels, of which less than 1 million barrels was added to stocks. The supply of domestic crude petroleum was supplemented by a gain in the imports of foreign crude oil of about 11 million barrels or 13 percent. Imports of refined products increased from about 52 million barrels

Runs to stills of crude petroleum in the United States in 1947, by districts and months

[Thousands of barrels]

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
East Coast:													
Domestic	15,346	13,320	15,435	15,814	18,197	17,940	19,861	17,643	17,546	16,771	15,753	17,090	200,716
Foreign	6,958	7,852	9,081	8,042	7,962	8,197	7,590	7,955	8,245	7,922	7,935	8,860	96,599
Total East Coast	22,304	21,172	24,516	23,856	26,159	26,137	27,451	25,598	25,791	24,693	23,688	25,950	297,315
Appalachian	5,190	4,892	5,040	4,880	5,040	5,025	4,963	5,365	4,986	5,037	4,832	5,127	60,377
Indiana, Illinois, Kentucky, etc	24,113	22,583	25,750	22,935	24,635	24,310	25,568	26,176	25,608	26,311	26,644	26,724	301,357
Oklahoma, Kansas, Missouri, etc	12,188	10,878	12,264	11,763	13,056	12,735	13,514	13,685	13,113	13,280	13,430	13,144	153,050
Texas Inland	6,513	6,415	6,708	6,593	6,066	7,097	7,636	7,401	7,136	7,492	7,547	7,978	84,582
Texas Gulf Coast:													
Domestic	34,610	31,259	33,550	30,326	34,533	35,361	38,688	38,838	39,598	39,757	38,498	41,346	436,364
Foreign	71	72	51	----------	70	264	67	----------	38	----------	26	1	660
Total Texas Gulf Coast	34,681	31,331	33,601	30,326	34,603	35,625	38,755	38,838	39,636	39,757	38,524	41,347	437,024
Louisiana Gulf Coast:													
Domestic	10,762	9,817	10,975	11,220	11,339	12,014	12,483	12,572	11,662	12,685	11,983	12,428	139,940
Foreign	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Total Louisiana Gulf Coast	10,762	9,817	10,975	11,220	11,339	12,014	12,483	12,572	11,662	12,685	11,983	12,428	139,940
Arkansas, Louisiana Inland, Mississippi, etc	1,864	1,763	1,964	1,865	1,863	2,029	2,008	2,241	2,176	2,397	2,238	2,417	24,825
Rocky Mountain	4,282	3,778	4,104	3,943	4,514	4,321	4,518	4,777	4,462	4,495	4,409	4,740	52,343
California	25,000	22,324	25,198	23,829	26,073	24,311	24,948	26,415	25,201	26,707	25,424	26,003	301,433
Total: Domestic	139,868	127,029	140,988	133,168	145,316	145,143	154,187	155,113	151,488	154,932	150,758	156,997	1,754,987
Foreign	7,029	7,924	9,132	8,042	8,032	8,461	7,657	7,955	8,283	7,922	7,961	8,861	97,259
Grand total: 1947 (final figures)	146,897	134,953	150,120	141,210	153,348	153,604	161,844	163,068	159,771	162,854	158,719	165,858	1,852,246
1946 (final figures)	140,130	130,232	144,488	139,884	148,621	145,069	150,541	150,550	145,181	146,816	140,514	148,171	1,730,197
Daily average 1947 (final figures)	4,739	4,820	4,843	4,707	4,947	5,120	5,221	5,260	5,326	5,253	5,291	5,350	5,075

in 1946 to 62 million in 1947. Stocks of refined products, however, declined almost 5 million barrels in 1947 compared with an increase of 36 million in 1946.

Receipts of domestic and foreign crude petroleum at United States refineries increased from 1,737.2 million barrels in 1946 to 1,855.6 million in 1947—a gain of 118.4 million barrels. In 1947 receipts of foreign crude oil were 97.5 million barrels, or 5 percent of the total; interstate receipts of domestic crude were 716.8 million, or 39 percent of the total; and intrastate receipts were 1,041.3 million barrels, or 56 percent of the total.

Demand for crude petroleum in the United States, 1944–47, by States of origin

[Thousands of barrels]

State	1944		1945		1946		1947 [1]	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
Alabama	33	0.1	151	0.4	382	1.0	408	1.1
Arkansas	29,226	79.9	29,272	80.2	28,068	76.9	29,553	81.0
California	322,473	881.1	329,473	902.7	310,094	849.6	330,800	906.3
Colorado	3,092	8.4	4,815	13.2	10,955	30.0	15,915	43.6
Florida			42	.1	44	.1	168	.5
Illinois	77,307	211.2	72,907	199.7	75,851	207.8	71,828	196.8
Indiana	5,027	13.7	4,955	13.6	6,776	18.6	5,869	16.1
Kansas	98,134	268.1	95,609	261.9	96,743	265.0	106,414	291.5
Kentucky	9,598	26.2	10,247	28.1	10,399	28.5	9,963	27.3
Louisiana	130,819	357.4	131,518	360.3	145,050	397.4	160,515	439.8
Michigan	18,573	50.7	17,210	47.2	16,977	46.5	16,570	45.4
Mississippi	16,261	44.4	17,814	48.8	23,826	65.3	35,338	96.8
Montana	8,862	24.2	8,241	22.6	9,075	24.9	8,344	22.9
Nebraska	427	1.2	316	.9	300	.8	226	.6
New Mexico	40,062	109.5	37,978	104.0	36,500	100.0	41,090	112.6
New York	4,726	12.9	4,666	12.8	4,860	13.3	4,741	13.0
Ohio	3,020	8.2	2,819	7.7	2,751	7.5	3,057	8.4
Oklahoma	125,533	343.0	135,318	370.7	139,878	383.2	144,379	395.5
Pennsylvania	14,382	39.3	12,487	34.2	12,724	34.9	12,812	35.1
Texas	752,849	2,057.0	762,576	2,089.3	757,211	2,074.6	809,774	2,218.5
West Virginia	3,101	8.5	2,930	8.0	2,875	7.9	2,701	7.4
Wyoming	37,901	103.6	36,247	99.3	36,679	100.5	45,011	123.3
Other States [2]	55	.2	59	.2	84	.2	123	.3
Total United States	1,701,461	4,648.8	1,717,650	4,705.9	1,728,102	4,734.5	1,855,599	5,083.8

[1] Subject to revision.
[2] Missouri, Tennessee, and Virginia.

Refinery receipts of crude petroleum in 1947, by methods of transportation, indicated that 73.4 percent of the total was delivered by pipe lines, compared with 74.3 percent in 1946; that 24.1 percent was delivered by boat, compared with 23.5 percent in 1946; and that 2.5 percent was delivered by tank car and trucks, compared with 2.2 percent in 1946.

The principal changes in the market demand for domestic crude petroleum, by States of origin (computed from production and changes in crude stocks by origin) in 1947 compared with 1946 were gains of 52.6 million barrels for Texas, 20.7 million for California, 15.5 million for Louisiana, 11.5 million for Mississippi, 9.7 million for Kansas, 8.3 million for Wyoming, 5.0 million for Colorado, 4.6 million for New Mexico, and 4.5 million barrels for Oklahoma. The principal declines were 4.0 million barrels for Illinois, 0.9 million for Indiana, and 0.7 million for Montana.

Receipts of crude petroleum at refineries in the United States, 1943–47, by methods of transportation

[Millions of barrels]

Method of transportation	1943	1944	1945	1946	1947 [1]
By boat:					
Intrastate	54.4	63.2	94.1	96.7	108.5
Interstate	35.2	57.1	113.3	226.2	241.0
Foreign	13.8	44.8	74.3	86.1	97.5
Total by boat	103.4	165.1	281.7	409.0	447.0
By pipe lines:					
Intrastate	788.8	909.6	913.7	888.9	912.9
Interstate	390.1	480.8	454.2	401.4	449.7
Total by pipe lines	1,178.9	1,390.4	1,367.9	1,290.3	1,362.6
By tank car and truck:					
Intrastate	15.7	16.5	15.2	20.1	19.9
Interstate	138.2	96.5	59.1	17.8	26.1
Total by tank car and truck	153.9	113.0	74.3	37.9	46.0
Grand total	1,436.2	1,668.5	1,723.9	1,737.2	1,855.6

[1] Subject to revision.

The total demand for Texas crude oil increased from 757.2 million barrels in 1946 to 809.8 million in 1947. About 9.6 million barrels of the record output of 819.4 million in 1947 were added to stocks. The relative contribution of Texas to the total demand for domestic crude oil declined from 43.8 percent in 1946 to 43.6 percent in 1947. Texas crude oil is distributed more widely in the domestic market than oil from any other State. In 1947 total deliveries to refineries amounted to 796.8 million barrels, of which 444.8 million went to refineries within the State and 352.0 million barrels moved to refineries in other States. The largest outside market for Texas crude oil is in the East Coast refineries that received 174 million barrels in 1947. Almost 107 million barrels of Texas crude was sent to refineries in Indiana, Illinois, Ohio, and Michigan in 1947.

California ranked second as a source of crude-oil supply in the United States, supplying 17.9 percent of the total demand for domestic crude oil in 1946 and 17.8 percent in 1947. The demand for California crude oil increased from 310.1 million barrels in 1946 to 330.8 million in 1947. In 1947, about 302 million barrels were delivered to refineries within the State, 22 million barrels of crude was used as fuel without refining, and the small balance represented exports to Canada and losses.

Louisiana was the third-largest source of crude-oil supply in 1947, with an output of 160.3 million barrels and an indicated demand of 160.5 million. The demand for Louisiana crude oil represented 8.4 percent of the total demand for domestic crude in 1946 and 8.7 percent in 1947. About half of the total supply was delivered to refineries within the State. The principal markets for Louisiana crude outside the State were in Texas and the East Coast.

Oklahoma ranked fourth as a source of domestic crude oil, supplying 8.1 percent of the total demand for domestic crude in 1946 and 7.8 percent in 1947. Production was supplemented in 1947 by a withdrawal of over 3 million barrels from stocks. Of the 141 million barrels delivered to refineries in 1947, about 56 million barrels were delivered to refineries within the State and 85 million barrels to

Daily average demand for domestic crude petroleum in the United States in 1946–47, by States of origin and by months

[Thousands of barrels]

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
1946													
Alabama	0.2	0.7	1.1	2.1	0.8	0.8	1.5	0.9	1.5	0.6	0.8	1.6	1.0
Arkansas	69.3	82.5	73.4	80.3	77.4	77.2	76.3	77.2	76.0	75.8	79.5	78.8	76.9
California	818.3	820.0	854.9	844.0	862.7	859.7	859.3	856.9	858.9	853.0	850.2	854.7	849.6
Colorado	23.1	26.9	10.4	30.0	23.3	34.1	26.0	32.0	37.8	47.6	31.4	37.7	30.0
Florida		.1	.2	.1		.2	.2	.2			.2	.1	.1
Illinois	167.2	212.5	132.3	216.9	242.3	186.9	230.6	228.9	231.9	231.2	194.5	219.0	207.8
Indiana	16.2	17.6	20.2	21.2	19.9	19.0	19.2	18.2	16.1	18.9	14.1	21.9	18.6
Kansas	240.6	282.5	250.1	256.8	251.9	265.5	288.7	274.3	291.9	264.2	271.2	245.4	265.1
Kentucky	30.0	29.6	24.4	25.2	29.0	32.7	25.3	28.3	31.1	25.5	29.3	31.7	28.5
Louisiana	412.9	400.2	366.9	404.7	403.1	370.3	402.0	390.0	411.8	422.4	385.5	398.5	397.4
Michigan	47.5	44.7	42.3	51.2	45.3	49.9	45.1	41.5	49.4	45.4	46.9	49.1	46.5
Mississippi	55.0	62.6	47.9	58.3	53.9	74.5	51.1	63.9	83.6	69.8	80.6	83.0	65.3
Montana	23.0	23.5	27.6	18.2	29.6	23.3	25.0	26.9	27.6	21.3	27.0	25.2	24.9
Nebraska	.9	.8	.8	.9	.9	.9	.9	.9	.7	.7	.7	.7	.8
New Mexico	97.0	65.2	113.3	101.8	103.5	108.8	102.0	89.9	124.5	89.8	94.4	107.6	100.0
New York	13.3	13.3	13.3	13.6	13.1	12.8	12.8	14.1	14.0	13.6	13.2	12.7	13.3
Ohio	6.2	8.3	7.0	6.2	8.3	7.6	7.9	8.2	7.0	7.7	7.7	8.3	7.5
Oklahoma	367.6	349.6	430.8	397.9	393.7	399.2	355.2	407.1	360.1	382.0	349.4	401.9	383.2
Pennsylvania	34.7	32.1	33.6	33.9	33.0	36.7	35.5	36.2	32.9	36.8	36.3	36.4	34.9
Texas	1,961.8	2,017.2	2,033.1	1,974.4	2,084.0	2,192.7	2,191.6	2,179.0	2,057.6	2,079.5	2,062.2	2,055.6	2,074.5
West Virginia	6.1	9.0	7.4	6.6	9.4	6.6	8.6	5.5	10.2	9.9	6.3	8.9	7.9
Wyoming	93.6	85.8	118.1	96.5	107.9	103.7	97.1	103.8	106.4	93.7	97.9	100.0	100.5
Missouri, Tennessee, and Virginia	.2	.3	.2	.2	.2	.2	.2	.2	.2	.2	.3	.4	.2
Total 1946	4,484.7	4,585.0	4,609.3	4,641.0	4,793.2	4,863.3	4,862.1	4,884.1	4,831.2	4,789.6	4,679.6	4,779.2	4,734.5
1947 [1]													
Alabama	.7	.8	.8	1.6	1.0	.7	1.9	1.3	1.1	1.2	.8	1.5	1.1
Arkansas	73.2	85.5	78.9	84.1	76.9	82.3	76.1	85.4	76.7	86.4	82.1	84.5	81.0
California	873.3	865.9	889.9	884.9	921.8	904.0	898.3	950.5	919.8	926.8	922.9	913.7	906.3
Colorado	41.9	41.6	38.6	40.8	43.2	40.6	45.3	46.0	46.7	45.9	46.2	46.3	43.6
Florida	.2	.1	.8	.3	.6	.5	.8	1.1				1.1	.5
Illinois	206.1	228.5	203.7	198.5	192.3	199.9	210.5	196.8	181.0	173.6	194.9	178.4	196.8
Indiana	18.1	17.1	16.7	18.2	15.6	16.9	16.8	15.2	15.8	14.8	13.1	14.7	16.1
Kansas	279.4	288.1	281.0	278.4	297.8	305.7	282.1	301.7	300.7	308.7	294.0	281.1	291.5
Kentucky	24.9	26.4	27.8	26.7	21.8	27.1	29.5	24.9	28.6	26.9	30.4	32.5	27.3
Louisiana	407.6	429.4	415.3	412.4	433.5	448.0	433.2	457.3	427.4	477.4	460.3	474.1	439.8
Michigan	45.9	45.1	43.8	43.0	43.9	40.6	50.5	40.6	47.0	47.2	50.2	47.0	45.4
Mississippi	81.2	88.5	69.1	80.9	115.8	91.8	109.5	84.9	107.0	117.8	109.1	105.3	96.8
Montana	20.1	22.0	21.2	22.5	25.4	21.6	18.8	23.4	25.1	23.3	24.4	26.4	22.9
Nebraska	.6	.6	.5	.6	.5	.6	.6	.5	.8	.6	.6	.6	.6
New Mexico	111.4	98.3	94.7	96.7	103.7	131.2	114.2	105.1	111.2	125.0	123.0	135.5	112.6

New York	12.3	13.4	11.9	11.7	12.9	12.3	13.6	15.7	13.1	13.2	12.8	12.7	13.0
Ohio	7.6	8.3	8.9	7.3	9.4	9.5	8.7	7.1	8.2	8.4	7.9	9.1	8.4
Oklahoma	395.0	365.3	405.8	343.1	406.5	384.1	403.5	399.4	427.5	386.5	417.6	409.2	395.5
Pennsylvania	37.8	36.9	35.6	32.0	37.5	35.3	32.9	33.6	37.7	34.5	33.1	34.6	35.1
Texas	1,964.1	1,996.8	2,016.7	2,019.7	2,104.6	2,221.9	2,460.4	2,324.4	2,460.7	2,298.0	2,342.8	2,396.7	2,218.5
West Virginia	7.5	8.0	5.0	5.1	6.2	6.9	7.4	9.2	7.4	10.6	8.0	7.7	7.4
Wyoming	108.9	107.9	113.6	116.5	120.3	118.4	117.6	132.5	132.5	138.9	136.0	135.6	123.3
Missouri, Tennessee, and Virginia	.5	.5	.4	.4	.4	.4	.3	.3	.3	.3	.2	.2	.3
Total 1947	4,718.3	4,775.0	4,780.7	4,725.4	4,991.6	5,100.3	5,332.5	5,256.9	5,376.3	5,266.0	5,310.4	5,348.5	5,083.8

[1] Subject to revision.

Demand for total crude petroleum in the United States, 1946–47, by States of origin and by months

[Thousands of barrels]

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
1946													
Alabama	7	18	34	63	25	25	45	27	47	18	23	50	382
Arkansas	2,147	2,310	2,275	2,409	2,400	2,315	2,365	2,393	2,279	2,348	2,385	2,442	28,068
California	25,367	22,960	26,501	25,320	26,742	25,793	26,637	26,564	25,766	26,444	25,506	26,494	310,094
Colorado	717	753	322	899	722	1,024	806	991	1,133	1,476	942	1,170	10,955
Florida	1	4	5	3	2	7	6	6	1	-	5	4	44
Illinois	5,183	5,951	4,102	6,508	7,512	5,607	7,147	7,095	6,956	7,167	5,834	6,789	75,851
Indiana	502	494	625	635	616	569	596	566	484	585	424	680	6,776
Kansas	7,460	7,909	7,754	7,706	7,811	7,964	8,948	8,502	8,756	8,191	8,135	7,607	96,743
Kentucky	930	830	757	756	900	980	785	878	933	790	878	982	10,399
Louisiana	12,801	11,206	11,374	12,143	12,496	11,109	12,462	12,092	12,354	13,094	11,565	12,354	145,050
Michigan	1,472	1,250	1,310	1,536	1,404	1,499	1,399	1,288	1,484	1,407	1,407	1,521	16,977
Mississippi	1,706	1,753	1,486	1,748	1,671	2,234	1,585	1,980	2,507	2,164	2,419	2,573	23,826
Montana	713	658	855	547	917	698	775	833	827	660	810	782	9,075
Nebraska	28	22	25	27	29	26	28	27	22	23	20	23	300
New Mexico	3,007	1,825	3,511	3,054	3,208	3,263	3,162	2,788	3,734	2,782	2,832	3,334	36,500
New York	412	373	413	407	405	384	397	437	420	422	396	394	4,860
Ohio	191	233	218	185	258	229	246	254	210	239	231	257	2,751
Oklahoma	11,395	9,790	13,354	11,938	12,204	11,976	11,012	12,620	10,803	11,843	10,484	12,459	139,878
Pennsylvania	1,075	899	1,041	1,016	1,023	1,102	1,100	1,121	988	1,142	1,090	1,127	12,724
Texas	60,816	56,481	63,028	59,232	64,603	65,780	67,940	67,548	61,728	64,465	61,866	63,724	757,211
West Virginia	190	251	230	199	290	198	267	172	305	307	190	276	2,875
Wyoming	2,902	2,401	3,663	2,894	3,344	3,111	3,012	3,218	3,192	2,905	2,938	3,099	36,679
Other States	5	8	6	6	6	6	6	6	7	6	9	13	[1] 84
Total domestic crude	139,027	128,379	142,889	139,231	148,588	145,899	150,726	151,406	144,936	148,478	140,389	148,154	1,728,102
Daily average	4,485	4,585	4,609	4,641	4,793	4,863	4,862	4,884	4,831	4,790	4,680	4,779	4,735
Foreign crude	6,813	6,840	6,691	7,330	7,657	6,414	7,535	6,845	7,680	7,006	6,994	7,181	84,986
Total demand for crude	145,840	135,219	149,580	146,561	156,245	152,313	158,261	158,251	152,616	155,484	147,383	155,335	1,813,088
Daily average	4,705	4,829	4,825	4,885	5,040	5,077	5,105	5,105	5,087	5,016	4,913	5,011	4,967
1947 [2]													
Alabama	23	22	24	47	31	22	59	40	34	37	24	45	408
Arkansas	2,268	2,395	2,445	2,523	2,383	2,470	2,359	2,647	2,301	2,679	2,464	2,619	29,553
California	27,073	24,246	27.586	26,546	28,577	27,121	27,849	29,465	27,594	28,732	27,686	28,325	330,800
Colorado	1,298	1,164	1,196	1,225	1,338	1,217	1,404	1,428	1,400	1,423	1,387	1,435	15,915
Florida	6	3	24	10	17	16	24	35	-	-	-	33	168
Illinois	6,390	6,397	6,315	5,954	5,961	5,997	6,525	6,101	5,430	5,382	5,847	5,529	71,828
Indiana	562	478	518	546	484	508	522	472	473	458	392	456	5,869
Kansas	8,661	8,067	8,710	8,352	9,231	9,171	8,744	9,353	9,022	9,569	8,820	8,714	106,414
Kentucky	771	740	862	800	677	813	916	772	858	835	912	1,007	9,963
Louisiana	12,634	12.024	12,876	12,373	13,439	13,440	13,428	14,176	12,821	14,798	13,810	14,696	160,515
Michigan	1,423	1,263	1,358	1,291	1,360	1,218	1,565	1,258	1,409	1,462	1,506	1,457	16,570

Mississippi	2, 517	2, 479	2, 143	2, 428	3, 590	2, 752	3, 394	2, 633	3, 211	3, 651	3, 274	3, 266	35, 338
Montana	623	618	658	673	789	649	584	726	753	721	732	818	8, 344
Nebraska	18	18	17	18	17	17	20	16	25	20	20	20	226
New Mexico	3, 455	2, 751	2, 936	2, 900	3, 213	3, 935	3, 539	3, 259	3, 336	3, 874	3, 690	4, 202	41, 090
New York	383	377	370	351	400	369	421	487	394	410	385	394	4, 741
Ohio	233	232	277	220	291	285	269	219	245	261	237	283	3, 057
Oklahoma	12, 245	10, 229	12, 579	10, 292	12, 601	11, 524	12, 509	12, 381	12, 825	11, 982	12, 527	12, 685	144, 379
Pennsylvania	1, 172	1, 032	1, 105	961	1, 163	1, 057	1, 019	1, 042	1, 130	1, 069	991	1, 071	12, 812
Texas	60, 887	55, 909	62, 517	60, 592	65, 243	66, 656	76, 274	72, 055	73, 821	71, 239	70, 283	74, 298	809, 774
West Virginia	232	223	153	153	192	208	230	284	221	327	239	239	2, 701
Wyoming	3, 376	3, 021	3, 520	3, 496	3, 729	3, 551	3, 644	4, 107	3, 976	4, 307	4, 080	4, 204	45, 011
Other States	13	12	12	12	13	11	10	9	9	9	6	7	[3] 123
Total domestic crude	146, 268	133, 700	148, 201	141, 763	154, 739	153, 007	165, 308	162, 965	161, 288	163, 245	159, 312	165, 803	1, 855, 599
Daily average	4, 718	4, 775	4, 781	4, 725	4, 992	5, 100	5, 333	5, 257	5, 376	5, 266	5, 310	5, 349	5, 084
Foreign crude	7, 039	7, 958	9, 153	8, 058	8, 058	8, 485	7, 748	7, 981	8, 291	7, 940	7, 968	8, 883	97, 562
Total demand for crude	153, 307	141, 658	157, 354	149, 821	162, 797	161, 492	173, 056	170, 946	169, 579	171, 185	167, 280	174, 686	1, 953, 161
Daily average	4, 945	5, 059	5, 076	4, 994	5, 252	5, 383	5, 582	5, 514	5, 653	5, 522	5, 576	5, 635	5, 351

[1] Missouri (51), Tennessee (10), and Virginia (23).
[2] Subject to revision.
[3] Missouri (54), Tennessee (8), and Virginia (61).

Distribution of crude petroleum in the United States in 1947, 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		
Arkansas	29,990			498				15,870	16,285	189
California and Washington	333,102							303,588	301,433	22,164
Colorado	15,748							4,731	4,649	62
Georgia, Delaware, Florida, and South Carolina	259			111			406	456	3,737	
Illinois, Minnesota, and Wisconsin	66,459	23,053	17,177	2,249	3,072	24,829	38,069	4,718	112,899	542
Indiana	5,853	2,871	20,623			19,187	47,809	4,245	95,021	24
Kansas and Nebraska	105,575		49,363			8,866	7,940	1,656	67,917	362
Kentucky and Tennessee	9,405	3,207		1,234				14,232	18,745	32
Louisiana:										
Gulf	123,708			76,799			41,211	21,126	139,940	1,066
Inland and Alabama	36,979			2,045			263	6,222	6,191	242
Maryland				493			14,305	128	20,224	
Massachusetts and Rhode Island				778			6,553	314	17,189	
Michigan	16,215	1,627	13		80	2,508	7,419	16,514	28,632	504
Mississippi	35,017								2,349	174
Missouri	55		717	25		1,489	8,237		10,503	56
Montana	8,693							11,732	11,409	12
New Jersey				4,263	1,778	2,350	58,737	8,344	109,910	
New Mexico	41,127				3,032		782		3,786	229
New York:										
East							4,778	2,419	15,420	
West	4,762	4,149	466			5,327		3,701	13,705	
Ohio:										
East	3,108	18,022	410	842		754		4,537	24,584	183
West		9,760	878	2,722		14,933	13,437	4,683	46,060	
Oklahoma	141,019		8,075			56,115	10,054		74,630	738
Pennsylvania:										
East				3,602	869		89,240	99	130,835	
West	12,690	233				2,252	2,650	12,721	17,857	3
Texas:										
Gulf	258,936			45,288	27,607	1,712	364,087	95	437,024	848
Inland	560,491				3,700	321	80,776		84,582	2,300
Utah								8,660	8,468	
West Virginia and Virginia	2,678	40		479		585	73	3,030	4,231	
Wyoming and Idaho	44,238							23,943	24,031	624
Total	1,856,107	62,962	97,722	141,428	40,138	141,228	796,826	477,764	1,852,246	30,354

[1] Subject to revision.

refineries in other States, including shipments of 25 million barrels to Illinois, 19 million to Indiana, 16 million to Ohio, and 9 million to Kansas.

The demand for Kansas crude oil rose from 96.7 million barrels in 1946 to 106.4 million in 1947. In 1947 about 49 million barrels of Kansas crude oil were delivered to refineries within the State. The largest deliveries to other States were 21 million barrels to Indiana and 17 million to Illinois.

Illinois ranked sixth as a source of domestic crude oil. The demand for Illinois crude declined from 75.9 million barrels in 1946 to 71.8 million in 1947. Of the total deliveries to refineries of 63 million barrels in 1947, 23 million went to refineries within the State, 28 million to refineries in Ohio, and most of the remainder to western New York, Kentucky, and Indiana.

The above six States supplied 88.0 percent of the demand for domestic crude oil in 1946 and 87.5 percent of the total in 1947. Among the remaining States, the most notable gains in crude-oil demand in 1947 were 11.5 million barrels for Mississippi, 8.3 million for Wyoming, 5.0 million for Colorado, and 4.6 million for New Mexico.

STOCKS

The stocks of all oils amounted to 502.1 million barrels on December 31, 1947—a decline of 5.0 million barrels in 1947 compared with the increase in total stocks of 43.5 million barrels in 1946.

Stocks of refined products amounted to 267.1 million barrels on December 31, 1947—a decline of 4.8 million during the year. Total stocks of crude oil increased 0.5 million barrels to a total of 230.7 million barrels, and stocks of natural gasoline declined 0.7 million barrels to 4.3 million barrels.

The total decline in refined stocks of 4.8 million barrels during 1947 included a decline of 8.5 million barrels in distillate fuel oil stocks, a decline of 1.4 million in finished gasoline stocks, an increase of 0.6 million in kerosine stocks, and a gain of 4.5 million barrels in all other refined stocks.

Stocks of crude petroleum, natural gasoline, and refined products in the United States at end of year, 1943–47

[Thousands of barrels]

Product	1943	1944	1945	1946	1947 [1]
Crude petroleum (refinable):					
At refineries	47,719	48,576 [2] 48,377	50,276	53,113	52,864
Pipe line and tank farm	181,422	158,181	153,957	156,238	156,726
Producers'	12,991	14,105	14,530	15,122	15,339
Total refinable	242,132	220,862 [2] 220,663	218,763	224,473	224,929
California heavy crude	7,272	6,107	4,496	5,703	5,725
Total crude petroleum	249,404	226,969 [2] 226,770	223,259	230,176	230,654
Natural gasoline	4,541	4,252 [2] 4,451	4,322	4,981	4,296
Refined products	229,362	245,868	235,998	271,937	267,103
Grand total	483,307	477,089	463,579	507,094	502,053

[1] Final figures.
[2] New basis comparable with succeeding years.

Stocks of crude petroleum in the United States in 1947, 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	1,995	2,022	1,850	1,931	1,966	2,102	2,098	2,178	2,057	2,391	2,289	2,332	2,621
California and Washington	22,143	22,601	23,357	23,588	24,288	24,123	24,825	25,645	24,517	24,488	24,242	24,096	24,423
Colorado	612	520	522	586	651	650	674	735	758	740	774	757	684
Georgia, Delaware, Florida, and South Carolina	326	227	404	310	323	243	528	445	398	499	416	384	480
Illinois, Minnesota, and Wisconsin	15,958	14,489	13,338	12,155	11,541	11,759	11,685	12,021	12,011	11,654	11,228	11,264	11,372
Indiana	3,418	3,700	3,401	3,120	3,173	3,236	3,453	2,972	3,585	3,145	3,450	3,269	2,963
Kansas and Nebraska	8,702	8,553	8,544	8,455	8,673	8,436	8,135	7,976	7,743	7,910	7,873	7,570	7,760
Kentucky and Tennessee	1,963	1,747	1,726	1,577	1,829	1,836	1,750	1,724	1,697	1,641	1,725	1,476	1,525
Louisiana and Alabama	13,336	13,291	13,012	13,623	13,050	13,215	12,664	12,284	12,372	12,306	11,830	11,867	12,323
Maryland	776	763	756	934	1,193	1,034	1,012	996	862	973	1,088	880	971
Massachusetts and Rhode Island	1,016	1,004	956	889	1,142	1,006	952	1,097	1,153	1,036	959	952	764
Michigan	2,116	2,199	2,091	2,044	1,940	1,892	1,746	1,430	1,392	1,318	1,408	1,415	1,411
Mississippi	957	1,524	1,129	1,115	1,167	1,111	1,013	998	1,029	1,036	934	1,056	1,057
Missouri and Iowa	5,489	5,744	5,634	5,243	5,274	5,258	5,203	5,263	5,254	5,226	5,265	5,144	5,278
Montana	808	884	915	904	958	905	1,032	1,188	1,207	1,208	1,255	1,222	1,196
New Jersey	5,629	6,555	8,188	8,255	8,286	7,900	7,158	5,981	6,610	5,759	5,589	6,097	4,291
New Mexico	1,603	1,712	1,829	1,851	1,749	1,743	1,538	1,488	1,649	1,671	1,698	1,567	1,598
New York	1,088	1,259	1,148	1,107	1,336	1,387	1,312	1,314	1,017	1,000	1,140	925	832
Ohio	5,776	6,451	6,291	6,423	6,949	6,153	6,081	5,155	5,095	5,610	5,354	5,021	5,206
Oklahoma	30,055	29,247	29,631	29,996	30,633	31,258	31,657	31,488	30,933	31,243	31,641	31,493	31,551
Pennsylvania	5,795	6,846	6,099	7,181	6,971	7,148	7,735	7,130	7,601	6,746	5,947	6,150	6,095
Texas	86,460	84,294	86,101	89,455	94,356	97,262	97,039	93,654	92,065	90,276	93,262	93,508	93,701
Utah	273	296	327	282	288	271	306	326	322	360	420	379	465
West Virginia	735	648	611	729	782	772	795	780	716	769	758	653	653
Wyoming and Idaho	7,444	7,272	7,261	7,228	7,192	7,068	6,887	6,706	6,480	6,253	6,121	5,985	5,709
Total gasoline-bearing crude	224,473	223,848	225,121	228,981	235,710	237,768	237,278	230,974	228,523	225,258	226,666	225,462	224,929
Heavy crude in California	5,703	5,584	5,790	5,999	5,953	5,825	5,429	5,208	5,320	5,194	5,275	5,623	5,725
Total crude petroleum	230,176	229,432	230,911	234,980	241,663	243,593	242,707	236,182	233,843	230,452	231,941	231,085	230,654

[1] Final figures.

Stocks of crude petroleum in the United States in 1947, 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	38	46	50	58	32	38	50	26	18	16	19	31	26
Arkansas	2, 813	2, 997	2, 848	2, 947	2, 806	2, 937	2, 889	3, 068	2, 933	3, 152	3, 099	3, 199	3, 250
California [2]	22, 102	22, 557	23, 328	23, 554	24, 243	24, 078	24, 779	25, 616	24, 487	24, 461	24, 213	24, 066	24, 382
Colorado	1, 467	1, 333	1, 190	1, 156	1, 096	1, 025	1, 073	1, 121	1, 189	1, 226	1, 289	1, 307	1, 300
Florida	17	18	20	16	21	25	40	47	43	71	94	118	108
Illinois	14, 857	14, 452	13, 357	12, 818	12, 452	12, 148	11, 497	10, 550	9, 870	9, 816	10, 036	9, 436	9, 488
Indiana	145	121	119	133	109	145	138	132	163	122	111	138	129
Kansas	9, 409	9, 094	8, 637	8, 583	8, 862	8, 567	8, 145	8, 564	8, 366	8, 257	8, 024	8, 046	8, 341
Kentucky	1, 550	1, 579	1, 518	1, 430	1, 417	1, 521	1, 460	1, 358	1, 363	1, 308	1, 315	1, 175	984
Louisiana	11, 670	11, 883	11, 606	11, 803	12, 287	12, 259	11, 764	11, 948	11, 514	12, 015	11, 341	11, 498	11, 446
Michigan	1, 234	1, 133	1, 074	1, 008	1, 019	985	1, 065	898	1, 019	1, 004	1, 011	872	879
Mississippi	2, 791	2, 994	2, 867	3, 379	3, 564	2, 803	2, 883	2, 465	2, 905	2, 776	2, 451	2, 427	2, 470
Montana	654	722	744	763	807	750	817	973	1, 016	1, 008	1, 058	1, 055	1, 003
Nebraska and Missouri	19	24	24	25	26	25	26	25	26	22	22	22	23
New Mexico	6, 280	5, 981	6, 199	6, 558	6, 858	6, 960	6, 273	6, 123	6, 527	6, 782	6, 716	6, 669	6, 317
New York	158	194	166	180	224	224	255	258	164	172	178	152	179
Ohio	645	643	612	579	625	590	569	582	622	651	681	694	696
Oklahoma	29, 944	28, 971	29, 138	28, 325	29, 432	28, 584	28, 424	27, 964	27, 487	26, 498	27, 087	26, 578	26, 584
Pennsylvania	1, 400	1, 338	1, 226	1, 138	1, 246	1, 164	1, 164	1, 255	1, 269	1, 211	1, 262	1, 265	1, 278
Texas	104, 477	104, 293	106, 364	110, 336	115, 100	118, 836	120, 695	115, 184	114, 906	111, 805	114, 279	114, 772	114, 130
West Virginia	559	554	514	581	630	649	650	638	573	581	507	476	475
Wyoming	8, 229	8, 182	8, 295	8, 276	8, 301	8, 257	8, 281	8, 292	7, 915	7, 789	7, 537	7, 410	7, 456
Foreign	4, 015	4, 739	5, 225	5, 335	4, 553	5, 198	4, 341	3, 887	4, 148	4, 515	4, 336	4, 056	3, 985
Total gasoline-bearing crude	224, 473	223, 848	225, 121	228, 981	235, 710	237, 768	237, 278	230, 974	228, 523	225, 258	226, 666	225, 462	224, 929
California heavy crude	5, 703	5, 584	5, 790	5, 999	5, 953	5, 825	5, 429	5, 208	5, 320	5, 194	5, 275	5, 623	5, 725
Total crude petroleum	230, 176	229, 432	230, 911	234, 980	241, 663	243, 593	242, 707	236, 182	233, 843	230, 452	231, 941	231, 085	230, 654

[1] Final figures. [2] Heavy crude stocks in California given below.

Stocks of crude petroleum in the United States in 1947, by location and months [1]

[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	539	437	465	422	532	585	587	651	619	671	563	603	603
California and Washington	6,883	7,089	7,623	7,111	7,308	7,196	7,085	7,955	7,427	7,423	7,077	7,138	6,919
Colorado	236	195	223	269	335	277	234	280	283	256	272	248	316
Georgia, Delaware, and South Carolina	320	219	394	302	318	235	523	442	394	495	412	379	476
Illinois, Minnesota, and Wisconsin	2,174	2,154	2,400	2,228	2,016	2,183	2,322	2,637	2,852	2,831	2,431	2,427	2,451
Indiana	1,670	1,935	1,815	1,460	1,564	1,498	1,699	1,511	1,778	1,466	1,559	1,464	1,381
Kansas and Nebraska	1,871	1,573	1,464	1,607	1,727	1,591	1,630	1,572	1,480	1,562	1,644	1,515	1,644
Kentucky and Tennessee	802	498	493	417	693	632	578	541	561	655	767	561	723
Louisiana	5,083	5,390	4,630	5,110	4,813	4,744	4,398	4,140	4,200	4,231	4,178	3,941	3,855
Maryland	776	763	756	934	1,193	1,034	1,012	996	862	973	1,088	880	971
Massachusetts and Rhode Island	1,016	1,004	956	889	1,142	1,006	952	1,097	1,153	1,036	959	952	764
Michigan	1,098	1,092	1,020	940	868	851	715	428	415	332	388	479	497
Mississippi	6	6	6	6	6	6	6	6	11	9	7	5	9
Missouri	283	260	251	214	230	227	220	227	243	197	199	271	248
Montana	194	242	212	232	284	262	282	416	378	353	481	449	507
New Jersey	5,425	6,451	8,084	8,159	8,161	7,787	7,006	5,842	6,451	5,627	5,495	5,969	4,200
New Mexico	63	72	107	118	53	57	51	45	55	59	60	68	60
New York	901	1,045	959	868	1,100	1,152	1,098	1,099	796	797	895	694	597
Ohio	1,322	1,726	1,522	1,092	1,047	1,032	1,405	1,365	1,406	1,517	1,284	1,131	1,552
Oklahoma	2,775	2,637	2,830	2,718	2,698	2,572	2,561	2,283	2,263	2,088	2,327	2,156	2,319
Pennsylvania	4,200	5,269	4,585	5,775	5,359	5,492	6,088	5,451	5,990	5,166	4,414	4,533	4,474
Texas	14,063	14,387	14,901	17,039	17,471	17,241	17,308	16,280	16,219	15,110	16,060	16,459	16,794
Utah	242	265	296	251	257	240	275	295	291	329	389	348	434
West Virginia	70	62	60	77	90	90	70	68	56	63	76	71	45
Wyoming and Idaho	1,101	1,062	1,054	1,072	1,121	1,023	1,055	1,029	953	804	824	919	1,025
Total at refineries	53,113	55,833	57,106	59,310	60,386	59,013	59,160	56,656	57,136	54,050	53,849	53,660	52,864
Pipe-line and tank-farm stocks:													
Arkansas	1,056	1,180	1,005	1,109	1,024	1,112	1,116	1,132	1,058	1,315	1,326	1,324	1,623
California	11,235	11,424	11,891	12,673	13,323	13,262	13,783	14,203	13,525	13,475	13,397	13,158	13,562
Colorado	291	225	199	217	216	243	315	335	355	354	357	364	238
Illinois	13,164	11,725	10,328	9,312	8,900	8,971	8,753	8,794	8,549	8,223	8,207	8,212	8,286
Indiana	1,683	1,705	1,526	1,600	1,544	1,673	1,694	1,401	1,747	1,624	1,836	1,745	1,522
Kansas and Nebraska	5,946	6,090	6,270	5,958	6,051	5,950	5,590	5,489	5,308	5,428	5,299	5,110	5,221
Kentucky and Tennessee	1,096	1,189	1,173	1,100	1,076	1,144	1,112	1,123	1,076	926	903	855	742
Louisiana and Alabama	7,227	6,860	7,345	7,471	7,211	7,405	7,230	7,098	7,066	7,028	6,626	6,809	7,366
Michigan	828	912	881	909	887	856	841	822	787	801	830	736	729
Mississippi	641	1,198	783	784	846	755	672	662	668	632	587	671	663
Missouri and Iowa	5,206	5,484	5,383	5,029	5,042	5,030	4,982	5,035	5,010	5,028	5,065	4,872	5,029
Montana	444	467	538	507	519	488	595	622	669	700	619	608	539

New Jersey	204	104	104	96	125	113	152	139	159	132	94	128	91
New Mexico	1,020	1,135	1,207	1,198	1,166	1,131	942	898	1,034	1,072	1,088	924	998
New York	157	184	159	209	206	205	184	185	191	173	215	201	205
Ohio	4,359	4,630	4,674	5,236	5,807	5,031	4,581	3,695	3,599	4,003	3,980	3,800	3,564
Oklahoma	26,085	25,400	25,561	25,993	26,655	27,401	27,796	27,950	27,335	27,930	28,144	28,077	28,102
Pennsylvania	1,425	1,407	1,344	1,236	1,452	1,501	1,487	1,524	1,451	1,420	1,378	1,452	1,456
Texas	67,802	65,492	66,655	67,831	72,295	75,376	75,016	72,679	71,066	70,461	72,517	72,119	72,087
Utah	31	31	31	31	31	31	31	31	31	31	31	31	31
West Virginia	500	421	386	482	527	517	560	547	495	541	522	422	443
Wyoming	5,838	5,725	5,717	5,656	5,581	5,545	5,352	5,192	5,062	4,979	4,832	4,606	4,229
Total pipe-line and tank-farm stocks	156,238	152,988	153,160	154,637	160,484	163,740	162,784	159,556	156,241	156,276	157,853	156,224	156,726
Producers' stocks	15,122	15,027	14,855	15,034	14,840	15,015	15,334	14,762	15,146	14,932	14,964	15,578	15,339
Grand total:													
1947 (final figures)	224,473	223,848	225,121	228,981	235,710	237,768	237,278	230,974	228,523	225,258	226,666	225,462	224,929
1946 (final figures)	218,763	223,442	227,220	221,400	222,480	221,592	223,140	224,351	224,157	222,417	222,177	226,453	224,473

[1] Excludes stocks of California heavy crude.

The failure to increase the stocks of refined products further during 1947 was particularly significant in view of the unexpectedly high demand for heating oils in the winter of 1947–48 and the local shortages that resulted. The decline in distillate fuel-oil stocks occurred primarily in the East Coast and Gulf Coast districts and affected the available supply of heating oils to meet demand in the East Coast.

The small total increase of 0.5 million barrels in crude stocks was in stocks of domestic crude oil. The principal changes by States of origin were gains of 9.7 million barrels for Texas and 2.3 million for California. The principal declines were 5.4 million barrels in Illinois crude stocks, 3.4 million in Oklahoma stocks, and 1.1 million barrels in Kansas stocks.

PRICES AND VALUE

The average value of crude petroleum at the well rose from $1.41 in 1946 to $1.91 in 1947. The range in value between the more important States in 1946 was $1.14 for Wyoming and $3.83 for New York. In 1947 the low was $1.68 and the high $4.21 for New York. The average value at the well for Texas rose from $1.41 in 1946 to $1.95 in 1947. The average value of crude petroleum at the well varies with the quality of the oil and the distance from market.

The posted price per barrel for Pennsylvania Grade (Bradford and Allegany districts) was increased six times during 1947 and rose from $3.65 per barrel on January 1 to $5.00 per barrel on December 6. A typical grade of Oklahoma-Kansas crude (34°–34.9° B.) had a posted price of $1.58 per barrel on January 1, rose to $1.83 on March 10, to $2.03 on October 15, and to $2.53 on December 6. The posted price for West Texas crude (30°–30.9° B.) was $1.37 on January 1, rose to $1.62 on March 10, to $1.82 on October 15, and to $2.32 on December 6.

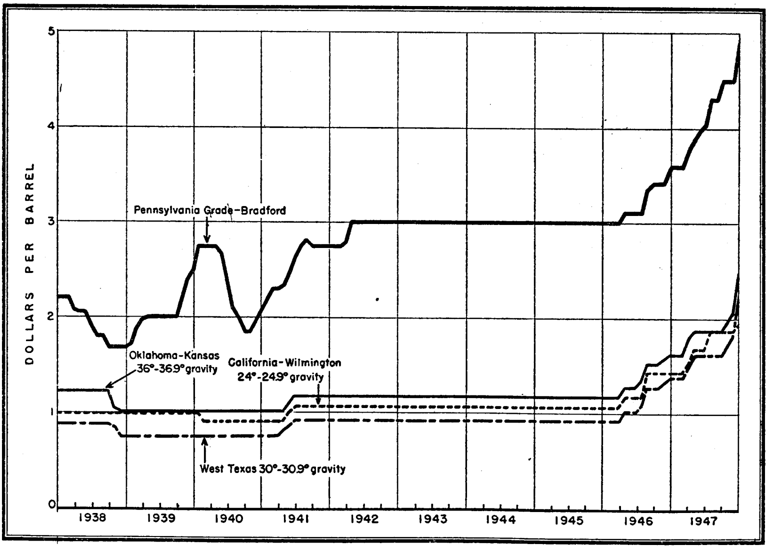

FIGURE 5.—Posted prices of selected grades of crude petroleum in the United States, 1938–47, by months.

Value of crude petroleum at wells in the United States, 1945–46, by States [1]

State	1945		1946	
	Total (thousands of dollars)	Average per barrel	Total (thousands of dollars)	Average per barrel
Arkansas	30,720	$1.07	35,750	$1.26
California	347,330	1.06	387,100	1.23
Colorado	5,780	1.15	15,650	1.32
Illinois	105,130	1.40	119,720	1.59
Indiana	6,890	1.42	10,690	1.59
Kansas	119,520	1.24	138,050	1.42
Kentucky	15,260	1.48	17,030	1.61
Louisiana:				
Gulf Coast	132,850	1.24	163,570	1.45
Northern	28,410	1.20	44,140	1.43
Total Louisiana	161,260	1.23	207,710	1.45
Michigan	25,010	1.45	27,660	1.62
Mississippi	19,240	1.01	30,130	1.24
Montana	10,810	1.28	12,710	1.44
Nebraska	370	1.21	400	1.35
New Mexico	37,610	1.01	44,540	1.21
New York	17,470	3.76	18,630	3.83
Ohio	7,240	2.56	7,710	2.65
Oklahoma	177,050	1.27	194,100	1.44
Pennsylvania	46,680	3.73	49,640	3.82
Texas:				
Gulf Coast	331,380	1.31	365,080	1.51
West Texas	175,730	1.00	236,520	1.23
East Texas	164,000	1.25	175,140	1.45
Other	243,300	1.25	293,660	1.43
Total Texas	914,410	1.21	1,070,400	1.41
West Virginia	9,620	3.34	9,960	3.40
Wyoming	36,610	1.01	44,430	1.14
Other States [2]	240	.90	540	1.04
Total	2,094,250	1.22	2,442,550	1.41

[1] Figures for 1947 not available when table was complied.
[2] Alabama, Florida, Missouri, Tennessee, and Virginia.

Posted price per barrel of petroleum at wells in the United States in 1947, 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	$3.65	$3.44	$1.76	$1.82	$1.82	$1.89	$1.58	$1.62
Mar. 1	3.81	3.60						
Mar. 10			2.01	2.07	2.07	2.14	1.83	1.87
Mar. 24			2.35					
Apr. 1	3.91	3.70						
May 16	4.05	3.84						
July 1	4.30	4.09						
Aug. 25			2.60					
Sept. 1	4.50	4.29						
Oct. 15				2.27	2.27	2.39	2.03	2.07
Dec. 6	5.00	4.79	3.10	2.77	2.77	2.89	2.53	2.57

See footnotes at end of table.

Posted price per barrel of petroleum at wells in the United States in 1947, 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]	Texas 30°-30.9° [8]	Texas 20°-20.9° [8]	Louisiana 30°-30.9° [9]
Jan. 1	$1.60	$1.37	$1.37	$1.54	$1.70	$1.88	$1.73	$1.53	$1.60
Mar. 10	1.85	1.62	1.62	1.79	1.95	2.13	1.98	1.78	1.85
Oct. 15	2.05	1.82	1.82	---------	2.15	2.33	2.18	1.98	2.05
Dec. 6	2.55	2.32	2.32	---------	2.65	2.83	2.68	2.48	2.55

Date	Rodessa, La., 36°-36.9°	Smackover, Ark.[10]	Elk Basin, Wyo., 30°-30.9° [4]	Salt Creek, Wyo., 36°-36.9° [11]	California [12]			
					Coalinga 32°-32.9°	Kettleman 37°-37.9°	Midway-Sunset, 19°-19.9°	Wilmington, 24°-24.9°
Jan. 1	$1.62	$1.38	$1.33	$1.62	$1.48	$1.69	$1.18	$1.42
Mar. 10	1.87	1.63	1.58	1.87	---------	---------	---------	---------
Mar. 19	---------	---------	---------	---------	1.73	1.94	1.42	1.67
May 1	---------	---------	---------	---------	1.79	---------	---------	---------
July 1	---------	---------	---------	---------	1.99	2.14	1.62	1.87
Oct. 15	2.07	1.83	1.78	2.07	---------	---------	---------	---------
Oct. 28	---------	---------	---------	---------	1.99	---------	1.73	1.87
Dec. 6	2.57	2.33	2.27	2.57	---------	---------	---------	---------
Dec. 27	---------	---------	---------	---------	2.49	2.64	2.23	2.37

[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 1947 reflects a full year's operation in which civilian demand predominated and was made more effective by the rapid increase in the number of new motor vehicles and heating-oil installations available. Shortages in these facilities restricted the expansion in domestic demand for oil in 1946 to a small gain, but further improvements in the availability of new equipment in 1948 should result in a further substantial gain in the domestic demand for oil products. The increased domestic demand for refined products—almost 11 percent in 1947—may represent the largest annual gain for some time to come, but there should be a further steady upward trend in the demand for motor fuel and light heating oils. The demand for heavy fuel oil varies more directly with the volume of industrial, railroad, and shipping operations and is controlled to a greater extent by the relative cost of other competing fuels.

The supply of refined products is directly related to the volume of refinery output from crude oil, the output of light products derived from natural gas at natural gasoline and cycle plants, and the imports of refined products.

Refineries operated close to maximum capacity in 1947, with total crude runs to stills averaging 5,075,000 barrels daily compared with 4,740,000 barrels daily in 1946—a gain of 7 percent. Whereas operations in 1946 were sufficiently above current demand to permit replenishing depleted stocks of refined products to the extent of almost 36 million barrels, they fell below current demand in 1947 to the extent of a reduction in total refined stocks of about 5 million barrels.

The production of light products at natural gasoline and cycle plants increased from 115.7 million barrels in 1946 to 132.0 million barrels in 1947—a gain of 14 percent.

In addition, some benzol from coke ovens is blended with oil products, amounting to 2.1 million barrels in 1946 and only 0.7 million barrels in 1947. The light products from this group are primarily blended with motor fuel or marketed as liquefied gases for fuel and chemical uses; a small amount of miscellaneous products is transferred to other oils.

Runs to stills and production at refineries in the United States of the various refined petroleum products, 1943–47

[Thousands of barrels]

Product	1943	1944	1945	1946	1947 [1]
Input:					
Crude petroleum:					
Domestic	1,417,559	1,622,514	1,645,862	1,645,845	1,754,987
Foreign	12,179	43,170	73,672	84,352	97,259
Total crude petroleum	1,429,738	1,665,684	1,719,534	1,730,197	1,852,246
Natural gasoline	61,198	67,207	70,324	62,861	70,692
Total input	1,490,936	1,732,891	1,789,858	1,793,058	1,922,938
Output:					
Gasoline	592,425	722,718	774,460	748,411	814,841
Kerosine	72,270	78,344	81,024	104,385	110,412
Distillate fuel oil	211,516	239,152	249,224	287,896	312,173
Residual fuel oil	417,306	461,455	469,492	431,364	447,795
Lubricating oil	38,679	41,106	41,867	45,645	51,765
Wax [2]	2,697	2,883	2,921	3,003	3,624
Coke [2]	6,942	9,017	10,115	10,621	12,077
Asphalt [2]	37,162	38,479	39,196	44,911	49,286
Still gas [2]	86,755	102,239	103,458	88,136	85,564
Road oil	2,295	1,556	2,686	6,175	7,074
Other finished products	9,660	18,436	19,080	22,539	24,348
Unfinished gasoline (net)	1,009	1,745	[3] 4,892	[3] 108	984
Other unfinished oils (net)	2,597	2,584	[3] 5,727	[3] 1,615	[3] 1,227
Shortage	9,623	13,177	6,954	1,695	4,222
Total output	1,490,936	1,732,891	1,789,858	1,793,058	1,922,938

[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.

The imports of refined products into continental United States increased from 51.6 million barrels in 1946 to 62.1 million in 1947. Residual fuel is the major item and amounted to 44.6 million barrels in 1946 and 54.3 million in 1947. Most of this residual fuel oil is withdrawn from bond duty free for use in bunkering ships engaged in the foreign trade. Other imports in 1947 included 4.2 million barrels of distillate fuel oil, 1.9 million barrels of unfinished oils, 1.4 million barrels of asphalt, and 0.4 million barrels of gasoline.

Salient statistics of the major refined petroleum products in the United States, 1943–47

[Thousands of barrels]

Product	1943	1944	1945	1946	1947 [1]
Motor fuel:					
Production	608,180	739,340	798,194	776,583	839,886
Imports	5,736	3,148	1,807	1	358
Exports	51,577	100,537	88,059	45,334	47,545
Stocks, end of year	68,405	77,874 / [2] 78,073	93,682	89,515	87,407
Domestic demand	568,238	632,482	696,333	735,417	794,807
Kerosine:					
Production	72,270	78,344	81,024	104,385	110,412
Imports	375	147			
Exports	4,752	4,888	6,180	8,637	7,264
Stocks, end of year	9,359	11,150	10,421	17,081	17,722
Domestic demand	68,598	71,812	75,573	89,088	102,507
Distillate fuel oil:					
Production	211,516	239,152	249,224	287,896	312,173
Transfers from crude	3,070	3,242	3,047	3,123	3,263
Imports	15,269	7,022	4,754	5,204	4,175
Exports	24,957	43,491	33,496	29,487	29,929
Stocks, end of year	41,728	38,333	35,778	59,620	51,081
Domestic demand	208,110	209,320	226,084	242,894	298,221
Residual fuel oil:					
Production	417,306	461,455	469,492	431,364	447,795
Transfers from crude	24,087	28,515	20,727	23,142	27,091
Imports	27,210	36,485	31,648	44,647	54,250
Exports	14,894	12,536	11,669	9,188	10,745
Stocks, end of year	48,484	50,383	37,158	47,094	47,091
Domestic demand	467,008	512,020	523,423	480,029	518,394
Lubricating oil:					
Production	38,679	41,106	41,867	45,645	51,765
Imports				88	44
Exports	8,863	8,709	6,575	11,051	14,236
Stocks, end of year	7,781	7,815	7,773	7,564	8,624
Domestic demand	31,459	32,363	35,334	34,891	36,513
Wax (1 barrel=280 pounds):					
Production	2,697	2,883	2,921	3,003	3,624
Imports			6	1	4
Exports	617	580	566	718	1,108
Stocks, end of year	293	335	293	308	351
Domestic demand	2,092	2,261	2,403	2,271	2,477
Coke (5 barrels=1 short ton):					
Production	6,942	9,017	10,115	10,621	12,077
Exports	1,570	1,045	1,046	1,933	2,102
Stocks, end of year	1,291	936	791	450	343
Domestic demand	5,250	8,327	9,214	9,029	10,082
Asphalt (5.5 barrels=1 short ton):					
Production	37,162	38,479	39,196	44,911	49,286
Imports	623	695	809	691	1,353
Exports	544	699	1,289	2,298	3,229
Stocks, end of year	3,098	3,444	3,810	3,861	4,021
Domestic demand	36,404	38,129	38,350	43,253	47,250
Road oil:					
Production	2,295	1,556	2,686	6,175	7,074
Stocks, end of year	193	189	370	606	613
Domestic demand	2,450	1,560	2,505	5,939	7,067
Still gas: (1 barrel=3,600 cubic feet): Production	86,755	102,239	103,458	88,136	85,564
Other finished products:					
Production:					
L. R. G	5,227	8,563	9,292	15,440	18,670
Other	4,433	9,873	9,788	7,099	5,678
Transfers of L. P. G. from natural gasoline	11,589	16,796	19,978	25,515	35,249
Exports	841	893	1,105	2,041	2,188
Stocks, end of year	734	965	1,061	1,120	1,107
Domestic demand	20,271	34,108	37,857	45,954	57,422

See footnotes at end of table.

Salient statistics of the major refined petroleum products in the United States, 1943–47—Continued

[Thousands of barrels]

Product	1943	1944	1945	1946	1947 [1]
Unfinished gasoline:					
Rerun (net)	[3] 1,009	[3] 1,745	4,892	108	[3] 984
Stocks, end of year	11,463	13,208	8,316	8,208	9,192
Other unfinished oils:					
Rerun (net)	[3] 2,597	[3] 2,584	5,727	1,615	1,227
Transfers of cycle products	1,574	1,821	848	1,261	1,704
Imports	366	9	258	978	1,879
Stocks, end of year	41,074	45,488	40,867	41,491	43,847
Shortage	9,623	13,177	6,954	1,695	4,222

[1] Subject to revision.
[2] New basis—to compare with following year.
[3] Negative quantity; represents net excess of unfinished produced over unfinished rerun.

The yields of refined products from crude oil are the resultant of the amount of crude oil run and the shift in the relative demand for the various products. The most significant developments in the last 3 years have been the downward trend in residual fuel-oil yield and the upward trend in distillate fuel-oil yields; this corresponds with the declining or static demand for residual and the rapid growth in distillate demand. Yields of residual fuel oil have decreased from 27.3 percent in 1945 to 24.9 percent in 1946 and 24.1 percent in 1947. Yields of distillate fuel oil have increased from 14.5 percent in 1945 to 16.6 percent in 1946 and 16.8 percent in 1947. The yield of gasoline has shown less variation owing to the shift from large military demand to civilian use and the increasing supply of natural gasoline. Gasoline yields have ranged from 40.9 percent in 1945 to 39.6 percent in 1946 and 40.2 percent in 1947. As long as required runs are close to maximum refinery capacity, sharp seasonal readjustments in yields are apt to occur.

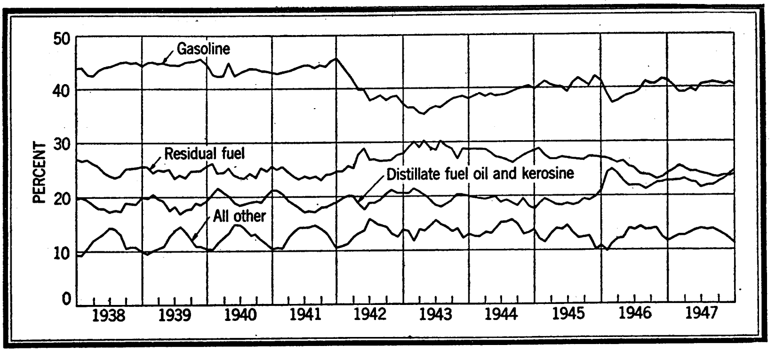

FIGURE 6.—Yields of principal products from crude oil run to stills in the United States, 1938–47, by months.

Stocks of refined oils declined from 271.9 million barrels at the beginning of 1947 to 267.1 million barrels on December 31, 1947—a decrease of 4.8 million barrels during the year. The principal changes in 1947 were decreases of 8.5 million barrels in stocks of distillate fuel oil and of 1.4 million barrels in stocks of finished gasoline. There was no change in residual fuel-oil stocks. Kerosine stocks increased

0.6 million barrels, stocks of unfinished gasoline rose 1.0 million barrels, stocks of other unfinished oils increased 2.4 million barrels, and stocks of lubricating oils rose 1.1 million barrels.

Percentage yields of refined petroleum products in the United States, 1938–47

[Computed on total crude runs to stills]

Product	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947 [1]
Finished products:										
Gasoline:										
Cracked	23.2	23.9	22.7	24.4	22.3	22.0	23.2	23.3	22.5	(2)
Straight run	21.1	21.1	20.4	19.8	17.5	15.1	16.2	17.6	17.1	(2)
Total gasoline	44.3	45.0	43.1	44.2	39.8	37.1	39.4	40.9	39.6	40.2
Kerosine	5.5	5.5	5.7	5.2	5.1	5.0	4.7	4.7	6.0	6.0
Distillate fuel oil	13.0	13.1	14.2	13.4	14.7	14.8	14.4	14.5	16.6	16.8
Residual fuel oil	25.3	24.7	24.4	24.3	26.9	29.2	27.7	27.3	24.9	24.1
Lubricating oil	2.6	2.8	2.8	2.8	2.9	2.7	2.5	2.4	2.7	2.8
Wax	.1	.1	.1	.2	.2	.2	.2	.2	.2	.2
Coke	.7	.7	.6	.6	.5	.5	.5	.6	.6	.7
Asphalt	2.1	2.2	2.3	2.6	2.6	2.6	2.3	2.3	2.6	2.7
Road oil	.6	.6	.6	.6	.6	.2	.1	.2	.4	.4
Still gas	5.7	5.5	5.5	5.9	5.9	6.1	6.1	6.0	5.1	4.6
Other	.2	.2	.3	.4	.6	.7	1.1	1.1	1.3	1.3
Unfinished products:										
Gasoline	[4] .1	(3 4)	.1	.1	.1	(3)	.1	[4] .3	(3 4)	(5)
Other	[4] .4	[4] .9	[4] .3	[4] .2	[4] .3	.2	.1	[4] .3	[4] .1	(6)
Shortage	.4	.5	.6	[4] .1	.4	.7	.8	.4	.1	.2
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Subject to revision.
[2] Not separated in 1947.
[3] Less than 0.1 percent.
[4] Negative percentage; represents excess percentage rerun over percentage produced.
[5] Added to finished gasoline production in computing yields in 1947.
[6] Added to crude runs in computing yields in 1947.

The most critical factor in the position of refined stocks in 1947 related to the stocks of distillate fuel oil. Total stocks of distillate fuel oil declined from 59.6 million barrels at the beginning of the year to 51.1 million on December 31, 1947—a reduction of 8.5 million barrels. As distillate stocks in California increased 1.5 million barrels, the decline east of California was 10.0 million barrels. In the refinery districts east of California, the combined stocks of distillate fuel oil in the East Coast, Texas Gulf Coast, and Louisiana Gulf Coast declined 12.6 million barrels in 1947, while stocks in the Indiana-Illinois and Oklahoma-Kansas districts increased by 1.8 million barrels.

The average increase of 50 cents per barrel in the value of crude oil at the well in 1947 was reflected in price increases for the principal refined products. The price of Regular Grade gasoline at Oklahoma refineries rose from 6.31 cents per gallon in 1946 to 8.42 cents per gallon in 1947. The average tank-wagon price of kerosine at Chicago rose from 11.37 cents per gallon in 1946 to 13.40 cents per gallon in 1947. The average price of a selected bright stock at Oklahoma refineries rose from 24.19 cents per gallon in 1946 to 28.84 cents per gallon in 1947. The price of Bunker "C" oil at New York rose from $1.76 per barrel in 1946 to $2.29 per barrel in 1947. The price of No. 2 fuel oil at New York Harbor rose from 5.93 cents per gallon in 1946 to 7.02 cents per gallon in 1947.

Stocks of refined petroleum products in the United States, 1946–47, by months

[Thousands of barrels]

Product	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
1946												
Gasoline	94,115	96,293	95,186	90,444	85,801	83,726	79,384	78,833	78,848	77,628	79,980	84,534
Kerosine	8,330	7,848	9,292	10,992	12,741	14,318	16,403	19,458	21,251	21,978	20,528	17,081
Distillate fuel oil	28,990	25,511	29,922	32,064	33,885	38,824	46,439	54,068	62,019	67,870	68,145	59,620
Residual fuel oil	34,573	34,008	32,995	35,206	38,932	41,492	45,446	48,186	54,012	55,580	52,735	47,094
Lubricating oil	7,694	7,966	7,951	7,852	7,565	7,635	7,293	7,030	7,244	7,338	7,384	7,564
Wax [1]	288	291	305	289	276	292	264	262	297	303	321	308
Coke [1]	732	734	709	722	600	425	390	358	445	478	467	450
Asphalt [1]	4,326	4,893	5,216	5,424	5,627	4,992	4,508	3,805	3,446	3,178	3,422	3,861
Road oil	304	405	427	642	880	1,000	977	828	634	579	562	606
Other finished products	1,058	979	1,101	1,112	1,128	1,107	1,087	1,246	1,205	1,223	1,170	1,120
Unfinished gasoline	8,279	8,543	8,975	8,300	8,159	8,245	8,394	7,912	8,173	8,324	8,607	8,208
Other unfinished oils	39,524	39,288	39,479	39,535	41,913	42,495	43,533	43,415	43,091	43,470	42,446	41,491
Total	228,213	226,759	231,558	232,582	237,507	244,551	254,118	265,401	280,665	287,949	285,767	271,937
1947												
Gasoline	90,300	94,985	96,952	92,719	86,727	81,160	77,069	77,190	75,882	74,710	78,669	83,111
Kerosine	13,732	11,493	9,811	9,625	12,609	14,653	17,651	20,824	22,276	22,750	20,626	17,722
Distillate fuel oil	48,197	36,901	31,423	30,268	34,279	39,676	46,444	54,707	59,764	63,252	61,334	51,081
Residual fuel oil	41,550	38,480	37,403	36,455	39,992	43,515	47,600	51,334	52,578	52,502	52,455	47,091
Lubricating oil	7,773	7,753	8,015	7,936	8,070	8,281	8,188	8,420	8,340	8,157	8,531	8,624
Wax [1]	293	304	327	306	319	315	334	314	344	325	346	351
Coke [1]	468	385	456	445	422	443	430	549	475	483	416	343
Asphalt [1]	4,300	4,885	5,510	5,657	5,847	5,503	4,764	3,941	3,288	2,974	3,637	4,021
Road oil	634	617	688	801	1,101	1,196	898	759	664	559	577	613
Other finished products	1,070	1,062	1,169	1,126	1,268	1,241	1,352	1,245	1,205	1,180	1,207	1,107
Unfinished gasoline	9,323	8,687	8,727	9,005	8,482	8,614	8,934	8,659	8,478	7,874	8,882	9,192
Other unfinished oils	41,270	41,084	40,542	41,694	42,829	43,905	44,769	43,854	45,119	43,313	44,048	43,847
Total	258,910	246,636	241,023	236,037	241,945	248,502	258,433	271,796	278,413	278,079	280,728	267,103

[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 petroleum products, 1946–47, by months

[Thousands of barrels]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1946													
Input:													
Crude petroleum	140,130	130,232	144,488	139,884	148,621	145,069	150,541	150,550	145,181	146,816	140,514	148,171	1,730,197
Natural gasoline	5,037	4,448	4,619	4,487	4,869	4,940	5,229	5,774	5,390	6,023	6,232	5,813	62,861
Total input	145,167	134,680	149,107	144,371	153,490	150,009	155,770	156,324	150,571	152,839	146,746	153,984	1,793,058
Output:													
Gasoline	59,338	52,751	58,914	58,276	62,482	61,645	65,150	67,853	64,304	65,630	64,868	67,200	748,411
Kerosine	9,688	9,506	9,852	8,396	8,887	8,376	8,435	8,179	7,825	8,566	7,893	8,782	104,385
Distillate fuel oil	24,390	23,047	25,298	23,181	23,348	23,320	24,589	23,703	23,877	24,432	23,741	24,970	287,896
Residual fuel oil	37,940	34,791	37,598	37,407	37,816	36,569	36,060	35,942	34,512	33,777	33,015	35,937	431,364
Lubricating oil	3,395	3,159	3,786	3,693	3,722	3,839	3,620	4,096	4,016	4,327	3,857	4,135	45,645
Wax [1]	234	232	276	243	242	234	216	247	245	266	283	285	3,003
Coke [1]	803	745	833	906	822	795	840	929	949	1,061	953	985	10,621
Asphalt [1]	2,527	2,636	2,973	3,260	3,915	4,060	4,685	4,792	4,553	4,436	3,687	3,387	44,911
Road oil	38	160	86	409	635	756	1,093	1,179	813	465	251	290	6,175
Still gas [1]	6,864	6,254	7,106	7,158	7,553	7,570	7,969	8,035	7,548	7,606	7,140	7,333	88,136
Liquefied gases	1,010	1,015	1,089	1,202	1,238	1,307	1,163	1,393	1,429	1,463	1,485	1,646	15,440
Other miscellaneous	457	439	609	525	634	659	656	717	691	673	554	485	7,099
Unfinished gasoline (net)	[2] 37	264	432	[2] 675	[2] 141	86	149	[2] 482	261	151	283	[2] 399	[2] 108
Other unfinished oils (net)	[2] 1,533	[2] 416	62	[2] 86	2,140	330	857	[2] 320	[2] 446	226	[2] 1,284	[2] 1,145	[2] 1,615
Shortage	53	97	193	476	197	463	288	61	[3] 6	[3] 240	20	93	1,695
Total output	145,167	134,680	149,107	144,371	153,490	150,009	155,770	156,324	150,571	152,839	146,746	153,984	1,793,058
1947 [4]													
Input:													
Crude petroleum	146,897	134,953	150,120	141,210	153,348	153,604	161,844	163,068	159,771	162,854	158,719	165,858	1,852,246
Natural gasoline	5,859	4,908	5,271	5,618	5,300	5,898	6,176	6,477	6,513	6,355	6,323	5,994	70,692
Total input	152,756	139,861	155,391	146,828	158,648	159,502	168,020	169,545	166,284	169,209	165,042	171,852	1,922,938
Output:													
Gasoline	64,419	58,499	64,340	61,120	65,981	67,753	71,376	73,881	71,257	73,505	69,946	72,764	814,841
Kerosine	9,415	9,243	9,476	8,854	9,284	8,717	9,117	8,970	8,547	9,308	9,352	10,129	110,412
Distillate fuel oil	24,131	21,746	25,577	22,925	24,954	24,214	26,270	26,946	27,325	29,072	28,254	30,759	312,173
Residual fuel oil	36,390	34,390	37,876	34,438	37,328	36,977	38,550	38,592	37,098	39,066	37,344	39,746	447,795
Lubricating oil	4,204	3,925	4,480	4,267	4,608	4,427	4,227	4,400	4,047	4,350	4,264	4,566	51,765
Wax [1]	299	292	334	286	320	279	320	236	321	286	307	344	3,624
Coke [1]	1,016	890	1,047	974	1,090	1,006	1,119	1,002	959	1,050	876	1,048	12,077
Asphalt [1]	2,973	2,928	3,315	3,337	4,341	4,531	4,839	5,431	5,125	4,956	3,998	3,512	49,286

Road oil	256	225	265	355	718	844	1,068	1,220	1,091	541	255	236	7,074
Still gas [1]	6,800	6,313	7,124	6,839	7,445	7,589	8,026	8,028	7,370	7,068	6,504	6,458	85,564
Liquefied gases	1,781	1,617	1,793	1,335	1,375	1,291	1,423	1,402	1,435	1,621	1,777	1,820	18,670
Other miscellaneous	472	509	511	475	471	440	471	472	384	466	465	542	5,678
Unfinished gasoline (net)	1,115	[2] 636	40	278	[2] 523	132	320	[2] 275	[2] 181	[2] 604	1,008	310	984
Other unfinished oils (net)	[2] 578	[2] 366	[2] 1,018	906	726	693	428	[2] 1,096	1,052	[2] 2,053	473	[2] 394	[2] 1,227
Shortage	63	286	231	439	530	609	466	336	454	577	219	12	4,222
Total output	152,756	139,861	155,391	146,828	158,648	159,502	168,020	169,545	166,284	169,209	165,042	171,852	1,922,938

[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.

Runs to stills and production at refineries in the United States of the various refined petroleum products, 1946–47, by districts

[Thousands of barrels]

	East Coast	Appalachian	Indiana, Illinois, Kentucky, etc.	Oklahoma, Kansas, Missouri	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas-Louisiana Inland	Rocky Mountain	California	Total United States
1946											
Input:											
Crude petroleum	276, 651	55, 756	279, 810	138, 385	78, 812	424, 619	121, 215	21, 967	48, 044	284, 938	1, 730, 197
Natural gasoline	1, 181	505	7, 080	5, 594	10, 978	15, 642	2, 533	1, 371	1, 023	16, 954	62, 861
Total input	277, 832	56, 261	286, 890	143, 979	89, 790	440, 261	123, 748	23, 338	49, 067	301, 892	1, 793, 058
Output:											
Gasoline	95, 303	25, 914	140, 722	71, 102	48, 371	177, 322	49, 481	8, 246	21, 578	110, 372	748, 411
Kerosine	13, 832	3, 309	15, 156	9, 116	4, 673	35, 284	15, 954	2, 067	1, 136	3, 858	104, 385
Distillate fuel oil	55, 252	6, 015	36, 861	21, 457	5, 362	86, 469	25, 590	3, 131	6, 609	41, 150	287, 896
Residual fuel oil	80, 007	8, 616	54, 323	23, 406	20, 092	90, 200	17, 040	5, 068	13, 388	119, 224	431, 364
Lubricating oil	9, 332	5, 175	4, 800	5, 479	282	13, 399	2, 098	1, 380	278	3, 422	45, 645
Wax [1]	1, 108	357	192	382	9	465	320	----------	78	92	3, 003
Coke [1]	598	146	5, 171	694	659	1, 139	1, 045	----------	221	948	10, 621
Asphalt [1]	11, 563	2, 046	10, 366	3, 851	2, 028	2, 172	2, 748	2, 506	1, 348	6, 283	44, 911
Road oil	172	----------	1, 701	758	----------	102	2	20	1, 160	2, 260	6, 175
Still gas [1]	12, 691	3, 436	16, 899	6, 732	4, 368	23, 095	6, 212	1, 322	2, 137	11, 244	88, 136
Liquefied gases	1, 851	33	1, 648	96	78	5, 613	4, 467	61	136	1, 457	15, 440
Other miscellaneous	903	569	885	490	828	2, 572	92	95	15	650	7, 099
Unfinished gasoline (net)	704	[2] 134	[2] 287	[2] 44	1, 274	[2] 1, 769	[2] 20	1	9	158	[2] 108
Other unfinished oils (net)	[2] 4, 734	[2] 69	[2] 792	[2] 615	[2] 606	4, 808	217	[2] 29	237	[2] 32	[2] 1, 615
Shortage	[3] 750	848	[3] 755	1, 075	2, 372	[3] 610	[3] 1, 498	[3] 530	737	806	1, 695
Total output	277, 832	56, 261	286, 890	143, 979	89, 790	440, 261	123, 748	23, 338	49, 067	301, 892	1, 793, 058
1947 [4]											
Input:											
Crude petroleum	297, 315	60, 377	301, 357	153, 050	84, 582	437, 024	139, 940	24, 825	52, 343	301, 433	1, 852, 246
Natural gasoline	883	530	8, 088	6, 002	11, 911	16, 925	3, 100	950	918	21, 385	70, 692
Total input	298, 198	60, 907	309, 445	159, 052	96, 493	453, 949	143, 040	25, 775	53, 261	322, 818	1, 922, 938
Output:											
Gasoline	104, 098	27, 039	147, 985	77, 581	52, 599	191, 335	58, 704	9, 239	23, 373	122, 888	814, 841
Kerosine	14, 257	3, 570	18, 324	8, 792	5, 477	34, 119	17, 394	2, 578	1, 250	4, 651	110, 412
Distillate fuel oil	57, 111	7, 362	45, 749	26, 230	7, 175	82, 850	27, 512	3, 459	8, 227	46, 498	312, 173
Residual fuel oil	86, 769	10, 250	57, 259	25, 246	21, 064	88, 592	24, 324	5, 410	13, 710	115, 171	447, 795
Lubricating oil	11, 078	5, 531	5, 261	5, 861	369	15, 009	2, 350	1, 484	311	4, 511	51, 765
Wax [1]	1, 387	397	227	475	11	528	413	----------	95	91	3, 624

Coke [1]	729	333	5, 205	728	554	1, 535	1, 184	----------	233	1, 576	12, 077
Asphalt [1]	13, 596	2, 260	8, 693	4, 554	2, 217	2, 555	3, 269	2, 795	1, 576	7, 771	49, 286
Road oil	150	7	1, 520	557	----------	85	3	17	1, 363	3, 372	7, 074
Still gas [1]	11, 690	3, 417	15, 580	6, 653	4, 058	24, 220	5, 636	1, 459	2, 210	10, 641	85, 564
Liquefied gases	2, 675	12	2, 073	329	132	4, 251	5, 036	308	62	3, 792	18, 670
Other miscellaneous	469	417	801	950	1, 111	811	93	183	66	777	5, 678
Unfinished gasoline (net)	[2] 440	[2] 65	215	62	[2] 73	1, 653	72	[2] 2	4	[2] 442	984
Other unfinished oils (net)	[2] 5, 880	[2] 89	669	244	[2] 594	6, 740	[2] 1, 667	[2] 472	97	[2] 275	[2] 1, 227
Shortage	509	466	[3] 116	790	2, 393	[3] 334	[3] 1, 283	[3] 683	684	1, 796	4, 222
Total output	298, 198	60, 907	309, 445	159, 052	96, 493	453, 949	143, 040	25, 775	53, 261	322, 818	1, 922, 938

[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.

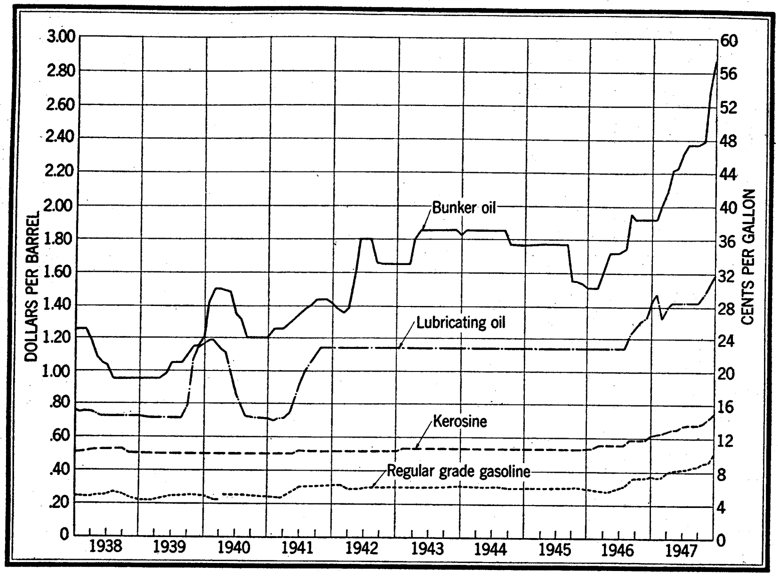

FIGURE 7.—Prices of Bunker "C" oil at New York Harbor, bright stock at Oklahoma refineries, tank-wagon prices of kerosine at Chicago, and Regular Grade gasoline at refineries in Oklahoma, 1938–47, by months.

The total crude-oil capacity of refineries increased from 5,569,482 barrels daily on January 1, 1947, to 6,034,252 barrels daily at the end of the year. The total capacity in operation increased from 5,336,399 at the beginning of the year to 5,825,566 at the end of the year. The capacity of all shut-down units declined from 233,083 barrels daily on January 1 to 208,686 at the end of 1947. Total capacity building on January 1 was reported at 162,200 barrels daily and rose to 367,250 on December 31, 1947.

Petroleum refinery capacity in the United States, January 1, 1943–48

Year	Number of refineries				Capacity (barrels per day)			
	Operating	Shut down	Total	Building	Operating	Shut down	Total	Building
1943	386	85	471	1	4,409,013	492,998	4,902,011	195,100
1944	384	68	452		4,709,382	383,641	5,093,023	118,270
1945	380	33	413	1	5,077,690	223,463	5,301,153	36,075
1946	364	29	393	1	5,086,165	229,691	5,315,856	53,100
1947	361	38	399		5,336,399	233,083	5,569,482	162,200
1948	352	38	390	2	5,825,566	208,686	6,034,252	367,250

AVIATION GASOLINE

Aviation gasoline is discussed separately because of the special interest in this type of fuel, but all the aviation-gasoline statistics are included in the statistics of total motor fuel and gasoline.

The total demand for Aviation Grade gasoline rose from 15.2 million barrels in 1946 to 26.7 million in 1947. Exports increased from 2.3 million barrels in 1946 to 5.1 million in 1947. Domestic

Salient statistics of aviation gasoline in the United States, 1946–47, by months

[Thousands of barrels]

1946	January	February	March	April	May	June	July	August	September	October	November	December	1946	1945
Production:														
100-octane and above	470	263	197	283	485	460	577	469	496	417	550	675	5,342	124,215
Other grades	2,036	1,441	1,871	1,613	1,662	1,676	1,693	1,919	1,680	1,773	1,392	1,314	20,070	28,180
Transfers out	748	793	1,641	685	906	1,023	999	1,086	976	642	627	806	10,932	11,162
Exports	93	135	371	129	198	233	125	249	273	121	221	146	2,294	34,117
Stocks:														
100-octane and above	1,724	1,811	1,330	1,728	1,796	1,823	1,875	1,782	1,836	1,666	1,635	1,472	1,472	1,450
Other grades	3,784	3,740	3,376	3,225	3,197	3,080	2,882	2,769	2,647	2,946	3,107	3,081	3,081	3,822
Domestic demand: All grades	1,429	733	901	835	1,003	970	1,292	1,259	995	1,298	964	1,226	12,905	116,990
Total demand by grades:														
100-octane and above	621	263	501	243	399	429	537	525	445	582	585	695	5,825	127,674
Other finished	747	591	694	644	738	719	821	888	740	754	581	659	8,576	17,893
Components	154	14	77	77	64	55	59	95	83	83	19	18	798	5,540

1947 [1]	January	February	March	April	May	June	July	August	September	October	November	December	1947	1946
Production:														
100-octane and above	704	713	954	566	1,219	1,353	1,545	2,061	2,258	2,121	2,187	2,186	17,867	5,342
Other grades	1,101	1,230	1,267	1,880	1,651	1,650	1,922	1,603	1,475	1,328	1,129	1,193	17,429	20,070
Transfers out	870	623	793	719	703	780	771	538	467	284	311	247	7,106	10,932
Exports	105	381	445	193	405	484	276	831	375	394	494	688	5,071	2,294
Stocks:														
100-octane and above	1,410	1,374	1,342	1,381	1,543	1,671	1,804	1,968	2,198	2,338	2,575	2,422	2,422	1,472
Other grades	2,912	2,919	2,826	3,311	3,268	3,176	3,340	3,512	3,605	3,581	3,531	3,642	3,642	3,081
Domestic demand: All grades	1,061	968	1,108	1,010	1,643	1,703	2,123	1,959	2,568	2,655	2,324	2,486	21,608	12,905
Total demand by grades:														
100-octane and above	571	685	899	518	1,047	1,200	1,397	1,896	2,033	1,982	1,930	2,334	16,492	5,825
Other finished	578	631	637	680	870	836	939	860	775	912	692	778	9,188	8,576
Components	17	33	17	5	131	151	63	34	135	155	196	62	999	798

[1] Subject to revision.

demand rose from 12.9 million barrels in 1946 to 21.6 million in 1947. Domestic demand includes reported deliveries for military use, amounting to 1.0 million barrels in 1946 and 7.1 million in 1947.

The total demand for grades of 100-octane and above rose from 5.8 million barrels in 1946 to 16.5 million in 1947. The total demand for all other grades, including components marketed as such, rose from 9.4 million barrels in 1946 to only 10.2 million in 1947. The rapid gain in the demand for 100-octane and above is indicated by the fact that it represented 38 percent of total demand in 1946 and 62 percent of the total in 1947.

It should be noted that, in the production figures for aviation gasoline, the item "transfers out" represents rejected materials that are returned to regular grades of gasoline and that this item should be subtracted from the gross production figure to determine net production of marketable grades.

The figures for aviation gasoline cover only the special grades identified as such by the producing companies and do not include automotive types of gasoline that may be used by many smaller planes.

MOTOR FUEL

The total record demand for motor fuel amounted to 780.8 million barrels in 1946 and 842.4 million in 1947. Exports rose from 45.3 million to 47.5 million and domestic demand rose from 735.4 to 794.8. Total demand increased 61.6 million barrels, or 7.9 percent, and domestic demand rose 59.4 million, or 8.1 percent. The gain of 61.6 million barrels in total demand in 1947 included an increase of 11.5 million barrels in aviation gasoline and of 50.1 million barrels in other grades.

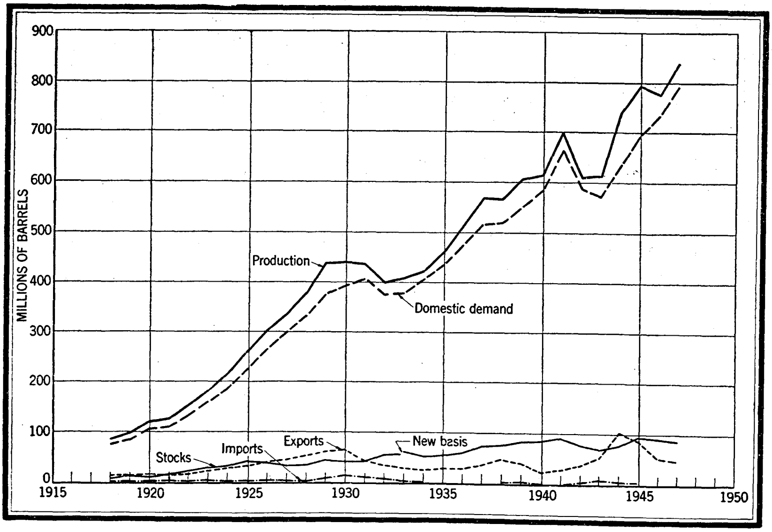

FIGURE 8.—Trends of production, domestic demand, exports, imports, and stocks of motor fuel in the United States, 1918-47

Production.—The total production of motor fuel rose from 776.6 million barrels in 1946 to 839.9 million in 1947. Total production includes the gasoline and naphtha produced at refineries from crude oil; the total production of light products at natural-gasoline and cycle plants less transfers of liquefied petroleum gases sold for fuel or chemical uses and some other minor products; and a small amount of motor benzol from coke plants that is used for blending.

In 1947 the production of gasoline and naphtha from crude oil amounted to 744.1 million barrels, compared with 685.6 million in 1946; the net supply from natural-gasoline and cycle plants was 95.0

Salient statistics of motor fuel in the United States in 1946, by months

[Thousands of barrels]

	1946						
	Jan.	Feb.	Mar.	Apr.	May	June	July
Production:							
Refinery gasoline:							
Gasoline	53,087	47,211	52,910	52,396	55,999	55,267	58,270
Naphtha	1,214	1,092	1,385	1,393	1,614	1,438	1,651
Natural gasoline, etc	9,961	9,081	9,401	9,149	9,410	9,380	9,439
Less sales of L. P. G. and transfers of cycle products [1]	2,315	2,083	1,979	1,863	1,956	1,865	2,033
Benzol	240	240	240	150	150	150	150
Total production	62,187	55,541	61,957	61,225	65,217	64,370	67,477
Daily average	2,006	1,984	1,999	2,041	2,104	2,146	2,177
Imports							
Exports	4,974	4,900	5,546	3,532	3,038	2,859	2,752
Daily average	160	175	179	118	98	95	89
Stocks, end of period:							
Finished gasoline	94,115	96,293	95,186	90,444	85,801	83,726	79,384
Natural gasoline	5,034	5,843	6,658	6,982	7,004	7,343	7,334
Total stocks	99,149	102,136	101,844	97,426	92,805	91,069	86,718
Domestic demand	51,746	47,654	56,703	62,111	66,800	63,247	69,076
Daily average	1,669	1,702	1,829	2,070	2,155	2,108	2,228

	1946—Continued						1945
	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Production:							
Refinery gasoline:							
Gasoline	60,503	57,530	58,074	57,084	59,777	668,108	685,560
Naphtha	1,576	1,384	1,533	1,552	1,610	17,442	18,576
Natural gasoline, etc	9,701	9,454	10,156	10,049	10,558	115,739	112,004
Less sales of L. P. G. and transfers of cycle products [1]	2,198	2,193	2,568	2,714	3,009	26,776	20,826
Benzol	150	150	150	150	150	2,070	2,880
Total production	69,732	66,325	67,345	66,121	69,086	776,583	798,194
Daily average	2,249	2,211	2,172	2,204	2,229	2,128	2,187
Imports					1	1	1,807
Exports	3,945	3,925	2,676	3,249	3,938	45,334	88,059
Daily average	127	131	86	108	127	124	241
Stocks, end of period:							
Finished gasoline	78,833	78,848	77,628	79,980	84,534	84,534	89,360
Natural gasoline	6,943	7,060	6,312	5,487	4,981	4,981	4,322
Total stocks	85,776	85,908	83,940	85,467	89,515	89,515	93,682
Domestic demand	66,729	62,268	66,637	61,345	61,101	735,417	696,333
Daily average	2,153	2,076	2,150	2,045	1,971	2,015	1,908

[1] Includes L. P. G. sales for fuel and chemical uses.

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Salient statistics of motor fuel in the United States in 1947, by months

[Thousands of barrels]

	1947 [1]						
	Jan.	Feb.	Mar.	Apr.	May	June	July
Production:							
Refinery gasoline:							
Gasoline	56,902	52,229	57,430	54,127	59,270	60,481	63,805
Naphtha	1,658	1,362	1,639	1,375	1,411	1,374	1,395
Natural gasoline, etc	10,571	9,864	10,953	10,753	10,342	10,455	10,969
Less sales of L. P. G. and transfers of cycle products [2]	3,307	3,050	3,401	2,931	2,538	2,513	2,725
Benzol	80	80	80	50	50	50	50
Total production	65,904	60,485	66,701	63,374	68,535	69,847	73,494
Daily average	2,126	2,160	2,152	2,112	2,211	2,328	2,371
Imports						101	
Exports	3,268	5,033	4,532	3,862	3,700	4,300	4,327
Daily average	105	180	146	129	119	143	140
Stocks, end of period:							
Finished gasoline	90,300	94,985	96,952	92,719	86,727	81,160	77,069
Natural gasoline	4,794	5,010	5,265	5,604	5,566	5,452	5,269
Total stocks	95,094	99,995	102,217	98,323	92,293	86,612	82,338
Domestic demand	57,057	50,551	59,947	63,406	70,865	71,329	73,441
Daily average	1,841	1,805	1,934	2,114	2,286	2,378	2,369

	1947 [1]—Continued						1946
	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Production:							
Refinery gasoline:							
Gasoline	66,148	63,361	65,736	62,283	65,375	727,147	668,108
Naphtha	1,256	1,383	1,414	1,340	1,395	17,002	17,442
Natural gasoline, etc	11,204	11,046	11,635	11,901	12,307	132,000	115,739
Less sales of L. P. G. and transfers of cycle products [2]	2,913	2,896	3,179	3,513	3,987	36,953	26,776
Benzol	50	50	50	50	50	690	2,070
Total production	75,745	72,944	75,656	72,061	75,140	839,886	776,583
Daily average	2,443	2,431	2,441	2,402	2,424	2,301	2,128
Imports	102	15		18	122	358	1
Exports	3,889	3,444	3,768	3,917	3,505	47,545	45,334
Daily average	125	115	122	131	113	130	124
Stocks, end of period:							
Finished gasoline	77,190	75,882	74,710	78,669	83,111	83,111	84,534
Natural gasoline	5,017	4,456	4,221	4,266	4,296	4,296	4,981
Total stocks	82,207	80,338	78,931	82,935	87,407	87,407	89,515
Domestic demand	72,089	71,384	73,295	64,158	67,285	794,807	735,417
Daily average	2,325	2,379	2,364	2,139	2,170	2,178	2,015

[1] Subject to revision.
[2] Includes L. P. G. sales for fuel and chemical uses.

million barrels, compared with 88.9 million in 1946; and the amount of benzol used was 0.7 million barrels, compared with 2.1 million in 1946. The total refinery output of gasoline includes the amount produced from crude oil plus the amount of light products from the other sources that is received for blending and shown in the refinery input.

The total output of gasoline at refineries amounted to 814.8 million barrels in 1947, including 744.1 million derived from crude oil and 70.7 million of natural gasoline and other light products received for blending.

Production of gasoline in the United States in 1947, by districts and months [1]

[Thousands of barrels]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Gasoline:													
East Coast	8,055	7,040	7,915	7,699	8,476	8,843	9,236	9,435	8,701	8,719	8,230	8,621	100,970
Appalachian	2,023	2,054	2,005	2,029	2,127	2,163	2,267	2,337	2,182	2,180	2,069	2,352	25,788
Indiana, Illinois, Kentucky, etc	10,697	9,916	11,349	9,996	10,700	11,023	12,234	12,306	11,944	12,394	12,072	12,341	136,972
Oklahoma, Kansas, Missouri, etc	5,641	5,179	5,595	5,269	5,865	5,880	6,129	6,174	5,934	6,105	6,093	6,243	70,107
Texas Inland	3,149	3,128	3,168	3,202	2,958	3,242	3,551	3,492	3,330	3,505	3,568	3,709	40,002
Texas Gulf Coast	12,935	11,681	13,036	11,236	13,503	13,956	15,364	15,589	15,411	16,005	14,818	16,243	169,777
Louisiana Gulf Coast	4,388	3,763	4,195	4,545	4,261	4,534	4,656	4,752	4,718	5,307	4,651	4,525	54,295
Arkansas, Louisiana Inland, Mississippi, etc	606	579	648	594	590	674	655	739	709	792	743	834	8,163
Rocky Mountain	1,863	1,687	1,736	1,635	2,035	1,829	1,885	2,059	1,840	1,826	1,924	1,933	22,252
California	7,545	7,202	7,783	7,922	8,755	8,337	7,828	9,265	8,592	8,903	8,115	8,574	98,821
Total gasoline	56,902	52,229	57,430	54,127	59,270	60,481	63,805	66,148	63,361	65,736	62,283	65,375	727,147
Naphtha:													
East Coast	262	154	206	161	182	140	244	166	165	154	179	232	2,245
Appalachian	187	35	46	47	60	57	51	38	53	56	43	48	721
Indiana, Illinois, Kentucky, etc	225	203	244	260	419	395	193	166	189	179	246	206	2,925
Oklahoma, Kansas and Missouri	104	104	120	124	133	129	118	127	139	126	137	111	1,472
Texas Inland	35	89	94	55	58	56	69	37	41	52	41	59	686
Texas Gulf Coast	311	415	497	314	274	349	407	360	466	476	370	394	4,633
Louisiana Gulf Coast	95	74	91	125	125	108	110	108	110	128	104	131	1,309
Arkansas and Louisiana Inland	2	6	6	10	6	11	10	8	21	23	14	9	126
Rocky Mountain	18	10	10	15	21	18	23	15	17	26	7	23	203
California	419	272	325	264	133	111	170	231	182	194	199	182	2,682
Total naphtha	1,658	1,362	1,639	1,375	1,411	1,374	1,395	1,256	1,383	1,414	1,340	1,395	17,002
Percent yield of gasoline and naphtha [2]	40.4	39.1	39.1	39.8	39.4	40.5	40.6	40.9	40.7	40.4	40.8	40.4	40.2
Natural gasoline blended at refineries	5,859	4,908	5,271	5,618	5,300	5,898	6,176	6,477	6,513	6,355	6,323	5,994	70,692
Total production:													
East Coast	8,465	7,315	8,202	7,944	8,676	9,000	9,558	9,611	8,898	8,967	8,520	8,942	104,098
Appalachian	2,267	2,133	2,104	2,121	2,228	2,263	2,360	2,411	2,278	2,275	2,151	2,448	27,039
Indiana, Illinois, Kentucky, etc	11,581	10,690	12,175	10,884	11,730	12,089	13,086	13,213	12,851	13,333	13,082	13,271	147,985
Oklahoma, Kansas, Missouri, etc	6,350	5,802	6,213	5,804	6,415	6,445	6,652	6,769	6,637	6,820	6,790	6,884	77,581
Texas Inland	4,088	3,983	4,253	4,365	3,715	4,475	4,586	4,652	4,503	4,615	4,618	4,746	52,599
Texas Gulf Coast	14,566	13,129	14,801	12,806	15,205	15,676	17,421	17,487	17,407	17,943	16,738	18,156	191,335
Louisiana Gulf Coast	4,783	4,060	4,511	4,949	4,667	4,876	5,034	5,157	5,121	5,681	4,999	4,866	58,704
Arkansas, Louisiana Inland, Mississippi, etc	700	679	735	682	667	765	746	827	804	896	828	910	9,239
Rocky Mountain	1,975	1,781	1,828	1,734	2,123	1,895	1,951	2,133	1,961	1,928	2,010	2,054	23,373
California	9,644	8,927	9,518	9,831	10,555	10,269	9,982	11,621	10,797	11,047	10,210	10,487	122,888
Total: 1947	64,419	58,499	64,340	61,120	65,981	67,753	71,376	73,881	71,257	73,505	69,946	72,764	814,841
1946	59,338	52,751	58,914	58,276	62,482	61,645	65,150	67,853	64,304	65,630	64,868	67,200	748,411

[1] Subject to revision.

[2] Based on crude runs to stills adjusted for net unfinished.

Yields.—The average refinery yield of gasoline and naphtha from crude oil reached a high of 45.0 percent in 1939. With the expansion of heavy fuel-oil requirements during the war it declined to 37.1 percent in 1943 and then rose to 40.9 percent in 1945, at the peak of aviation-gasoline production. It dropped to 39.6 percent in 1946 and rose to 40.2 percent in 1947. The yield of gasoline tends to fluctuate materially during the year, declining in the winter when fuel-oil demand is at a peak and rising in summer when motor-fuel demand is greatest.

Domestic Demand.—The domestic demand for motor fuel set a new record in 1947, increasing about 8 percent from a total of 735.4 million barrels in 1946 to 794.8 million in 1947. The daily average domestic demand by quarters in 1947 was 1,862,000 barrels daily in the first quarter, showing a gain of 7.4 percent compared with the same period of 1946; 2,259,000 barrels daily in the second quarter, a gain of 7.0 percent compared with 1946; 2,358,000 barrels daily in the third quarter, or 9.5 percent greater than in 1946; and 2,225,000 barrels daily in the fourth quarter, or 8.3 percent above the same period of 1946. The percentage of the total domestic demand for the year was 21.1 percent in the first quarter, 25.9 percent in the second quarter, 27.3 percent in the third quarter, and 25.7 percent in the fourth quarter.

The annual survey of the Public Roads Administration analyzed civilian motor-fuel consumption based on the tax returns of the various States. This survey showed a total gasoline usage of 762.8 million barrels in 1947, including a highway use of 671.8 million, nonhighway uses of 82.5 million, and losses of 8.5 million barrels. An increase in highway use of 10 percent is indicated in 1947 compared with 1946. The difference between this survey and the Bureau of Mines domestic demand was 32 million barrels, which includes deliveries for military purposes, some additional losses, and probably a considerable amount of naphtha used for industrial purposes.

Production and Consumption by States.—The table showing the production and consumption of gasoline by States is designed to indicate roughly the areas of surplus production and deficit supply. The refinery production used is compiled from reports to the Bureau of Mines, and the consumption figures are compiled from State tax reports by the American Petroleum Institute. The production figure used does not include the natural gasoline blended or used outside refineries; and the consumption figure, while it includes military deliveries, is about 15 million barrels less than the total domestic demand figure for 1947.

In 1947, the refinery production figure by States amounted to 814.8 million barrels and the consumption figure to 779.4 million barrels. The production figure includes a considerable part of the gasoline for export. A study of the table reveals that the Gulf Coast States were the largest surplus producers in 1947, with a refinery output of about 307 million barrels and a consumption of only 84 million. The surplus of 223 million barrels gives rise to the major Gulf–East Coast tanker movement, to some of the largest gasoline pipe-line movements to the Middle Western States, and to a major part of the gasoline exports.

Production and consumption of gasoline in the United States, 1945–47, by States

[Thousands of barrels]

State	1945		1946		1947 [1]	
	Production	Consumption [2]	Production	Consumption [2]	Production	Consumption [2]
Alabama	(3)	7,318	(3)	9,374	(3)	10,409
Arizona		3,168		4,084		4,531
Arkansas	3,668	5,117	4,112	6,543	4,768	7,169
California	[4] 121,094	65,760	[4] 110,372	75,461	[4] 122,888	81,144
Colorado	2,568	7,061	2,716	8,051	2,657	8,855
Connecticut		7,143		9,156		10,037
Delaware		1,308		1,666		1,859
District of Columbia		2,811		3,470		3,754
Florida		10,184		13,611		15,539
Georgia	[5] 8,268	9,947	[5] 6,635	12,919	[5] 7,461	14,045
Idaho	(6)	2,704	(6)	3,520	(6)	3,946
Illinois	[7] 54,582	30,315	[7] 53,896	39,141	[7] 58,979	43,106
Indiana	43,825	18,039	44,874	21,158	46,077	22,996
Iowa		14,239		17,855		18,784
Kansas	[8] 33,353	11,757	[8] 34,639	14,202	[8] 37,914	15,238
Kentucky	[9] 9,440	8,729	[9] 8,178	9,761	[9] 9,763	10,809
Louisiana	[3] 52,457	7,519	[3] 53,615	8,961	[3] 63,143	9,917
Maine		3,466		4,395		4,776
Maryland	(5)	7,831	(5)	9,055	(5)	9,949
Massachusetts	[10] 5,679	14,270	[10] 2,865	17,863	[10] 3,606	19,543
Michigan	10,381	27,896	8,998	34,650	10,632	38,605
Minnesota	(7)	12,835	(7)	16,949	(7)	18,182
Mississippi	(3)	5,608	(3)	7,264	(3)	8,021
Missouri	(8)	14,521	(8)	19,404	(8)	21,358
Montana	3,973	3,162	4,242	4,172	4,042	4,482
Nebraska	(8)	6,330	(8)	7,796	(8)	8,794
Nevada		1,233		1,424		1,520
New Hampshire		1,822		2,469		2,697
New Jersey	31,871	17,811	28,615	22,267	32,555	24,454
New Mexico	2,010	3,096	1,905	3,899	1,845	4,274
New York	9,632	35,500	9,792	46,328	9,446	50,509
North Carolina		11,372		15,154		16,689
North Dakota		4,544		5,434		5,664
Ohio	34,691	33,411	35,125	38,757	34,179	42,259
Oklahoma	39,393	13,619	36,463	12,492	39,667	13,840
Oregon		6,662		9,066		10,315
Pennsylvania	56,993	30,083	60,662	39,559	64,238	43,189
Rhode Island	(10)	2,965	(10)	3,229	(10)	3,516
South Carolina	(5)	5,628	(5)	7,426	(5)	8,315
South Dakota		4,013		4,992		5,364
Tennessee	(9)	9,113	(9)	11,827	(9)	12,593
Texas	234,703	46,583	225,693	53,908	243,934	55,393
Utah	(6)	2,865	(6)	3,573	(6)	3,958
Vermont		1,300		1,840		2,033
Virginia		11,002		13,367		14,575
Washington	(4)	9,974	(4)	12,562	(4)	13,765
West Virginia	2,566	4,508	2,299	6,212	2,206	6,873
Wisconsin	(7)	13,853	(7)	17,592	(7)	19,217
Wyoming	[6] 13,313	1,793	[6] 12,715	2,253	[6] 14,841	2,550
Total	774,460	581,788	748,411	716,111	814,841	779,410

[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 and Nebraska included with Kansas.
[9] Tennessee included with Kentucky.
[10] Rhode Island included with Massachusetts.

The Atlantic Coast States produced only 117 million barrels in 1947 but consumed 245 million, with a deficit of 128 million—primarily supplied by the Gulf–East Coast tanker movement.

The States north of the Gulf coast and between the Atlantic States and the Mountain States produced 244 million barrels of gasoline and consumed 311 million—the deficit being supplied by pipe-line movements, river shipments, and tank-car shipments from the Gulf coast.

The Mountain States produced 23 million barrels of gasoline and consumed 28 million—the deficit being supplied from the east or from California.

Production in the Pacific Coast district amounted to 123 million barrels in 1947, and consumption in the five States was 111 million barrels. The surplus was available for export or shipment to the Mountain States.

Methods of Distribution.—The total quantity of motor fuel delivered from pipe lines in 1947 amounted to 244.1 million barrels compared with 218.8 million in 1946. These totals represent about 30 percent of the total refinery production of gasoline in 1947 and 29 percent of production in 1946. The total stocks held by pipe lines, including working tanks and line fill, were 9.3 million barrels at the beginning of 1947 and 9.0 million barrels at the end of the year. The indicated shortage or loss resulting in the pipe-line movement was 1.1 million barrels in 1947 compared with 0.8 million in 1946. The tanker and barge movement of gasoline from the Gulf coast to east coast ports amounted to 132.6 million barrels in 1947 compared with 124.0 million in 1946.

Shipments of motor fuel by pipe lines in the United States in 1947, by months

[Thousands of barrels]

	1947						
	Jan.	Feb.	Mar.	Apr.	May	June	July
Motor fuel turned into lines	17,363	15,228	19,128	18,954	21,299	21,869	22,049
Motor fuel delivered from lines	16,307	14,674	19,060	18,906	22,457	22,294	22,651
Shortage (or overage)	167	(8)	34	84	80	91	76
Stocks in lines and working tanks, end of month	10,149	10,711	10,745	10,709	9,471	8,955	8,277

	1947—Continued						1946
	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Motor fuel turned into lines	23,195	21,760	22,331	20,762	21,033	244,971	218,174
Motor fuel delivered from lines	22,690	21,792	22,722	20,305	20,288	244,146	218,756
Shortage (or overage)	112	123	124	99	69	1,051	761
Stocks in lines and working tanks, end of month	8,670	8,515	8,000	8,358	9,034	9,034	9,260

Stocks.—Stocks of gasoline as reported include stocks held at refineries, bulk terminals, and pipe lines but do not include stocks in the smaller distribution plants or stocks held by consumers or in military custody.

Stocks of finished gasoline declined 1.4 million barrels in 1947 from a total of 84.5 million barrels on the first of the year to 83.1 million on December 31. Stocks of natural gasoline and cycle products also declined during the year from 5.0 million barrels to 4.3 million. Stocks of unfinished gasoline increased from 8.2 million barrels at the beginning of 1947 to 9.2 million barrels at the end of the year.

The small decline in gasoline stocks during 1947 can be attributed to the relatively greater increases in the demand for other light products and the necessity of operating refineries close to capacity to meet the large increase in the total demand for all oils. The change in finished-gasoline stocks by quarters in 1947 included an increase of 12.4 million barrels in the first quarter, a large decline of 15.8 million in the second quarter, a small decline of 5.3 million in the third quarter, and a gain of 7.2 million barrels in the last quarter of the year.

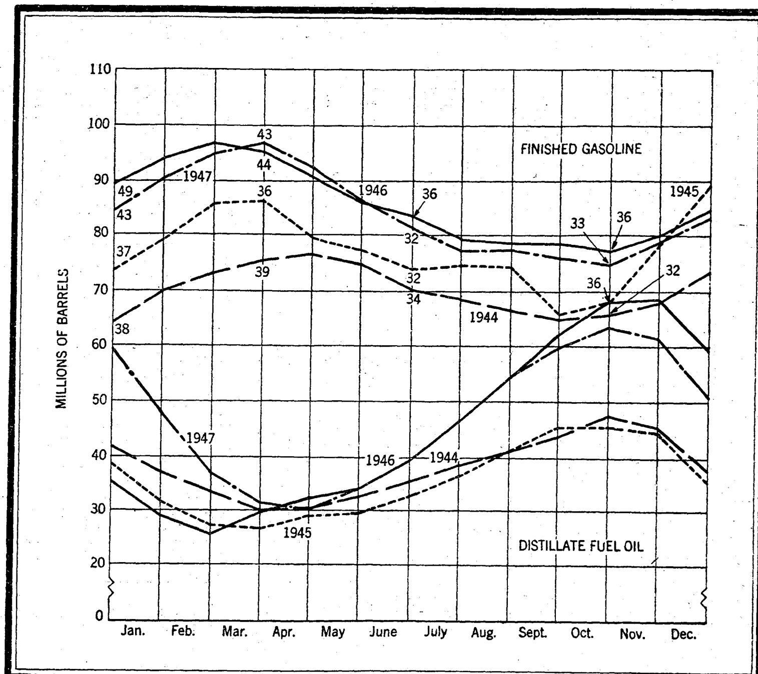

FIGURE 9.—Stocks of finished gasoline in the United States, 1944–47, by months, with figures representing days' supply at certain periods; also stocks of distillate fuel oil, 1944–47, by months.

Days' supply of motor fuel on hand in the United States at end of month, 1945–47 [1]

Month	1945			1946			1947 [2]		
	Finished gasoline	Natural gasoline	Total motor fuel	Finished gasoline	Natural gasoline	Total motor fuel	Finished gasoline	Natural gasoline	Total motor fuel
January	39.1	2.0	41.1	50.1	2.7	52.8	45.5	2.4	47.9
February	39.1	2.1	41.2	48.0	2.9	50.9	45.7	2.4	48.1
March	35.9	1.9	37.8	43.5	3.0	46.5	43.2	2.4	45.6
April	34.1	2.0	36.1	40.1	3.1	43.2	38.6	2.3	40.9
May	32.8	2.1	34.9	38.9	3.2	42.1	34.4	2.2	36.6
June	31.6	2.0	33.6	36.1	3.2	39.3	32.3	2.2	34.5
July	31.6	1.8	33.4	34.8	3.2	38.0	31.5	2.1	33.6
August	32.3	1.8	34.1	35.7	3.2	38.9	31.0	2.0	33.0
September	34.9	2.1	37.0	35.3	3.1	38.4	30.5	1.8	32.3
October	36.1	2.1	38.2	36.1	2.9	39.0	32.9	1.9	34.8
November	44.2	2.4	46.6	38.1	2.6	40.7	34.4	1.9	36.3
December	48.9	2.4	51.3	43.4	2.6	46.0	40.5	2.1	42.6

[1] Stocks divided by the daily average total demand (domestic demand plus exports) for succeeding month.
[2] Subject to revision.

Stocks of gasoline in the United States in 1947, 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	20,591	21,460	21,484	21,232	19,594	19,410	19,713	19,835	18,721	17,829	18,761	19,324
Appalachian	3,038	3,347	3,300	3,284	3,207	2,791	2,756	2,615	2,798	2,560	2,764	2,813
Indiana, Illinois, Kentucky, etc	18,745	20,400	22,035	20,370	17,507	15,071	14,516	14,318	14,048	13,463	14,833	16,229
Oklahoma, Kansas, Missouri, etc	9,233	9,972	10,311	9,642	8,592	7,695	6,380	6,641	6,675	6,431	7,589	7,968
Texas Inland	3,318	3,722	3,690	3,615	3,214	2,847	2,535	2,273	1,952	1,836	2,279	2,464
Texas Gulf Coast	12,461	12,542	12,151	10,792	11,273	11,886	10,735	11,263	11,875	11,995	11,300	13,141
Louisiana Gulf Coast	4,806	4,547	4,828	4,968	4,177	3,900	3,924	4,010	4,218	4,941	4,306	4,318
Arkansas, Louisiana Inland, Mississippi, etc	2,034	2,332	1,999	1,875	1,796	1,576	1,539	1,577	1,523	1,441	1,609	1,478
Rocky Mountain	2,500	2,954	3,036	2,926	3,014	2,761	2,284	1,643	1,333	1,221	1,622	2,023
California	13,574	13,709	14,118	14,015	14,353	13,223	12,687	13,015	12,739	12,993	13,606	13,353
Total finished gasoline	90,300	94,985	96,952	92,719	86,727	81,160	77,069	77,190	75,882	74,710	78,669	83,111
Unfinished gasoline:												
East Coast	948	990	1,046	1,072	990	829	974	799	883	722	878	845
Appalachian	446	444	475	483	488	502	405	432	356	353	344	315
Indiana, Illinois, Kentucky, etc	666	745	885	776	877	824	846	769	715	655	885	817
Oklahoma, Kansas, and Missouri	307	320	315	296	258	273	316	299	283	307	395	364
Texas Inland	409	449	409	459	320	440	404	453	512	451	398	466
Texas Gulf Coast	2,765	3,147	2,752	3,099	2,813	3,044	3,058	3,211	3,002	2,833	3,145	3,509
Louisiana Gulf Coast	1,247	335	438	423	400	321	472	423	526	386	416	396
Arkansas and Louisiana Inland	2	17	10	11	14	13	14	3	5	2	2	------
Rocky Mountain	172	165	183	197	181	168	162	182	178	188	208	150
California	2,361	2,075	2,214	2,189	2,141	2,200	2,283	2,088	2,018	1,977	2,211	2,330
Total unfinished gasoline	9,323	8,687	8,727	9,005	8,482	8,614	8,934	8,659	8,478	7,874	8,882	9,192
Total finished and unfinished gasoline:												
East Coast	21,539	22,450	22,530	22,304	20,584	20,239	20,687	20.634	19,604	18,551	19,639	20,169
Appalachian	3,484	3,791	3,775	3,767	3,695	3,293	3,161	3,047	3,154	2,913	3,108	3,128
Indiana, Illinois, Kentucky, etc	19,411	21,145	22,920	21,146	18,384	15,895	15,362	15,087	14,763	14,118	15,718	17,046
Oklahoma, Kansas, Missouri, etc	9,540	10,292	10,626	9,938	8,850	7,968	6,696	6,940	6,958	6,738	7,984	8,332
Texas Inland	3,727	4,171	4,099	4,074	3,534	3,287	2,939	2,726	2,464	2,287	2,677	2,930
Texas Gulf Coast	15,226	15,689	14,903	13,891	14,086	14,930	13,793	14,474	14,877	14,828	14,445	16,650
Louisiana Gulf Coast	6,053	4,882	5,266	5,391	4,577	4,221	4,396	4,433	4,744	5,327	4,722	4,714
Arkansas, Louisiana Inland, Mississippi, etc	2,036	2,349	2,009	1,886	1,810	1,589	1,553	1,580	1,528	1,443	1,611	1,478
Rocky Mountain	2,672	3,119	3,219	3,123	3,195	2,929	2,446	1,825	1,511	1,409	1,830	2,173
California	15,935	15,784	16,332	16,204	16,494	15,423	14,970	15,103	14,757	14,970	15,817	15,683
Total: 1947	99,623	103,672	105,679	101,724	95,209	89,774	86,003	85,849	84,360	82,584	87,551	92,303
1946	102,394	104,836	104,161	98,744	93,960	91,971	87,778	86,745	87,021	85,952	88,587	92,742

[1] Final figures.
[2] Includes stocks of finished gasoline at refineries, bulk terminals, and in pipe lines.

The principal changes in stocks of finished gasoline by refinery districts in 1947 were increases of 1.3 million barrels in the Texas Gulf and 0.7 in the East Coast. Declines occurred in the other districts, including 1.0 million in the Indiana–Illinois district, 0.7 million in the Texas Inland, 0.5 in the Louisiana Gulf district, and 0.4 million barrels each in the Oklahoma–Kansas–Missouri, and California districts, and 0.3 million in the Appalachian district.

Stocks may be expressed in terms of days' supply by dividing the stocks at the end of a month by the daily average total demand for the succeeding month. Using this basis, the stocks of finished gasoline represented 43.4 days' supply in December 1946 and 40.5 days' supply in December 1947.

Prices.—Gasoline prices followed the upward trend in crude-oil value in 1947. The average price of Regular-Grade gasoline at Oklahoma refineries rose from 6.31 cents per gallon in 1946 to 8.42 cents in 1947. In 1947 the average price per gallon was 7.25 cents in January and February; rose to 7.80 cents in March and to 8.13 cents in April; continued to rise in May, June, July, and August, and reached 8.69 cents in September; rose to 9.09 cents in October, and 9.13 cents in November; and jumped to 10.30 cents per gallon in December with the last major increase in the price of crude oil.

The average dealers' net price for Regular-Grade gasoline (exclusive of tax) in 50 representative cities in the United States supplies an index of gasoline prices at the wholesale level. This average price, according to the American Petroleum Institute, rose from 10.40 cents a gallon in 1946 to 12.33 cents in 1947, an increase of 19 percent for the year. Starting at 11.27 cents on January 1, 1947, the price rose sharply to 12.46 cents by April 1, and reached 12.69 cents by September 1 and 13.14 cents per gallon by December 1. In the same series, the average service-station price, including State and local taxes but not the Federal tax, rose from 19.27 cents per gallon in 1946 to 21.61 cents in 1947. Including the Federal tax of 1.50

Average monthly prices of gasoline in the United States, 1946–47, in cents per gallon

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave. for year
1946													
Monthly average at refineries in Oklahoma, 73–75 octane [1]	5.72	5.62	5.50	5.52	5.72	5.90	6.15	6.88	7.12	7.13	7.14	7.25	6.31
Average of 50 cities on 1st of month: [2]													
Dealers' net (ex. tax)	10.07	9.99	9.86	9.86	9.89	9.90	9.99	10.67	11.10	11.13	11.12	11.18	10.40
Service station (including State and local taxes only)	18.74	18.71	18.72	18.69	18.70	18.72	18.77	19.67	20.10	20.08	20.11	20.20	19.27
1947													
Monthly average at refineries in Oklahoma, 73–75 octane [1]	7.25	7.25	7.80	8.13	8.19	8.25	8.34	8.66	8.69	9.09	9.13	10.30	8.42
Average of 50 cities on 1st of month: [2]													
Dealers' net (ex. tax)	11.27	11.41	11.42	12.46	12.47	12.43	12.44	12.56	12.69	12.59	13.03	13.14	12.33
Service station (including State and local taxes only)	20.23	20.34	20.43	21.67	21.67	21.72	21.83	21.98	22.15	22.10	22.57	22.65	21.61

[1] National Petroleum News.
[2] American Petroleum Institute; compiled by The Texas Co.

cents per gallon, the average price to the consumer rose from 20.77 cents per gallon in 1946 to 23.11 cents per gallon in 1947. The average of all taxes for the year, shown in the 50-city survey, was 6.08 cents per gallon in 1946 and 6.18 cents in 1947. The Federal tax remained the same at 1.50 cents per gallon, so that the small increase was all in State and local taxes.

Exports.—Exports of motor fuel (including shipments to noncontiguous Territories) rose from 45.3 million barrels in 1946 to 47.5 million in 1947. The exports of aviation gasoline, included in the total, rose from 2.3 million barrels in 1946 to 5.1 million in 1947. The shipments from continental United States to noncontiguous Territories rose from 3.5 million barrels in 1946 to 5.0 million in 1947. These figures indicate that all the gain in total exports was due to the increase in aviation-gasoline export and that most of the gain in exports by destination was to the noncontiguous Territories.

Exports of motor fuel to Europe declined from 26.2 million barrels in 1946 to 22.9 million in 1947. Shipments to the United Kingdom rose from 12.6 million barrels in 1946 to 15.9 million in 1947 while shipments to France declined from 5.5 million in 1946 to 2.6 million barrels in 1947. Exports of motor fuel to Canada increased from 4.7 million barrels in 1946 to 6.1 million in 1947. Exports to Australia and New Zealand rose from 2.5 million barrels in 1946 to 3.8 million in 1947.

KEROSINE AND RANGE OIL

The domestic demand for kerosine continued to expand noticeably in 1947, while exports declined. The production of kerosine during the year was adequate to cover all requirements plus a small quantity added to stocks. The salient factors for kerosine in 1947 differed from those prevailing in 1946, when production not only satisfied greatly increased domestic and export demands, but there was in addition a large volume diverted to storage.

An unusual gain (29 percent) in kerosine production in 1946 was not repeated in 1947, as the total—110,412,000 barrels—was only 6 percent over the 1946 quantity of 104,385,000 barrels. The increase in 1947 was the result of higher crude runs (7 percent over the 1946 volume), while the above-average expansion in kerosine production in 1946 was due mostly to a higher yield (6.0 percent in 1946 compared with 4.7 percent in 1945), as crude runs at refineries for 1946 were only slightly above those of the preceding year.

Gains in kerosine production were reported for all refinery districts in 1947 except the Oklahoma–Kansas–Missouri and Texas Gulf Coast areas. Outstanding percentage gains in kerosine output in 1947 were indicated for the Indiana–Illinois–Kentucky, Texas Inland, Arkansas and Louisiana Inland, and California refinery districts. It should be added, however, that for these several areas only the kerosine produced in the Indiana–Illinois–Kentucky group of States is relatively important in volume, and there the gain in 1947 (due to increased crude runs and a higher percentage yield) was 21 percent over the 1946 total. About 16 percent of all the kerosine made in 1947 was credited to the Louisiana Gulf Coast district; and there, although the 1947 percent yield was lower, the output increased by 9 percent owing to greatly stepped-up crude runs to stills. Similar conditions (a lower percentage yield coupled with increased crude runs) prevailed in the East Coast district, and there the kerosine production in 1947 showed a 3-percent gain over 1946. The small declines in kerosine production in 1947 for the Texas Gulf Coast area (3 percent below 1946) and the Oklahoma-Kansas-Missouri area (4 percent under 1946) were, for both districts, the result of lower percentage yields, as crude runs increased. There were 8-percent and 10-percent gains in kerosine outputs reported respectively for the Appalachian and Rocky Mountain districts in 1947, although the quantities involved were relatively small.

Salient statistics of kerosine in the United States, 1946–47, by months and districts

Month and district	Production (thousands of barrels)		Yield (percent)		Domestic demand (thousands of barrels)		Stocks (thousands of barrels)	
	1946	1947 [1]	1946	1947 [1]	1946	1947 [1]	1946	1947 [1]
By months:								
January	9,688	9,415	6.9	6.4	11,167	12,325	8,330	13,732
February	9,506	9,243	7.3	6.8	9,585	10,532	7,848	11,493
March	9,852	9,476	6.8	6.3	7,958	10,078	9,292	9,811
April	8,396	8,854	6.0	6.3	5,994	8,082	10,992	9,625
May	8,887	9,284	6.0	6.1	6,338	6,068	12,741	12,609
June	8,376	8,717	5.8	5.7	5,185	5,910	14,318	14,653
July	8,435	9,117	5.6	5.6	5,338	5,348	16,403	17,651
August	8,179	8,970	5.4	5.5	4,321	5,447	19,458	20,824
September	7,825	8,547	5.4	5.4	5,288	6,580	21,251	22,276
October	8,566	9,308	5.8	5.6	7,502	8,163	21,978	22,750
November	7,893	9,352	5.6	5.9	8,899	11,070	20,528	20,626
December	8,782	10,129	5.9	6.1	11,513	12,904	17,081	17,722
Total	104,385	110,412	6.0	6.0	89,088	102,507	17,081	17,722
By districts:								
East Coast	13,832	14,257	5.0	4.8	(2)	(2)	7,806	7,177
Appalachian	3,309	3,570	5.9	5.9			477	406
Indiana-Illinois-Kentucky, etc.	15,156	18,324	5.4	6.1			2,006	2,861
Oklahoma-Kansas-Missouri, etc.	9,116	8,792	6.6	5.7			971	843
Texas Inland	4,673	5,477	5.9	6.5			402	554
Texas Gulf Coast	35,284	34,119	8.3	7.8			2,921	2,478
Louisiana Gulf Coast	15,954	17,394	13.2	12.4			1,436	1,801
Arkansas-Louisiana Inland, and Mississippi	2,067	2,578	9.4	10.4			358	261
Rocky Mountain	1,136	1,250	2.4	2.4			106	169
California	3,858	4,651	1.4	1.5			598	1,172
Total	104,385	110,412	6.0	6.0	89,088	102,507	17,081	17,722

[1] Subject to revision.
[2] Figures not available.

A marked gain in the domestic demand for kerosine, evident in 1946 when requirements were 18 percent over 1945, was repeated in 1947 as the indicated total of 102,507,000 barrels was 15 percent above the corresponding demand of 89,088,000 barrels for 1946. This active domestic market for kerosine is continuing, as the demand through May 1948 is in turn 15 percent above the comparative total of 1947. The domestic demand for kerosine cannot be shown by refinery districts, as the interdistrict movements and import and export totals for the individual areas are not readily available.

Exports of kerosine, which registered large gains in both 1945 and 1946, declined from 8,637,000 barrels in 1946 to 7,264,000 in 1947—a shrinkage of 16 percent. The larger share of the kerosine shipped abroad was credited to the United Kingdom; however, consignments to that destination dropped from 3,013,000 barrels in 1946 to 1,429,000 in 1947. In contrast, kerosine exports to Canada rose noticeably from 602,000 barrels in 1946 to 3,300,000 in 1947. Shipments of kerosine to most other countries declined sharply in 1947 compared with 1946.

Sales of kerosine in the United States, 1945–46, by regions, States, and uses [1]

[Thousands of barrels]

Region [2] and State	Sold as range oil		Tractor fuel		All other uses		Total	
	1945	1946	1945	1946	1945	1946	1945	1946
Pacific Coast:								
California	381	250	24		1,286	1,221	1,691	1,471
Oregon	32	40			160	152	192	192
Washington	32	46			226	297	258	343
Arizona	27	31	1		113	112	141	143
Nevada	3	2			13	15	16	17
Rocky Mountain:								
Idaho	7	13	12	11	41	45	60	69
Montana	30	48	51	70	56	63	137	181
Wyoming	10	19	22	21	27	25	59	65
Utah	6	11	7	7	18	18	31	36
Colorado	40	65	60	107	81	83	181	255
New Mexico	89	142	51	48	84	99	224	289
North Central:								
North Dakota	97	113	184	193	94	126	375	432
South Dakota	103	138	149	192	91	112	343	442
Minnesota	381	515	237	245	450	478	1,068	1,238
Nebraska	260	335	143	173	211	241	614	749
Iowa	347	415	831	896	624	777	1,802	2,088
Wisconsin	300	369	384	442	474	571	1,158	1,382
Illinois	1,822	2,138	451	516	1,772	2,049	4,045	4,703
Indiana	314	399	256	278	1,123	1,221	1,693	1,898
Michigan	429	570	467	513	820	915	1,716	1,998
Ohio	559	731	197	248	552	611	1,308	1,590
Kentucky	133	197	112	103	605	693	850	993
Tennessee	386	449	178	194	728	803	1,292	1,446
South Central:								
Missouri	557	660	174	213	817	982	1,548	1,855
Kansas	179	217	274	351	353	457	806	1,025
Texas	1,092	1,362	788	849	2,628	3,016	4,508	5,227
Oklahoma	274	381	251	284	712	892	1,237	1,557
Arkansas	369	466	230	263	625	815	1,224	1,544
Louisiana	203	253	224	238	827	1,031	1,254	1,522
Mississippi	96	127	165	203	503	661	764	991
Alabama	186	240	118	109	540	685	844	1,034
New England:								
Maine	1,402	1,636	5	6	48	56	1,455	1,698
New Hampshire	839	982	1	2	11	21	851	1,005
Vermont	442	505	2	2	62	78	506	585
Massachusetts	10,785	12,838			433	478	11,218	13,316
Rhode Island	2,048	2,423	3		65	68	2,116	2,491
Connecticut	3,651	4,219		1	95	118	3,746	4,338
Middle Atlantic:								
New York	6,994	8,204	76	78	1,099	1,189	8,169	9,471
New Jersey	3,545	4,195	52	65	1,040	1,174	4,637	5,434
Pennsylvania	1,354	1,658	95	112	1,172	1,297	2,621	3,067
Delaware	132	172	1	1	64	76	197	249
Maryland	691	807	9	17	550	614	1,250	1,438
District of Columbia	125	155	1	1	88	110	214	266
South Atlantic:								
Virginia	419	526	19	26	667	771	1,105	1,323
West Virginia	41	61	11	10	172	234	224	305
North Carolina	858	1,075	109	114	681	758	1,648	1,947
South Carolina	320	410	79	91	566	680	965	1,181
Georgia	394	536	104	131	580	609	1,078	1,276
Florida	756	961	139	120	642	844	1,537	1,925
Total	43,540	52,105	6,747	7,544	24,689	28,441	74,976	88,090

[1] Figures for 1947 by States not yet available.
[2] States are grouped according to petroleum-marketing territories rather than to conventional geographic regions.

A large gain in stocks of kerosine realized in 1946 was not repeated in 1947, as the year-end total of 17,722,000 barrels was only slightly above (4 percent) the 1946 quantity of 17,081,000 barrels. Kerosine held at refineries of 9,940,000 barrels at the end of 1947 was 2 percent above the 1946 item of 9,772,000 barrels. The gain for quantities reported at bulk terminals was at a higher rate—about 7 percent—or from 7,309,000 barrels at the close of 1946 to 7,782,000 for 1947. Kerosine in storage at the end of 1947 represented a 33-day supply for both the domestic and export markets at the January 1948 rate of demand. This is a decline from 1946, when the year-end inventory was sufficient for 41 days.

Kerosine stocks declined in 5 of the 10 refinery districts in 1947, which is somewhat different from what happened in 1946, when all areas of the country reported increased inventories. Kerosine stored in the Indiana–Illinois–Kentucky district continued to mount, and the 1947 year-end total of 2,861,000 barrels was 43 percent above the 1946 item of 2,006,000 barrels. Incidently, kerosine stocks held in the area increased from 12 percent of the national total in 1946 to a 16-percent share in 1947. Year-end stocks of kerosine in the Louisiana Gulf Coast, a supply area, rose by a quarter from 1,436,000 barrels in 1946 to 1,801,000 in 1947, while in contrast, inventories in the Texas Gulf district—the most important supply area—declined by 15 percent from 2,921,000 barrels in 1946 to 2,478,000 in 1947. Kerosine stored in the east coast, an important consuming area, which doubled in 1946, dropped from 7,806,000 barrels in 1946 to 7,177,000 in 1947; furthermore, the volume declined from 46 percent of the national total in 1946 to about 41 percent in 1947. Kerosine stocks reported for the remaining districts are not nationally important. Quantities declined in the Appalachian, Oklahoma–Kansas–Missouri, and Arkansas-Louisiana Inland districts in 1947, while gains were indicated for the Texas Inland, Rocky Mountain, and California refinery areas. Kerosine held in the California district nearly doubled, rising from 598,000 barrels at the end of 1946 to 1,172,000 in 1947.

The sharp upward trend in the demand for kerosine in 1946 is reflected in the annual survey of sales made by the Bureau of Mines. Deliveries of kerosine for domestic consumption increased from 74,976,000 barrels in 1945 to 88,090,000 in 1946—a 17-percent gain compared with an increment of 5 percent in 1945. All parts of the country reported gains in kerosine deliveries in 1947 except the California marketing area, where the demand declined for a third consecutive year. Over 70 percent of the kerosine is sold in the New England, Middle Atlantic, and North Central States, where it is used principally as range-burner fuel for cooking, hot water, and space heating. In the New England States, where about 27 percent of all kerosine is sold, deliveries increased by 18 percent from 19,892,000 barrels in 1945 to 23,433,000 in 1946. Sales of kerosine in the Middle Atlantic area account for about 23 percent of the national total, and there the demand rose by 17 percent from 17,088,000 barrels in 1945 to 19,925,000 in 1946. There was a similar percentage gain in kerosine sales in the North Central States from 16,264,000 barrels in 1945 to 18,959,000 in 1946. Important quantities of kerosine are also sold in the South Central States, and deliveries in that particular market were up 21 percent from 12,185,000 barrels in 1945 to 14,755,000 in 1946. The demand for kerosine is not relatively important in the South Atlantic and Rocky Mountain areas; however, substantial gains in the volume of sales were indicated in 1946. Kerosine marketed on the Pacific coast declined from 2,298,000 barrels in 1945 to 2,166,000 in 1946.

Sales of range oil in the United States, 1944–46, by States [1]

[Thousands of barrels]

	1944	1945	1946	
			Total	Percent of total
Massachusetts	10,993	11,227	13,296	22.0
New York	7,013	7,122	8,546	14.1
Connecticut	3,918	3,995	4,442	7.3
New Jersey	3,504	3,756	4,426	7.3
Illinois	3,139	3,345	3,934	6.5
Rhode Island	2,042	2,132	2,524	4.2
Pennsylvania	1,055	1,365	1,913	3.2
Maine	1,435	1,522	1,763	2.9
Michigan	1,101	1,226	1,423	2.4
Texas	931	1,111	1,383	2.3
Missouri	727	867	1,111	1.8
North Carolina	761	885	1,106	1.8
Minnesota	858	926	1,097	1.8
Wisconsin	864	949	1,072	1.8
New Hampshire	808	873	1,028	1.7
Florida	735	804	1,027	1.7
Iowa	964	1,035	852	1.4
Ohio	562	669	852	1.4
Maryland	690	696	815	1.3
Indiana	582	604	707	1.2
Georgia	427	471	616	1.0
Other States	4,527	5,441	6,631	10.9
Total	47,636	51,021	60,564	100.0

[1] Figures for 1947 by States not available when table was compiled.

About 60 percent of all kerosine is reported as sold for range oil, and this demand increased from 43,540,000 barrels in 1945 to 52,105,000 in 1946, a gain of 20 percent compared with a 6-percent increment in 1945. Appreciable quantities of kerosine (about 9 percent of the total) are delivered for tractor fuel, and such requirements rose from 6,747,000 barrels in 1945 to 7,544,000 in 1946. Sales of kerosine for various other uses, including lamp fuel, jet-propulsion fuel, agricultural, and industrial consumption, account for about one-third of all kerosine sales, and these miscellaneous demands increased from 24,689,000 barrels in 1945 to 28,441,000 in 1946—a gain of 15 percent.

Some No. 1 fuel oil, in addition to kerosine, is delivered for range fuel. This light grade of fuel oil so reported increased by 13 percent from 7,481,000 barrels in 1945 to 8,459,000 in 1946. These quantities should be added to the kerosine in order to determine the total demand for range fuel. This adjustment indicates a market for 60,564,000 barrels of range fuel in 1946, or a total 19 percent above the 1945 quantity of 51,021,000 barrels

Monthly reports of the Bureau of Mines indicate domestic sales of 102,507,000 barrels of kerosine for all purposes in 1947. A breakdown of this total into principal uses, as taken from the annual survey of sales, is not available at this time. However, it is estimated that approximately 61,300,000 barrels were sold for range fuel, 8,500,000 for tractor fuel, and the balance—32,707,000 barrels—for miscellaneous uses.

Monthly average prices of kerosine in the United States, 1946–47

[Platt's Oil Price Handbook]

	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1946													
41°–43° gravity w. w. kerosine at refineries, Oklahoma cents per gallon	4.48	4.88	4.88	4.88	4.88	4.88	4.94	5.43	5.39	5.38	5.41	5.77	5.10
Kerosine (and/or No. 1 fuel oil) at New York Harbor cents per gallon	6.10	6.10	6.10	6.10	6.10	6.10	6.15	6.72	6.70	6.70	6.70	6.99	6.38
Kerosine, tank-wagon at Chicago cents per gallon	10.66	11.10	11.10	11.10	11.10	11.10	11.14	11.70	1.70	11.70	11.85	12.20	11.37
Kerosine, tank-wagon at New York City cents per gallon	9.30	9.30	9.30	9.30	9.30	9.30	9.41	10.00	10.00	10.00	10.00	10.28	9.62
1947													
41°–43° gravity w. w. kerosine at refineries, Oklahoma cents per gallon	5.81	5.81	6.57	6.99	7.00	7.00	7.01	7.20	7.25	7.58	8.00	9.09	7.11
Kerosine (and/or No. 1 fuel oil) at New York Harbor cents per gallon	7.00	6.86	7.25	7.80	7.80	7.80	7.89	8.10	8.20	8.21	8.71	9.31	7.91
Kerosine, tank-wagon at Chicago cents per gallon	12.44	12.50	12.81	13.00	13.00	13.37	13.50	13.50	13.50	13.85	14.30	15.01	13.40
Kerosine, tank-wagon at New York City cents per gallon	10.30	10.20	10.56	11.10	11.10	11.10	11.54	11.90	11.90	11.90	12.65	13.19	11.45

The pressure for kerosine and the general inflationary trend forced up representative prices by about 2 cents a gallon in 1947. Mark-ups were numerous throughout the year, and, as an example, there were 21 changes in the quotation for 41°–43° gravity, water-white kerosine at refineries in Oklahoma. An average for this grade of 5.81 cents a gallon ruling at the end of December 1946 held through January and February. Seven mark-ups in March resulted in an average quotation of 6.57 cents a gallon for the month. Changes came at frequent intervals thereafter, ending in an average price of 9.09 cents a gallon for December and an average of 7.11 cents a gallon for all of 1947 compared with 5.10 cents for 1946. Higher refinery prices for kerosine in 1947 were reflected in the quotations for kerosine, including No. 1 fuel oil at New York Harbor, and numerous upward changes were reported throughout the year. A price of 7 cents a gallon for these fuels at New York Harbor ruling at the end of December 1946 held through January 1947. Two slight downward price changes in February lowered the monthly average to 6.86 cents a gallon. An upward turn in March to 7.80 cents gave an average of 7.25 cents a gallon for the month. The 7.80 cents a gallon was quoted through June and then numerous mark-ups ended in an average of 9.31 cents a gallon for December and a weighted average of 7.91 cents a gallon for all of 1947 against 6.38 cents in 1946.

A tank-wagon price of 12.20 cents a gallon for kerosine at Chicago at the end of 1946 rose to 12.50 cents in early January. Other changes in March, June, October, and finally to 15.6 cents a gallon in December gave a year-end average price of 15.01 cents a gallon and an average of 13.40 cents for all of 1947 compared with 11.37 cents for 1946. A tank-wagon quotation of 10.30 cents a gallon for kerosine at New York in January 1947 dipped momentarily to 10.10 cents in the middle of February; however, it was back at 10.30 cents at the beginning of March. Quotations trended upward thereafter and ended at 13.60 cents a gallon in mid-December or an average of 13.19 cents for the month. The weighted average price for tank-wagon kerosine at New York was 11.45 cents a gallon for 1947 against 9.62 cents for 1946.

DISTILLATE FUEL OIL

In 1946 a greater volume of distillate fuel oil, including Diesel fuel, resulting from expanded production, transfers, and imports enabled oil companies not only to supply a higher domestic demand coupled with lower exports, but also to divert an important surplus to storage. The several items covering distillate grades of fuel oil varied somewhat in 1947, when production at a lower rate of increase, together with practically static transfers and lower imports, were not enough to meet a greatly increased demand; consequently, a draft on stocks was necessary to make up the deficit. The domestic market for distillate fuel oils increased by 23 percent from 242,894,000 barrels in 1946 to 298,221,000 in 1947. This important expansion in demand in 1947 compares with gains of about 8 percent for both 1945 and 1946. Exports of light fuel oils dropped sharply in 1945 and 1946 as war activities tapered off; however there was a small gain in 1947, when the foreign demand totaled 29,929,000 barrels compared with 29,487,000 in 1946.

Salient statistics of distillate fuel oil in the United States, 1946–47, 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	
	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]
By months:																
January	24,390	24,131	17.4	16.4	253	270			582	543	2,560	1,073	29,453	35,294	28,990	48,197
February	23,047	21,746	17.7	16.1	220	231			480	406	1,905	1,992	25,321	31,687	25,511	36,901
March	25,298	25,577	17.5	16.9	243	217			528	365	1,957	2,358	19,701	29,279	29,922	31,423
April	23,181	22,925	16.6	16.3	379	272			251	215	3,606	3,246	18,063	21,321	32,064	30,268
May	23,348	24,954	15.7	16.4	243	280			674	386	4,138	2,347	18,306	19,262	33,885	34,279
June	23,320	24,214	16.1	15.8	242	280			342	265	4,115	2,385	14,850	16,977	38,824	39,676
July	24,589	26,270	16.3	16.3	257	284		1	668	129	2,738	3,561	15,161	16,355	46,439	46,444
August	23,703	26,946	15.7	16.4	265	312			507	372	3,018	3,274	13,828	16,093	54,068	54,707
September	23,877	27,325	16.4	17.2	250	269			408	234	2,064	3,357	14,520	19,414	62,019	59,764
October	24,432	29,072	16.6	17.6	248	287			330	474	1,028	3,229	18,131	23,116	67,870	63,252
November	23,741	28,254	16.9	17.9	257	285			264	474	877	1,934	23,110	28,997	68,145	61,334
December	24,970	30,759	16.9	18.5	266	275			170	312	1,481	1,173	32,450	40,426	59,620	51,081
Total United States	287,896	312,173	16.6	16.9	3,123	3,262		1	5,204	4,175	29,487	29,929	242,894	298,221	59,620	51,081
By districts:																
East Coast	55,252	57,111	20.0	19.2											20,613	13,540
Appalachian	6,015	7,362	10.8	12.2											568	1,018
Indiana, Illinois, Kentucky, etc	36,861	45,749	13.2	15.2	447	466									6,114	7,297
Oklahoma, Kansas, Missouri, etc	21,457	26,230	15.5	17.1	760	754									2,536	3,151
Texas Inland	5,362	7,175	6.8	8.5	1,041	1,102									492	525
Texas Gulf Coast	86,469	82,850	20.4	19.0	449	470			(3)	(3)	(3)	(3)	(3)	(3)	12,150	7,782
Louisiana Gulf Coast	25,590	27,512	21.1	19.7	160	201									3,942	2,803
Arkansas, Louisiana Inland, Mississippi, etc	3,131	3,459	14.3	13.9	29	39									512	398
Rocky Mountain	6,609	8,227	13.8	15.7	237	230									452	782
California	41,150	46,498	14.4	15.4				1							12,241	13,785
Total United States	287,896	312,173	16.6	16.9	3,123	3,262		1	5,204	4,175	29,487	29,929	242,894	298,221	59,620	51,081

[1] Figures represent crude oil used as fuel on pipe lines.
[2] Subject to revision.
[3] Figures not available.

Refiners reported a production of 312,173,000 barrels of distillate fuel oil in 1947, a gain of 8 percent over the 1946 total of 287,896,000 barrels. The rate of increase in 1947 was well below the 16-percent gain realized in 1946; as a result, the new supply coming from refineries satisfied only about 95 percent of all demands compared with over a 97-percent share in 1946. Furthermore, the greatly increased production of distillates in 1946 allowed an important addition to inventory, while conversely a reduction in stocks became necessary in 1947. The percentage yield for light fuel oils rose slightly from 16.6 percent in 1946 to 16.9 percent in 1947 and this gain (including that for gasoline and naphtha) resulted in a lower yield for residual grades in the latter year. A larger volume of crude runs to stills in 1947 (7 percent over 1946) was an added factor that made possible a higher production of distillates.

All refinery districts, except the Texas Gulf Coast, produced more distillate fuel oil in 1947 than in 1946. The smaller rate of gain in production of light fuel oils in 1947 is connected largely with the outputs reported for the Texas Gulf and East Coast districts, both important supply areas. Distillates originating in the Texas Gulf Coast declined by 4 percent from 86,469,000 barrels in 1946 to 82,850,-000 in 1947. There was only a nominal increase in crude runs in this district in 1947; furthermore, the yield for distillate fuel oils dropped from well over 20 percent in 1946 to 19 percent in 1947.

The lower production in the Texas Gulf represented less than 27 percent of the total output of light fuel oils in 1947 compared with a 30-percent share in 1946. In the East Coast, an important consuming as well as a supply area for distillates, there was only a small gain in production—57,111,000 barrels in 1947 compared with 55,252,000 in 1946—resulting solely from increased crude runs (about 8 percent over 1946) as the yield declined from 20 percent in 1946 to 19 percent in 1947.

Sales of distillate fuel oil [1] in the United States, 1942–46, by uses [2]

[Thousands of barrels]

Use	1942	1943	1944	1945	1946
Railroads	6,488	8,608	10,627	14,458	17,570
Ships' bunkers (including tankers)	8,900	11,069	13,187	14,130	12,064
Gas and electric power plants	5,704	5,954	5,837	6,824	10,581
Smelters, mines, and manufacturing industries	12,617	15,125	16,953	19,071	21,317
Heating oils	121,506	112,581	111,729	121,342	142,637
Fuel oil (No. 1) sold as range oil	4,978	5,876	6,619	7,481	8,459
U. S. Navy, Army, and Coast Guard	11,269	33,383	42,879	30,366	9,385
Oil-company fuel	1,064	884	981	1,128	1,890
Miscellaneous uses	14,287	14,232	15,060	16,825	18,647
Total United States	186,813	207,712	[3] 223,872	[3] 231,625	242,550
Exports and shipments to noncontiguous Territories	21,575	24,957	43,491	33,496	29,487
Total	208,388	232,669	267,363	265,121	272,037

[1] Includes Diesel fuel.
[2] Figures for 1947 not available when table was compiled.
[3] These totals involve some duplication owing to rehandling of fuel oil initially sold to the Government.

The output of distillate fuel oil showed large gains in most of the other major producing areas. In the Indiana-Illinois-Kentucky district the quantity rose by one-fourth from 36,861,000 barrels in 1946 to 45,749,000 in 1947 due both to a higher yield (about 13 percent in 1946 and 15 percent in 1947) and to an 8-percent gain in crude runs. Refiners in the California district, where about 15 percent of the light fuel oils are produced, reported 46,498,000 barrels in 1947, a 13-percent gain over the 1946 quantity of 41,150,000 barrels. This expansion in output of distillates for the area in 1947 was also attributable to both a higher percentage yield and the running of more crude petroleum.

An important gain (22 percent) in the production of light fuel oils was made in the Oklahoma-Kansas-Missouri refinery district, where the total output was 26,230,000 barrels in 1947 compared with 21,457,000 in 1946. The Louisiana Gulf Coast produced a comparative quantity of distillates in 1947—27,512,000 barrels; however, the gain was only 8 percent over the 1946 total of 25,590,000 barrels. Crude runs were up noticeably in both these areas in 1947, which was a factor in the higher outputs of light fuel oils; however, the percentage yield dropped in the Louisiana Gulf Coast in 1947, while in the Oklahoma-Kansas-Missouri area there was a gain. The production of distillate fuel oils in the remaining refinery districts—Appalachian, Texas Inland, Arkansas and Louisiana Inland, and the Rocky Mountain—is not relatively important. Gains in output were reported for all these areas, however, and were due to increased crude runs and higher percentage yields, except for the Arkansas-Louisiana Inland district, where there was a slight decline from 14.3 percent in 1946 to 13.9 percent in 1947.

"Transfers" of light crude oil used as fuel by pipe lines must be added to the fuel-oil account. Quantities included in this classification increased from 3,123,000 barrels in 1946 to 3,263,000 in 1947 and represented about 1 percent of the total supply from all sources. The more important "transfers" are reported from the Texas Inland and Oklahoma-Kansas-Missouri refinery districts. No similar items appear in the fuel-oil figures for the East Coast and Appalachian areas.

Imports have accounted for less than 2 percent of the total supply of distillate fuel oils in recent years, and the quantity for continental United States declined by 20 percent from 5,204,000 barrels in 1946 to 4,175,000 in 1947. Most of this light fuel oil came from Curaçao, Venezuela, and Mexico.

A break-down of domestic requirements for distillate fuel oils in 1947 into quarterly periods reveals that a higher-than-average share (over 32 percent) of the demand fell in the first 3 months, when the total of 96,260,000 barrels was 29 percent over the comparative item of 74,475,000 for 1946, which total in turn was only 9 percent over that in the first quarter of 1945. The weather was not only colder in the 1947 period, but many new domestic oil burners had been installed during the year and these factors forced up the market to an unexpected level. It was also colder in the second quarter of 1947; but with less pressure for supplies as the heating season waned, deliveries of 57,560,000 barrels were only 12 percent above the 51,219,000 required in 1946. Furthermore, the domestic demand in the second quarter of 1947 represented only about 19 percent of the year's total in contrast to a 21- to 22-percent share for the same period in previous years. An expanding market was evident in the third quarter of 1947, when the indicated demand for light fuel oils—51,862,000 barrels—was 19 percent over the comparative total of 43,509,000 in 1946.

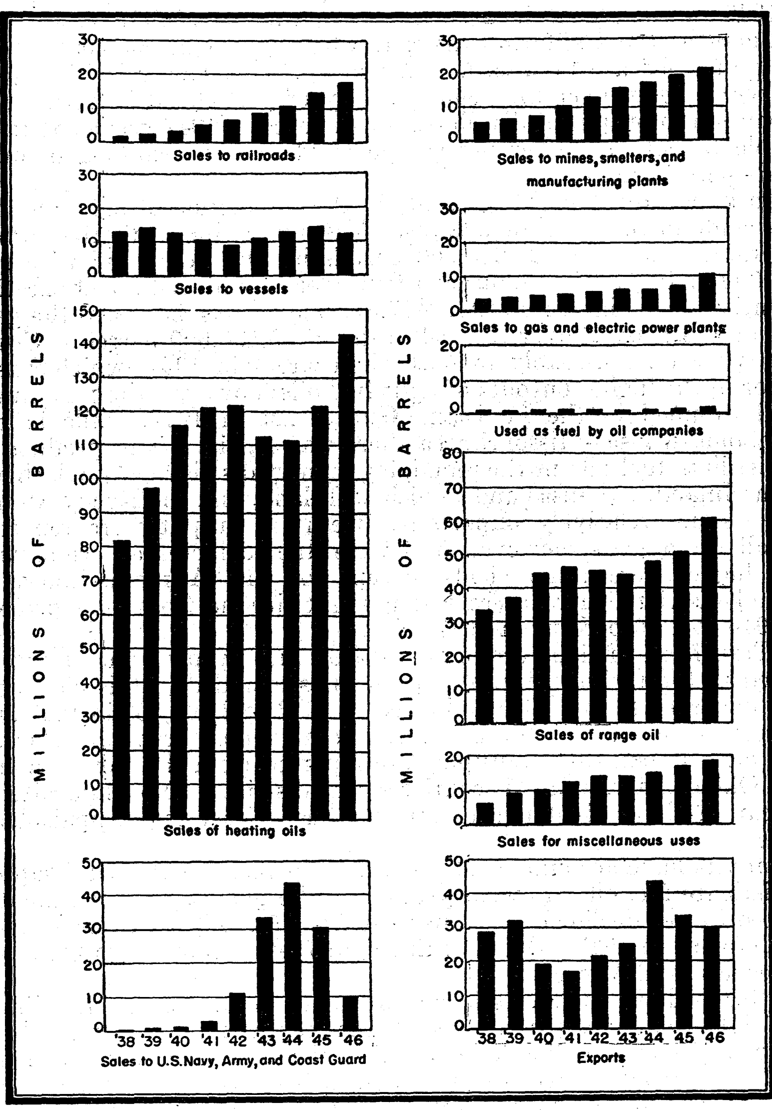

FIGURE 10.—Sales of distillate fuel oil, including Diesel oil, and range oil in the United States, 1938–46, by uses.

Here again it is noticed that the third quarterly share (17 percent of the 1947 total) was also below the average percentage for other years. Colder weather and an unusual increase in domestic burner installations are reflected in the domestic demand for light fuel oils in the fourth quarter of 1947, when the total of 92,539,000 barrels was 26 percent over the 73,691,000 delivered in the same period of 1946. The final quarterly total in 1947 represented 31 percent of the year's demand and like the percentage for the first quarter was somewhat above comparative percentage shares in previous years.

The market for light fuel oils was still very active during the first half of 1948; but with a prolonged cold spell in January and February, which caused unusual difficulties in distribution, spot shortages, and local rationing of supplies in some areas, the demand was not fully satisfied. As a result, the January–June total of 183,686,000 barrels was only 19 percent above the comparative quantity of 153,820,000 for 1947, which in turn was 22 percent over the 1946 half-year item.

Sales of distillate fuel oil [1] in the United States, 1942–46, by regions and States [2]

[Thousands of barrels]

Region [3] and State	1942	1943	1944	1945	1946
Pacific Coast:					
Washington	4,598	5,654	5,933	6,586	7,695
Oregon	2,541	2,850	2,927	3,219	4,592
California	12,820	17,552	18,032	16,753	17,840
Arizona	872	774	878	961	1,126
Nevada	635	582	715	715	766
Rocky Mountain:					
Idaho	519	433	569	597	787
Montana	502	532	989	1,745	1,381
Wyoming	317	308	744	1,231	537
Utah	424	487	571	703	839
Colorado	646	741	1,015	1,171	1,517
New Mexico	227	403	522	563	570
North Central:					
North Dakota	661	550	482	662	916
South Dakota	737	648	618	691	909
Minnesota	6,543	5,867	5,290	5,658	7,120
Nebraska	2,155	2,010	2,561	2,578	2,716
Iowa	4,039	3,758	3,528	4,633	5,149
Wisconsin	5,885	5,572	4,986	5,074	6,106
Illinois	17,641	16,177	16,056	17,174	19,635
Indiana	2,958	2,804	2,927	3,086	3,830
Michigan	7,385	6,799	6,535	7,337	8,542
Ohio	3,247	3,543	3,586	4,414	5,054
Kentucky	1,031	1,051	1,067	1,172	1,158
Tennessee	800	1,095	1,168	1,331	1,559
South Central:					
Missouri	5,499	4,814	4,900	5,364	6,362
Kansas	1,299	1,539	1,615	2,115	2,282
Texas	6,422	18,595	23,551	19,724	10,686
Oklahoma	476	666	662	676	701
Arkansas	884	1,092	1,152	1,134	1,363
Louisiana	2,555	4,408	4,961	3,825	2,762
Mississippi	541	581	627	631	777
Alabama	991	1,286	1,375	1,255	1,473
New England:					
Maine	1,190	1,062	1,012	1,149	1,440
New Hampshire	1,229	938	820	879	1,001
Vermont	607	523	575	626	699
Massachusetts	10,976	10,190	10,460	11,640	12,865
Rhode Island	2,659	2,377	2,440	3,049	3,097
Connecticut	5,279	5,452	5,789	6,210	6,784
Middle Atlantic:					
New York	28,880	29,458	27,770	29,954	33,376
New Jersey	17,635	19,017	25,535	25,964	22,201
Pennsylvania	8,432	10,225	12,925	12,618	14,781
Delaware	516	650	803	512	570
Maryland	3,628	3,795	4,026	4,976	5,271
District of Columbia	2,203	1,907	1,786	1,863	2,039
South Atlantic:					
Virginia	2,157	2,966	3,535	2,612	3,146
West Virginia	300	391	314	338	374
North Carolina	1,119	1,227	1,252	1,584	2,177
South Carolina	663	824	924	917	1,144
Georgia	1,043	900	959	1,298	1,564
Florida	2,447	2,639	2,405	2,658	3,271
Total	186,813	207,712	[4] 223,872	[4] 231,625	242,550

[1] Includes Diesel fuel oil.
[2] Figures for 1947 not yet available.
[3] States are grouped according to petroleum-marketing territories rather than to conventional geographic regions.
[4] These totals involve some duplication due to rehandling of fuel oil initially sold to the Government.

A very unfavorable situation in distillate fuel-oil stocks developed during 1947, and the year-end total of 51,081,000 barrels was 14 percent below the comparative 1946 figure of 59,620,000 barrels. This decline is in contrast to a desirable "build-up" in volume by 67 percent in 1946 over 1945. The weakness in the distillate stocks at the end of 1947 was largely associated with the big decreases in quantities held on the east coast, an area which consumes nearly half of the Nation's total of light fuel oils, and in the Texas and Louisiana Gulf coasts, supply districts for the important East coast market. The inadequacy of distillate stocks in these strategic areas was a factor that made for the tightness of supplies during the prolonged cold spell in the early months of 1948. The weak stock situation for distillate grades of fuel oil at the end of 1947 perhaps can be better realized when it is noticed that quantities held represented only a 36-day supply for all needs at the rate of demand in the following January in contrast to a 53-day reserve at the end of 1946. It also can be stated that 23,842,000 barrels of light fuel oils (8 percent of the total supply) were added to storage in 1946, while in contrast 8,539,000 barrels had to be withdrawn from stocks in 1947 to satisfy the domestic and export markets.

Distillate fuel-oil stocks held at refineries declined by 16 percent from 38,708,000 barrels in 1946 to 32,413,000 at the end of 1947. This shrinkage is in contrast to a 62-percent "build-up" during 1946 over the December 1945 total. Distillates reported at bulk terminals expanded by a desirable 75 percent in 1946 over 1945; however in 1947 there was an 11-percent drop from 20,912,000 barrels in 1946 to 18,668,000 at the close of 1947.

Stocks of distillate fuel oils carried in the important East coast dropped from 20,613,000 barrels in 1946 to 13,540,000 in December 1947—a 34-percent shrinkage. Stated in another way, supplies held in the area at the end of 1947 represented about a quarter of the national total compared with over a third of the inventory twelve months previous. The East coast receives a large part of its distillate fuel oil by tanker from the Gulf Coast refinery districts; with smaller inventories at the close of 1947—7,782,000 barrels in 1947 compared with 12,150,000 in 1946 for the Texas Gulf and 2,803,000 in 1947 against 3,942,000 in 1946 for the Louisiana Gulf—these supply areas were at some disadvantage in making adequate shipments to eastern points during the scarcity period of early 1948.

Light fuel oil moves from the Texas Inland and Oklahoma-Kansas-Missouri refinery districts by rail and inland water routes to markets to the north and east. The supply situation for distillates was much better in this general area in 1947; and, even with mounting demands stocks continued to accumulate as they did in 1946. In the Oklahoma–Kansas–Missouri district the year-end inventory increased by a quarter from 2,536,000 barrels in 1946 to 3,151,000 in 1947. Only small quantities of light fuel oils are carried in the Texas Inland area; however, the total rose from 492,000 barrels in 1946 to 525,000 at the close of 1947. The Indiana–Illinois–Kentucky district is an important consuming as well as a supply area for distillate fuel oils, and year-end quantities there increased by 19 percent from 6,114,000 barrels in 1946 to 7,297,000 in 1947.

Distillate fuel-oil inventories in the California refinery district mounted by 13 percent from 12,241,000 barrels at the end of 1946 to 13,785,000 in 1947. The light fuel oils stored in California in December 1947 represented 27 percent of the national total and were greater in volume than those reported in the important East Coast area for the first time since 1942. Year-end stocks of distillates credited to the Appalachian, Rocky Mountain, and Arkansas and Louisiana Inland refinery districts are not relatively large in volume; however the quantities nearly doubled in the first two areas in 1947 over 1946, and there was a decline of 22 percent in volume for the latter area in the same period.

General inflation and a pressure for supplies were strongly reflected in the steady rising prices for distillate grades of fuel oil in 1947. The quotation for No. 2 Straw fuel oil at refineries in Oklahoma was revised upward 28 times during the year, new postings appearing every month except during April. An average price of 4.98 cents a gallon for December 1946 was nearly doubled (9.28 cents a gallon) by December 1947, and the weighted average value for all of 1946 of 4.33 cents a gallon advanced to a comparative 6.74 cents for 1947. Quotations for No. 2 fuel oil at New York Harbor followed the sharp upward trend in evidence during the year, advancing from 6.43 cents a gallon in December 1946 to 8.34 at the close of 1947, and the weighted average for the year mounted from 5.93 cents a gallon for 1946 to 7.02 cents for 1947.

Diesel oil at shore plants in the New York Harbor area rose over a series of 11 price changes from 6.6 cents a gallon at the close of 1946 to an average of 9.7 cents in late December 1947. The quotation for this grade at New York Harbor averaged 7.31 cents a gallon for all of 1947 compared with 6.0 cents in 1946. Diesel fuel for ships' bunkers at representative ports increased about a third during 1947. Ships' Diesel oil at New York Harbor selling at $2.73 a barrel at the close of 1946 rose to an average of $3.54 for December 1947, while this same fuel for vessels loading at Gulf ports advanced steadily during 1947, except for a fractional drop in February, from $2.31 to $2.30 a barrel. There were fewer price changes during 1947 for ships' Diesel fuel at San Pedro, Calif.; however a substantial advance is found in the quotations from $2.20 a barrel in late December 1946 to $3.18 in the closing days of 1947. This same grade of Diesel fuel for ships' bunkers sells at a slightly higher price at San Francisco, where quotations ranged from $2.25 a barrel at the end of 1946 to $3.39 on December 29, 1947.

There was also a sharp upward trend in the retail as well as in the wholesale prices of light fuel oils during 1947, according to retail price records for various fuels in a number of cities as compiled and published monthly by the Bureau of Labor Statistics, United States Department of Labor. The December 1946 quotation of 9.04 cents a gallon for No. 2 distillate fuel oil at New York was shaded a fraction of a cent in the first quarter of 1947. However, there was a steady advance during the balance of the year to a value of 11.81 cents a gallon in December. The quotation for this same grade of light fuel oil at Chicago failed to show a decline in the first quarter of 1947 and the advance was uninterrupted from 8.87 cents a gallon in December 1946 to 11.94 cents in October 1947. The November price was down slightly to 11.83 cents a gallon, and this decline was followed by a rise to 13.16 cents in December 1947.

Monthly average prices of distillate fuel oil and Diesel fuel in the United States, 1946–47

[Platt's Oil Price Handbook]

	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1946													
No. 2 straw fuel oil at refineries, Oklahoma ....cents per gallon..	3.70	4.13	4.13	4.13	4.13	4.13	4.19	4.57	4.56	4.61	4.67	4.98	4.33
No. 2 fuel oil at New York Harbor cents per gallon..	5.45	5.70	5.70	5.70	5.70	5.70	5.75	6.33	6.30	6.29	6.13	6.43	5.93
Diesel oil, shore plants, New York Harbor ....cents per gallon..	5.29	5.70	5.70	5.70	5.70	5.70	5.70	6.35	6.50	6.50	6.50	6.60	6.00
Diesel oil for ships:													
New York......dollars per barrel..	2.19	2.36	2.36	2.36	2.36	2.36	2.37	2.61	2.61	2.61	2.65	2.73	2.46
Gulf Coast..................do....	1.65	1.76	1.86	1.86	1.86	1.86	1.88	2.09	2.13	2.13	2.21	2.31	1.97
California..................do....	1.45	1.51	1.77	1.77	1.77	1.77	1.77	2.39	2.20	2.20	2.20	2.20	1.91
1947													
No. 2 straw fuel oil at refineries, Oklahoma ....cents per gallon..	5.02	5.11	5.89	6.25	6.32	6.41	6.76	7.18	7.30	7.43	7.89	9.28	6.74
No. 2 fuel oil at New York Harbor cents per gallon..	6.29	6.00	6.31	6.80	6.82	7.06	7.19	7.20	7.20	7.22	7.77	8.34	7.02
Diesel oil, shore plants, New York Harbor ....cents per gallon..	6.60	6.60	6.78	7.15	7.15	7.18	7.31	7.40	7.40	7.43	8.09	8.63	7.31
Diesel oil for ships:													
New York......dollars per barrel..	2.73	2.73	2.81	2.97	2.98	2.98	2.98	3.02	3.07	3.07	3.34	3.54	3.02
Gulf Coast..................do....	2.31	2.30	2.39	2.46	2.46	2.48	2.58	2.69	2.72	2.72	2.96	3.20	2.60
California..................do....	2.22	2.31	2.41	2.60	2.60	2.60	2.75	2.75	2.75	2.75	2.77	2.75	2.61

California has not shipped any distillate fuel oil by tankers to the East coast since 1941; however, this traffic was revived in 1947, when a total of 161,000 barrels was reported in this movement. The California refinery district (California, Oregon, Washington, Arizona, and Nevada) also makes some rail and truck shipments of distillate fuel oil to other areas. This trade has increased from 636,000 barrels in 1945 to 870,000 in 1946 and to 1,131,000 in 1947. There is a contramovement of distillates by rail and truck into the West Coast area from other States, and these receipts totaled 309,000 barrels in 1947 compared with 289,000 in 1946 and 251,000 in 1945.

The tanker movement of distillate fuel oil from the Gulf area to the East coast reached another new peak in 1947 according to published records of the Oil and Gas Division, United States Department of the Interior, when the total was 80,533,000 barrels compared with 68,851,000 in 1946. Most of the light fuel oil carried in this traffic originates in Texas (67,286,000 barrels in 1947 and 60,115,000 in 1946) while the balance (13,247,000 barrels in 1947 and 8,736,000 in 1946) comes from petroleum refineries in Louisiana.

Some distillate fuel oil from the Gulf coast is distributed by barges to points on the Mississippi River and its tributaries. This traffic dropped sharply from 4,352,000 barrels in 1945 to 1,879,000 in 1946; however there was an increase to 4,698,000 barrels in 1947. Most of this light fuel oil is loaded in Louisiana; very little of it is credited to Texas. Suppliers in Arkansas also distribute some distillate grades of fuel oil by barges operating on the Mississippi River system. This trade slumped after the close of World War II to a negligible 83,000 barrels in 1946; however there was a slight upturn to 127,000 in 1947. Virtually all the distillates moved by barge on the Mississippi River are consumed in districts 2 and 3. Very little of the supply reaches the western edges of district 1.

A tanker rate of 38 cents a barrel, effective October 15, 1945, for No. 2 fuel oil shipped from Gulf ports to Atlantic coast terminals—not east of New York—remained in force throughout 1946 and 1947.

Exports of distillate fuel oil at a war peak of 43,491,000 barrels in 1944 dropped to 29,487,000 in 1946, and the 1947 total remained at approximately the same level—29,929,000 barrels. One tenth of the available light-fuel-oil supply was exported in 1946; 9 percent of it was shipped overseas in 1947. Greatly increased amounts of distillate fuel oil were credited to Canada (1,649,000 barrels in 1946 and 5,797,000 in 1947) and Sweden (1,627,000 barrels in 1946 and 2,680,000 in 1947), while sharp declines were noted for the United Kingdom (14,399,000 barrels in 1946 and 8,973,000 in 1947), France (2,234,000 barrels in 1946 and 675,000 in 1947), and U. S. S. R. (1,075,000 barrels in 1946 and 451,000 in 1947). In addition, increases in 1947 were reported for Mexico, Cuba, Denmark, Belgium, Italy, China, and Australia, while losses were evident for New Zealand and Spain.

RESIDUAL FUEL OIL

A larger available supply of residual fuel oil in 1947 from increased production, transfers, and imports enabled distributors to meet expanded domestic and export markets with only a negligible draft on stocks. This situation differed from conditions prevailing in 1946, when a lower demand, both domestic and foreign, left a considerable surplus, which was diverted to storage and this addition to inventory was made even though the production of heavy fuel oil declined noticeably during the year. The indicated domestic demand for residual grades of fuel oil increased by 8 percent from 480,029,000 barrels in 1946 to 518,394,000 in 1947. The gain in 1947 is in contrast to a shrinkage of 9 percent in domestic requirements in 1946 compared with the 1945 total. The exports of heavy fuel oil have declined steadily from 14,894,000 barrels in 1943 to 9,188,000 in 1946; however, this foreign trade increased to 10,745,000 barrels in 1947.

Although crude petroleum run through refineries increased by 7 percent in 1947 over 1946, the production of residual fuel oil—447,795,000 barrels in 1947—was only about 4 percent above the 1946 total of 431,364,000 barrels. This gain in the production of heavy fuel oil in 1947 is in contrast to an 8-percent decline in 1946 from the quantity reported for 1945. The smaller relative gain (compared to the increase in crude runs) in residual-fuel-oil production in 1947 was connected with a somewhat lower yield—24.2 percent in 1947 compared with 24.9 percent in 1946. A further cut in the yield of residuals in 1947 as well as the one made in 1946 enabled refiners to increase the outputs of gasoline and the distillate fuels. Residual fuel oil produced in 1947 covered 85 percent of the total demand, or slightly less than the comparative 86 percent for 1946 and the 88 percent for 1945.

Sales of residual fuel oil [1] in the United States, 1942–46, by uses [2]

[Thousands of barrels]

Use	1942	1943	1944	1945	1946
Railroads	99,996	116,278	114,535	112,297	100,305
Ships' bunkers (including tankers)	37,817	62,196	92,069	100,365	88,185
Gas and electric power plants	28,101	30,858	34,476	34,532	50,921
Smelters, mines, and manufacturing industries	84,515	84,219	86,664	91,176	95,177
Heating oils	47,483	42,670	40,474	43,874	49,734
U. S. Navy, Army, and Coast Guard	56,531	92,713	101,347	97,485	35,822
Oil-company fuel	44,871	47,123	55,363	57,336	58,054
Miscellaneous uses	6,019	6,420	4,484	5,200	5,028
Total United States	405,333	[3] 482,477	[3] 529,412	[3] 542,265	483,226
Exports and shipments to noncontiguous Territories	12,095	14,894	12,536	11,669	9,188
Total	417,428	497,371	541,948	553,934	492,414

[1] Includes Navy grade and crude oil burned as fuel.
[2] Figures for 1947 not available when table was compiled.
[3] These totals involve some duplication due to rehandling of fuel oil initially sold to the Government.

All refinery districts produced more residual fuel oil in 1947 than in 1946, except the Texas Gulf and California areas, both major sources of supply. Refineries operating on the west coast make about one quarter of the heavy fuel oil, and there the total dropped by 3 percent from 119,224,000 barrels in 1946 to 115,171,000 in 1947. The smaller quantity of heavy fuel oil produced there in 1947 was the result of a lower yield—38.2 percent in 1947 compared with 41.8 percent in 1946—as crude runs were higher by 6 percent. Residual fuel oil credited to the Texas Gulf coast district of 88,592,000 barrels in 1947 was 2 percent below the 1946 total of 90,200,000 barrels, both quantities representing about a fifth of the national total. The drop in volume in 1947 was due, as it was in the California district, to a lower

Salient statistics of residual fuel oil in the United States, 1946–47, by months and districts

[Thousands of barrels]

Month and district	Production		Yield (percent)		Transfers[1]				Imports		Exports		Domestic demand		Stocks, end of period	
					East of California		California									
	1946	1947[2]	1946	1947[2]	1946	1947[2]	1946	1947[2]	1946	1947[2]	1946	1947[2]	1946	1947[2]	1946	1947[2]
By months:																
January	37,940	36,390	27.1	24.7	390	383	1,036	1,493	3,920	5,390	711	901	45,160	48,299	34,573	41,550
February	34,791	34,390	26.7	25.4	420	405	1,014	1,455	3,591	5,003	690	1,015	39,691	43,308	34,008	38,480
March	37,598	37,876	26.0	25.1	307	405	1,549	1,887	3,047	5,383	821	776	42,693	45,852	32,995	37,403
April	37,407	34,438	26.7	24.5	313	416	1,375	1,988	2,114	5,462	856	1,112	38,142	42,140	35,206	36,455
May	37,816	37,328	25.4	24.5	343	402	1,651	1,952	4,036	4,805	532	893	39,588	40,057	38,932	39,992
June	36,569	36,977	25.2	24.2	334	346	1,847	2,425	3,946	3,004	566	992	39,570	38,237	41,492	43,515
July	36,060	38,550	24.0	23.9	340	421	1,894	2,340	3,703	4,030	931	844	37,112	40,412	45,446	47,600
August	35,942	38,592	23.9	23.5	328	396	1,574	2,369	3,869	3,186	666	945	38,307	39,864	48,186	51,384
September	34,512	37,098	23.8	23.4	275	403	1,655	1,934	4,273	3,516	1,039	1,030	33,850	40,677	54,012	52,578
October	33,777	39,066	23.0	23.7	324	430	1,969	1,452	3,323	3,879	811	908	37,014	43,995	55,580	52,502
November	33,015	37,344	23.5	23.6	325	442	2,022	1,248	3,804	5,002	514	545	41,497	43,538	52,735	52,455
December	35,937	39,746	24.3	23.9	366	479	1,491	1,620	5,021	5,590	1,051	784	47,405	52,015	47,094	47,091
Total	431,364	447,795	24.9	24.2	4,065	4,928	19,077	22,163	44,647	54,250	9,188	10,745	480,029	518,394	47,094	47,091
By districts:																
East Coast	80,007	86,769	28.9	29.2											8,399	7,302
Appalachian	8,616	10,250	15.5	17.0											528	690
Indiana-Illinois-Kentucky, etc	54,323	57,259	19.4	19.0	532	822									4,200	5,072
Oklahoma-Kansas-Missouri, etc	23,406	25,246	16.9	16.5	243	402									1,280	1,729
Texas Inland	20,092	21,064	25.5	24.9	897	1,198									736	785
Texas Gulf Coast	90,200	88,592	21.2	20.3	469	378			(3)	(3)	(3)	(3)	(3)	(3)	6,935	7,412
Louisiana Gulf Coast	17,040	24,324	14.1	17.4	942	865									1,864	1,918
Arkansas, Louisiana Inland, Mississippi, etc	5,068	5,410	23.1	21.8	551	566									604	174
Rocky Mountain	13,388	13,710	27.9	26.2	431	697									604	742
California	119,224	115,171	41.8	38.2			19,077	22,163							22,405	21,267
Total	431,364	447,795	24.9	24.2	4,065	4,928	19,077	22,163	44,647	54,250	9,188	10,745	480,029	518,394	47,094	47,091

[1] Represents quantities used on leases and for general industrial purposes.
[2] Subject to revision.
[3] Figures not available.

yield—20.3 percent in 1947 compared with 21.2 percent in 1946—as the crude runs showed a small gain in the period.

Both the residual yield (28.9 percent in 1946 and 29.2 percent in 1947) and crude runs were higher in the East Coast area in 1947 than in 1946, and these favorable factors resulted in a 9-percent gain in the production of heavy fuel oil, the quantity increasing from 80,007,000 barrels in 1946 to 86,769,000 in 1947. Refiners operating in the Indiana–Illinois–Kentucky group of States produced 57,259,000 barrels of residual grades of fuel oil in 1947 and 54,323,000 in 1946. This gain in output came from increased crude runs, as the yield dropped slightly from 19.4 percent in 1946 to 19.0 percent in 1947. The Louisiana Gulf showed a large gain (43 percent) in residual fuel-oil production in 1947—24,324,000 barrels compared with 17,040,000 in 1946—and this outstanding increase was due both to a 15-percent gain in crude runs and to a much higher yield—17.4 percent in 1947 against 14.1 percent in 1946.

The yield of heavy fuel oil dropped slightly in the Oklahoma–Kansas–Missouri refinery district in 1947 (16.5 percent in 1947 against 16.9 percent in 1946); however, an important gain in crude runs (11 percent over 1946) made it possible for the oil companies to produce 25,246,000 barrels of residuals—an 8-percent increase over the 1946 total of 23,406,000 barrels. Similar factors—a slightly lower yield (24.9 percent in 1947 compared with 25.5 percent in 1946) but counteracted by increased crude runs—allowed refiners operating in the Texas Inland district to produce 21,064,000 barrels of heavy fuel oil in 1947, a small gain over the 1946 output of 20,092,000 barrels. Small amounts of residual fuel oil are also produced in the Appalachian, Arkansas and Louisiana Inland, and Rocky Mountain refinery districts and the respective outputs all showed gains in 1947 over 1946. The quantity reported for the Appalachian area rose by 19 percent from 8,616,000 barrels in 1946 to 10,250,000 in 1947 resulting from both a higher percentage yield and increased crude runs.

Some crude petroleums of low gasoline content are consumed as fuel on leases and by industrial plants and quantities so used are designated as "transfers" and constitute a secondary source of supply. "Transfers" increased by 17 percent from 23,142,000 barrels in 1946 to 27,091,000 in 1947, and these items accounted for about 5 percent of the total supply of heavy fuel oils for both years. Most of the crude oil burned direct as fuel is reported from the California refinery district and the quantity for that area mounted from 19,077,000 barrels in 1946 to 22,163,000 in 1947. "Transfers" of relatively small volume make up part of the supply of heavy fuel oils in the other refinery districts, except in the East Coast and Appalachian areas.

Imports of residual fuel oil have increased from 31,648,000 barrels in 1945 to 44,647,000 in 1946 and to 54,250,000 in 1947. Imported heavy fuel oil made up about 10 percent of the total supply from all sources in 1947 compared with a 9-percent proportion in 1946. As in other years, most of this imported heavy fuel oil originated in Curaçao and Venezuela, with less important quantities credited to Mexico, Canada, and Trinidad. New sources of supply were indicated for the first time in 1947 as 1,524,000 barrels were received from Saudi Arabia and 193,000 were credited to other Arabian areas. Receipts of heavy fuel oil from Bahrain were up sharply from 3,000 barrels in 1946 to 645,000 in 1947.

Sales of residual fuel oil [1] in the United States, 1942–46, by regions and States [2]

[Thousands of barrels]

Region [3] and State	1942	1943	1944	1945	1946
Pacific Coast:					
Washington	11,431	12,991	12,896	13,615	12,856
Oregon	13,036	15,958	15,638	17,205	14,662
California	87,019	118,848	116,127	129,514	92,039
Arizona	3,947	4,117	2,905	2,706	2,618
Nevada	5,422	6,940	7,507	6,626	5,823
Rocky Mountain:					
Idaho	561	603	580	557	490
Montana	3,392	3,804	5,460	6,253	6,274
Wyoming	2,296	2,572	5,327	4,710	4,365
Utah	571	887	1,202	1,396	1,324
Colorado	1,148	1,404	1,489	1,262	1,237
New Mexico	552	595	755	1,184	1,112
North Central:					
North Dakota	42	93	104	623	572
South Dakota	167	212	226	241	306
Minnesota	1,194	1,170	1,219	1,106	1,089
Nebraska	626	648	556	581	491
Iowa	685	986	913	882	1,029
Wisconsin	1,612	1,667	1,806	1,671	1,610
Illinois	13,083	14,694	15,540	15,092	15,130
Indiana	9,220	9,220	11,776	12,118	11,825
Michigan	7,532	7,257	6,506	6,482	5,760
Ohio	9,126	10,024	10,897	11,534	9,817
Kentucky	1,123	1,222	1,022	926	1,005
Tennessee	749	1,082	1,580	1,550	813
South Central:					
Missouri	5,720	6,730	6,030	5,971	5,164
Kansas	7,747	11,099	10,754	10,584	9,948
Texas	57,027	75,625	79,495	81,758	66,466
Oklahoma	8,856	9,711	8,787	8,314	8,157
Arkansas	2,627	3,229	3,110	2,321	2,331
Louisiana	11,309	12,788	14,003	13,416	13,052
Mississippi	271	465	618	505	294
Alabama	2,322	2,466	2,468	3,131	3,180
New England:					
Maine	2,141	1,754	2,061	1,718	2,258
New Hampshire	814	433	701	536	768
Vermont	206	110	107	142	203
Massachusetts	14,727	12,548	16,595	14,513	14,711
Rhode Island	5,176	3,168	4,008	4,168	5,576
Connecticut	5,076	4,114	4,347	4,934	7,117
Middle Atlantic:					
New York	25,248	27,207	25,635	27,105	30,380
New Jersey	30,337	36,111	56,143	49,272	42,814
Pennsylvania	22,817	24,515	32,529	35,210	35,097
Delaware	1,298	1,334	879	1,173	1,044
Maryland	9,693	10,854	12,287	12,889	14,604
District of Columbia	1,114	952	759	866	1,073
South Atlantic:					
Virginia	2,231	4,584	6,643	5,943	6,402
West Virginia	983	1,244	980	888	482
North Carolina	522	500	384	504	643
South Carolina	989	670	1,029	790	2,112
Georgia	1,808	2,502	2,807	2,821	3,018
Florida	9,740	10,770	14,222	14,959	14,085
Total	405,333	[4] 482,477	[4] 529,412	[4] 542,265	483,226

[1] Includes some crude oil burned as fuel.
[2] Figures for 1947 not available when table was compiled.
[3] States are grouped according to petroleum-marketing territories rather than to conventional geographic regions.
[4] These totals involve some duplication due to rehandling of fuel oil initially sold to the Government.

A higher domestic demand for residual fuel oil was indicated in each quarter of 1947 over corresponding requirements in 1946. The market was down sharply in 1946; however, the percentage decline was less pronounced as the year progressed, and by the first quarter of 1947 domestic deliveries of 137,459,000 barrels were 8 percent over the 127,544,000 reported for the initial 3 months of 1946. The rate of gain dropped to 3 percent (120,434,000 barrels in the April–June quarter of 1947, compared with 117,300,000 in the same period of

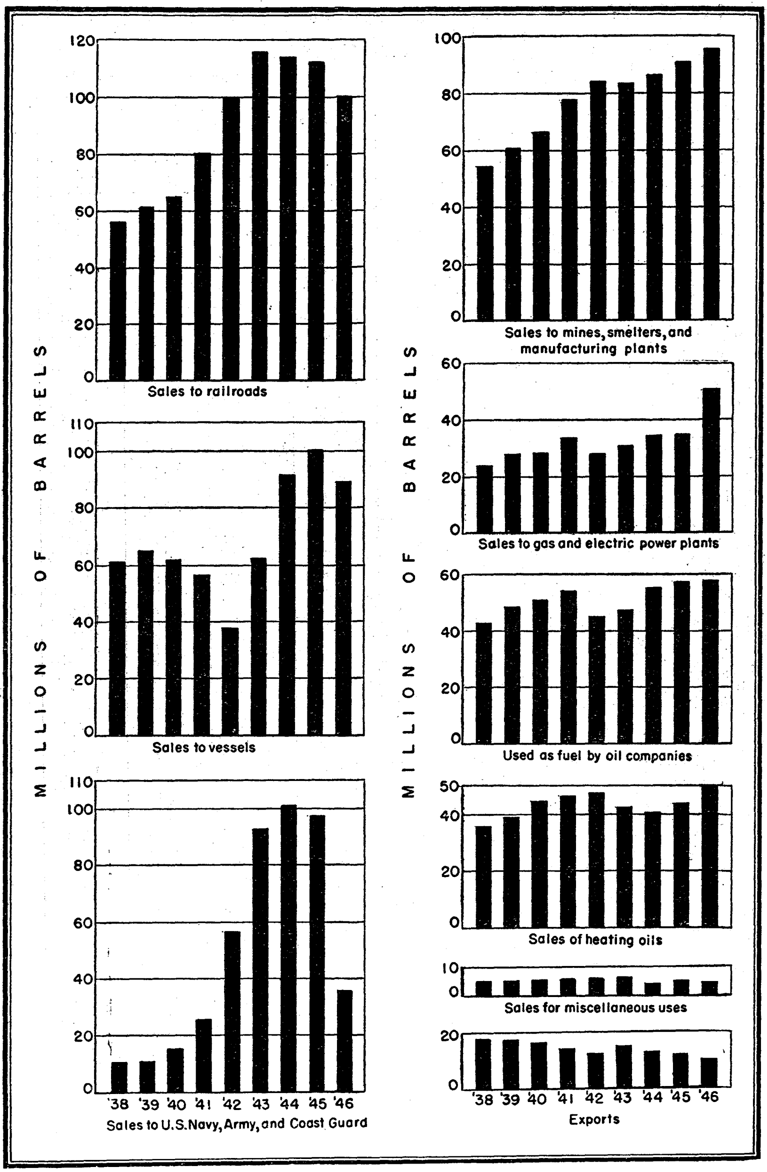

FIGURE 11.—Sales of residual fuel oil in the United States, 1938–46, by uses.

1946) as the heating season drew to a close, but this less active demand proved to be only the usual seasonal slackening as requirements were maintained in the third quarter and then mounted noticeably in the final 3 months of the year when industrial activities increased and the fall heating season opened. Indicated requirements in the third quarter of 1947 of 120,953,000 barrels were little above those in the preceding period, but 11 percent over the curtailed demand of

109,269,000 in the comparative 3 months of 1946. There was a similar percentage gain in the final quarter of 1947—139,548,000 barrels against 125,916,000 in the closing months of 1946—and it should be added that this fourth-quarter total for 1947 was above comparative requirements in the opening quarter of the same year for the first time since 1944. The gain (8 percent) in domestic demand for residuals realized in 1947 has not been repeated to date in 1948, as the half-year total of 263,863,000 barrels was only 2 percent above corresponding requirements of 257,893,000 in 1947.

A desirable build-up of 9,936,000 barrels in residual fuel-oil stocks realized in 1946 was not repeated in 1947, as there was no excess to divert to storage after the increased domestic and export demands had been satisfied from the available supply. In fact, there was virtually no change in the heavy-fuel-oil-stock level in 1947, as the year-end total of 47,091,000 barrels was only 3,000 below the comparative inventory of 47,094,000 for 1946. Residual-grade fuel oil held at refineries did, however, show a small gain (4 percent) increasing from 37,414,000 barrels at the end of 1946 to 38,807,000 in December 1947, while the stock decline was limited to those reported at bulk terminals, which dropped by 14 percent from 9,680,000 barrels in 1946 to 8,284,000 at the close of 1947. The year-end inventories of heavy-fuel oil for both 1946 and 1947 represented a 30-day supply at the following January rate of total demand and these quantities compare with a 25-day reserve at the close of 1945.

All refinery districts reported a gain in residual-fuel-oil stocks in 1947 over 1946, except for quantities held in the important California and East Coast areas. Year-end inventories on the west coast dropped by 5 percent from 22,405,000 barrels in 1946 to 21,267,000 in December 1947 or from 48 percent of the national total in 1946 to a 45-percent share in 1947. On the east coast, where over a third of all residual fuel oils is consumed, quantities held in storage diminished by 13 percent from 8,399,000 barrels in 1946 to 7,302,000 at the close of 1947. These stocks represented 18 percent of all stored heavy fuel oil in 1946 and less than 16 percent in December 1947.

The Texas Gulf coast, an important supply area for heavy fuel oils, is credited with about 15 percent of the year-end stocks, and the quantity reported increased by 7 percent from 6,935,000 barrels in 1946 to 7,412,000 in December 1947. Large quantities of residual grades of fuel oil are also held in the Indiana-Illinois-Kentucky refinery district, and the volume there rose from 4,200,000 barrels in 1946 to 5,072,000 at the close of 1947—a 21-percent gain. Heavy-fuel-oil stocks carried in the remaining refinery districts are not relatively important in volume, however all such inventories showed increases in 1947 over 1946. The most outstanding gain (35 percent) for this group was reported for the Oklahoma-Kansas-Missouri area, where year-end stocks rose from 1,280,000 barrels in 1946 to 1,729,000 in 1947.

There was a steady upward trend in the price of heavy fuel oils in 1947 due both to general inflationary conditions and a rising demand. The Oklahoma refinery quotation for No. 6 grade of $1.36 a barrel in December 1946 mounted steadily to an average of $1.80 in early April 1947, then dropped to $1.72 average for a few days. This lower value did not hold and subsequent changes brought the average price to $2.17 on September 9. Another recession in late September also proved to be only temporary and a subsequent upward movement forced the quotation to an average of $2.55 a barrel in the final month of the year. The weighted average price of this grade rose from $1.16 a barrel for 1946 to $2.01 for 1947. An important gain is also noted in the average price of No. 5 residual fuel oil at New York Harbor, which increased through 12 changes from an average of $2.32 a barrel in December 1946 to $3.27 in December 1947, while the weighted average for the year went from $1.99 a barrel for 1946 to $2.70 for 1947.

Representative quotations for Bunker C sold to vessels also showed a strong upward movement in 1947. Suppliers at New York Harbor, selling this fuel for $1.92 a barrel in December 1946, marked up their prices ten times during 1947 until the quotation reached an average of $3.02 a barrel in late December. The weighted price for the year rose from $1.76 a barrel for 1946 to $2.29 for 1947. There were numerous changes in the quotations for Bunker C at Gulf ports during 1947. A December 1946 average price of $1.54 a barrel mounted steadily to an average of $2.27 for October 1947. There was some shading in the quotations during late October and early November, but an upturn was again noted in December to $2.60 a barrel average for the month. The weighted price for all of 1947 of $2.04 a barrel compares with $1.26 for 1946. The December 1946 quotation for Bunker C at San Pedro, Calif., of $1.25 a barrel held until March 1947 when advances brought the price to $1.45 a barrel. Two further mark-ups in midsummer and two more near the end of 1947 resulted in a final quotation of $2.10 a barrel. The weighted price for this grade at San Pedro rose from $1.22 a barrel for 1946 to $1.55 for 1947. Bunker C for vessels at San Francisco was quoted at slightly higher levels—$1.30 a barrel on December 31, 1946, and an average of $2.16 in late December 1947.

The Bureau of Labor Statistics, United States Department of Labor, compiles retail fuel prices for a number of cities in all parts of the country. Its published reports show that the quotation for No. 6 grade heavy fuel oil in lots of 100 gallons or more in New York averaged 5.54 cents a gallon in December 1946. The price advanced through several changes to 6.28 cents a gallon for April and May 1947, and these were followed by a slight off-season decline to 6.26 cents, which level held through October. A second series of increases near the close of the year ended with a December 1947 average quotation of 7.92 cents a gallon. The average retail price for No. 5 at Chicago—7.14 cents a gallon in December 1946—was unchanged through March 1947. There was a steady upward trend in the quotations thereafter which ended with an average of 10.42 cents a gallon for December 1947.

One thousand barrels of heavy fuel oil were shipped from California by tanker to the East coast in 1947, the first movement in this traffic since 1940, when 566,000 barrels were transported. The California refinery district (California, Oregon, Washington, Arizona, and Nevada) is credited with rail and truck shipments of 85,000 barrels of residual fuel oil to other sections of the country in 1947 compared with a total of 91,000 barrels in 1946 and 158,000 in 1945. Other Western States make some overland shipments of heavy fuel oil to the Pacific

Monthly average prices of residual fuel oil in the United States, 1946–47

[Platt's Oil Price Handbook]

	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1946													
No. 6 fuel oil at refineries, Oklahoma dollars per barrel	0.94	0.94	1.03	1.15	1.15	1.15	1.16	1.28	1.24	1.24	1.25	1.36	1.16
No. 5 fuel oil at New York Harbor dollars per barrel	1.64	1.64	1.75	1.90	1.90	1.90	1.91	2.23	2.25	2.22	2.23	2.32	1.99
Bunker "C" for ships:													
New York do	1.51	1.51	1.60	1.72	1.72	1.72	1.74	1.97	1.92	1.92	1.92	1.92	1.76
Gulf Coast do	.97	.97	1.06	1.18	1.18	1.18	1.22	1.49	1.48	1.43	1.47	1.54	1.26
California do	1.10	1.10	1.14	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.22
1947													
No. 6 fuel oil at refineries, Oklahoma dollars per barrel	1.36	1.40	1.62	1.76	2.08	2.20	2.20	2.20	2.22	2.22	2.25	2.55	2.01
No. 5 fuel oil at New York Harbor dollars per barrel	2.32	2.39	2.49	2.62	2.66	2.71	2.71	2.71	2.73	2.75	3.05	3.27	2.70
Bunker "C" for ships:													
New York do	1.92	2.00	2.09	2.22	2.23	2.27	2.27	2.34	2.37	2.37	2.60	2.76	2.29
Gulf Coast do	1.54	1.57	1.66	1.85	1.90	2.10	2.15	2.24	2.24	2.27	2.39	2.60	2.04
California do	1.25	1.25	1.32	1.45	1.45	1.46	1.72	1.73	1.73	1.73	1.74	1.80	1.55

Coast area; however the volume of this trade has declined from 773,000 barrels in 1945 to 734,000 in 1946 and down to 592,000 in 1947. According to published records in the Oil and Gas Division, United States Department of the Interior, water shipments of residual fuel oil from the Gulf to the Atlantic coast increased by 11 percent from 55,186,000 barrels in 1946 to 61,189,000 in 1947. However, the volume of this traffic is still below the peak of 75,923,000 barrels recorded in 1941. Most of this heavy fuel oil (51,728,000 barrels in 1947 and 49,071,000 in 1946) is loaded in Texas; very little of the total comes from Louisiana (9,461,000 barrels in 1947 and 6,115,000 in 1946).

Barge movements of residual fuel oil from the Gulf coast to terminals on the Mississippi River and its branches, which declined from 1,042,000 barrels in 1945 to 642,000 in 1946, turned upward to 1,021,000 barrels in 1947. Most of this fuel oil is from refineries in Louisiana, while smaller quantities are credited to Texas and Arkansas. Virtually all of it is unloaded in districts 2 and 3, while small quantities reach the western portion of district 1.

There were no changes in tanker rates during 1947 for heavy fuel oil shipped from the Gulf to the East coast, not east of New York. A charge of 43.8 cents a barrel for 10°–19.9° gravity fuel oil, dating from October 15, 1945, was in force throughout the year.

A decline in the export of residual fuel oil, starting in 1944 and continuing through 1946, was not repeated in 1947, as the total of 10,745,000 barrels was 17 percent over 1946 foreign shipments of 9,188,000 barrels. The quantities in both years represented about 2 percent of the total heavy-fuel-oil supply. Most of the foreign countries received more of this grade of fuel oil in 1947 than in 1946. Canada and Mexico were both credited with major shares of these shipments, the quantity for Canada increasing from 1,924,000 barrels in 1946 to 2,407,000 in 1947, and that for Mexico rose from 836,000 barrels in 1946 to 1,342,000 in 1947. The United Kingdom received 402,000 barrels of residuals in 1947 and none in 1946. Exports of 1,005,000 barrels of heavy fuel oil to Cuba in 1945 and 1,137,000 in 1946 dropped sharply to 598,000 in 1947, while quantities reported for U. S. S. R. varied greatly from 159,000 barrels in 1945 to 874,000 in 1946 and then down to 197,000 barrels in 1947. Sweden, Denmark, Belgium, Canal Zone, Guatemala, Chile, and China all received more American heavy fuel oil in 1947 than in 1946.

LUBRICATING OIL

The refinery production of lubricating oils amounted to 45.6 million barrels in 1946 and 51.8 million in 1947—a gain of over 13 percent in 1947 compared with an increase of 9 percent in 1946. Although production increased in all the refinery districts, the greatest gain was in the East Coast, where production rose from 20.4 percent of the total in 1946 to 21.4 percent in 1947. The Texas Gulf district produced 29.4 percent of the total in 1946 and 29.0 percent in 1947. Production in the Appalachian district declined from 11.3 percent of the total in 1946 to 10.7 percent in 1947.

The percentage yield of lubricating oils from crude rose from 2.7 percent in 1946 to 2.8 percent in 1947.

The total demand for lubricating oils increased from 45.9 million

Salient statistics of lubricating oil in the United States, 1946–47, by months and districts

Month and district	Production (thousands of barrels)		Yield (percent)		Domestic demand (thousands of barrels)		Stocks, end of period (thousands of barrels)	
	1946	1947 [1]	1946	1947 [1]	1946	1947 [1]	1946	1947 [1]
By months:								
January	3,395	4,204	2.4	2.9	2,692	2,951	7,694	7,773
February	3,159	3,925	2.4	2.9	2,278	2,680	7,966	7,753
March	3,786	4,480	2.6	3.0	2,564	2,929	7,951	8,015
April	3,693	4,267	2.6	3.0	3,061	3,066	7,852	7,936
May	3,722	4,608	2.5	3.0	2,867	3,104	7,565	8,070
June	3,839	4,427	2.6	2.9	2,714	2,873	7,635	8,281
July	3,620	4,227	2.4	2.6	3,049	3,003	7,293	8,188
August	4,096	4,400	2.7	2.7	3,235	3,051	7,030	8,420
September	4,016	4,047	2.8	2.6	3,095	3,217	7,244	8,340
October	4,327	4,350	3.0	2.6	3,536	3,427	7,338	8,157
November	3,857	4,264	2.7	2.7	2,900	2,917	7,384	8,531
December	4,135	4,566	2.8	2.8	2,900	3,295	7,564	8,624
Total	45,645	51,765	2.7	2.8	34,891	36,513	7,564	8,624
By districts:								
East Coast	9,332	11,078	3.4	3.7			2,172	2,386
Appalachian	5,175	5,531	9.3	9.1			597	559
Indiana, Illinois, Kentucky, etc.	4,800	5,261	1.7	1.7			809	886
Oklahoma, Kansas	5,479	5,861	4.0	3.8			460	538
Texas Inland	282	369	.4	.4			36	76
Texas Gulf Coast	13,399	15,009	3.2	3.5	(2)	(2)	1,672	2,229
Louisiana Gulf Coast	2,098	2,350	1.7	1.7			216	221
Arkansas and Louisiana Inland	1,380	1,484	6.3	5.9			113	154
Rocky Mountain	278	311	.6	.6			77	91
California	3,422	4,511	1.2	1.5			1,412	1,484
Total	45,645	51,765	2.7	2.8	34,891	36,513	7,564	8,624

[1] Subject to revision. [2] Figures not available.

Average monthly refinery prices of five selected grades of lubricating oil in the United States, 1946–47, in cents per gallon

[National Petroleum News]

Grade	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1946													
Oklahoma:													
200 viscosity, No. 3 color, neutral	13.50	13.50	13.50	13.50	13.64	14.08	14.57	15.50	15.50	16.00	16.08	16.79	14.68
150–160 viscosity at 210°, bright stock, 10–25 pour test	22.75	22.75	22.75	22.75	22.75	22.75	22.84	24.34	25.35	26.16	26.33	28.75	24.19
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	30.84	32.75	34.13	36.28	36.50	37.07	32.55
600 steam-refined, cylinder stock, filterable	15.00	15.00	15.00	15.00	15.00	15.00	15.36	19.00	21.36	24.30	25.00	26.38	18.45
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.85	11.38	11.28	11.68	12.13	10.62
1947													
Oklahoma:													
200 viscosity, No. 3 color, neutral	17.32	17.32	17.93	19.00	18.77	18.50	18.50	18.50	18.50	18.71	19.25	20.41	18.56
150–160 viscosity at 210°, bright stock, 10–25 pour test	29.06	26.50	27.95	28.50	28.50	28.50	28.50	28.50	28.50	29.36	30.50	31.75	28.84
Pennsylvania:													
200 viscosity, No. 3, color, neutral, 420–425 flash, 25 pour test	37.50	37.73	38.86	39.50	39.50	39.98	40.00	40.00	40.00	40.00	40.00	40.86	39.49
600 steam-refined, cylinder stock, filterable	27.89	28.23	29.38	30.50	30.64	31.98	32.42	33.00	33.00	33.50	33.50	34.84	31.57
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	12.44	12.75	13.32	13.50	13.50	13.50	13.50	13.50	12.89	12.75	13.42	13.84	13.24

barrels in 1946 to 50.7 million in 1947—a gain of 4.8 million barrels, including an increase in exports of 3.2 million and an increase in domestic demand of 1.6 million barrels. Although the domestic demand in 1947 was 4.6 percent greater than in 1946, the rate of growth has not paced the increase in the highway consumption of motor fuel, which gained 10 percent in 1947 compared with 1946. The increased use of reclaimed lubricants, particularly for commercial vehicles, is a significant factor.

OTHER PRODUCTS

Wax.—Refinery production of petroleum wax has increased each year since 1938. The production of 3,624,000 barrels (converted at the rate of 280 pounds to the barrel) was almost 21 percent greater than in 1946.

All the producing districts except California showed gains in 1947. Of the total increase of 621,000 barrels in production, 279,000 barrels was in the East Coast district and 93,000 barrels each in the Oklahoma–Kansas and Louisiana Gulf districts.

Total demand increased from 2,989,000 barrels in 1946 to 3,585,000 barrels in 1947. Of the total increase in 1947 of 596,000 barrels, 390,000 was an increase in exports and 206,000 in domestic demand. Imports have been very small, amounting to only 1,000 barrels in 1946 and 4,000 barrels in 1947.

Salient statistics of wax in the United States, 1946–47, by months and districts

[Thousands of barrels] [1]

Month and district	Production		Domestic demand		Exports		Stocks, end of period	
	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]
By months:								
January	234	299	166	217	73	97	288	293
February	232	292	181	195	48	87	291	304
March	276	334	209	222	53	89	305	327
April	243	286	201	225	58	82	289	306
May	242	320	197	219	58	88	276	319
June	234	279	149	206	69	77	292	315
July	216	320	189	218	56	83	264	334
August	247	236	189	164	60	92	262	314
September	245	321	156	197	54	95	297	344
October	266	286	234	205	26	100	303	325
November	283	307	186	183	79	103	321	346
December	285	344	214	226	84	115	308	351
Total	3,003	3,624	2,271	2,477	718	1,108	308	351
By districts:								
East Coast	1,108	1,387					125	145
Appalachian	357	397					70	66
Indiana-Illinois-Kentucky, etc.	192	227					39	55
Oklahoma-Kansas-Missouri	382	475					22	27
Texas Inland	9	11	(3)	(3)	(3)	(3)	----	----
Texas Gulf Coast	465	528					28	25
Louisiana Gulf Coast	320	413					5	9
Rocky Mountain	78	95					16	21
California	92	91					3	3
Total	3,003	3,624	2,271	2,477	718	1,108	308	351

[1] Conversion factor: 280 pounds to the barrel.
[2] Subject to revision.
[3] Figures not available.

Average monthly refinery price of 124°–126° white crude scale wax at Pennsylvania refineries, 1943–47, in cents per pound

[National Petroleum News]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1943	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
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
1946	4.25	4.25	4.25	4.25	4.25	4.25	4.32	5.66	5.76	6.00	6.00	6.07	4.94
1947	6.19	7.06	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.85	7.88	8.03	7.61

Coke.—The production of petroleum coke increased from 10.6 million barrels (converted at the rate of 5 barrels to the short ton) to 12.1 million barrels in 1947. Production increased in every district in 1947 except in the Texas Inland district. The Indiana-Illinois district continued to be the largest producers representing 48.7 percent of the total in 1946 and 43.1 percent in 1947. Production in the Gulf Coast districts rose from 20.6 percent of the total in 1946 to 22.5 percent in 1947, and production in the California district increased from 8.9 percent of the total in 1946 to 13 percent in 1947.

The total demand for petroleum coke increased from 11.0 million barrels in 1946 to 12.2 million in 1947. The gain of 1.2 million barrels in 1947 represented an increase of 0.2 million in exports and of 1.0 million in domestic demand.

Salient statistics of petroleum coke in the United States, 1946–47, by months and districts

Month and district	Production (thousands of barrels) [1]		Yield (percent)		Domestic demand (thousands of barrels) [1]		Stocks, end of period (thousands of barrels) [1]	
	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]	1946	1947 [2]
By months:								
January	803	1,016	0.6	0.7	766	861	732	468
February	745	890	.6	.7	611	831	734	385
March	833	1,047	.6	.7	711	843	709	456
April	906	974	.7	.7	784	792	722	445
May	822	1,090	.6	.7	752	888	600	422
June	795	1,006	.5	.7	577	765	425	443
July	840	1,119	.6	.7	745	935	390	430
August	929	1,002	.6	.6	803	717	358	549
September	949	959	.6	.6	785	912	445	475
October	1,061	1,050	.7	.6	920	921	478	483
November	953	876	.7	.6	766	768	467	416
December	985	1,048	.7	.6	809	849	450	343
Total	10,621	12,077	.6	.7	9,029	10,082	450	343
By districts:								
East Coast	598	729	.2	.2	(3)	(3)	1	1
Appalachian	146	333	.2	.6			3	9
Indiana-Illinois-Kentucky, etc	5,171	5,205	1.8	1.7			135	97
Oklahoma-Kansas and Missouri	694	728	.5	.5			19	17
Texas Inland	659	554	.8	.7			4	18
Texas Gulf Coast	1,139	1,535	.3	.4			12	6
Louisiana Gulf Coast	1,045	1,184	.9	.8			6	2
Rocky Mountain	221	233	.5	.4			40	33
California	948	1,576	.3	.5			230	160
Total	10,621	12,077	.6	.7	9,029	10,082	450	343

[1] Conversion factor: 5.0 barrels to the short ton.
[2] Subject to revision.
[3] Figures not available.

Asphalt and Road Oil.—The total demand for asphalt amounted to 50.5 million barrels in 1947—converted at the rate of 5.5 barrels to the short ton. The increase of 4.9 million barrels in 1947 included a gain of 0.9 million in exports and 4.0 million in domestic demand. The increase in domestic demand was about 9 percent in 1947 compared with a gain of 13 percent in 1946. The domestic demand for road oil has been increasing rapidly with the termination of wartime restrictions. It rose from 5.9 million barrels in 1946 to 7.1 million in 1947, an increase of 19 percent in 1947.

Still Gas.—The production of still gas declined from 317 billion cubic feet in 1946 to 308 billion in 1947. The Texas Gulf district showed a gain of 4 billion cubic feet, and there were small gains in the Arkansas-Louisiana Inland and Rocky Mountain districts. Production declined in all other districts particularly in the Indiana-Illinois and East Coast districts.

Production of still gas in the United States, 1945–47, by districts

District	1945		1946		1947 [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	49,547	13,763	45,688	12,691	42,084	11,690
Appalachian	12,632	3,509	12,370	3,436	12,301	3,417
Indiana—Illinois—Kentucky, etc	62,759	17,433	60,837	16,899	56,088	15,580
Oklahoma—Kansas—Missouri, etc	26,489	7,358	24,235	6,732	23,951	6,653
Texas Inland	16,128	4,480	15,725	4,368	14,609	4,058
Texas Gulf Coast	108,227	30,063	83,142	23,095	87,192	24,220
Louisiana Gulf Coast	34,225	9,507	22,363	6,212	20,289	5,636
Arkansas and Louisiana Inland	6,059	1,683	4,759	1,322	5,252	1,459
Rocky Mountain	8,114	2,254	7,693	2,137	7,956	2,210
California	48,269	13,408	40,478	11,244	38,308	10,641
Total	372,449	103,458	317,290	88,136	308,030	85,564

[1] Subject to revision.

Miscellaneous Oils.—The domestic demand for finished miscellaneous products increased from 46.0 million barrels to 57.4 million in 1947—a gain of 25 percent. The major products in this group are liquefied gases for fuel use and for chemical and rubber manufacture. In 1946, the domestic demand for liquefied gases amounted to 39.7 million barrels and rose to 52.7 million in 1947—a gain of almost 33 percent. The domestic demand for all other miscellaneous products declined from 6.3 million barrels in 1946 to 4.7 million in 1947.

The supply of liquefied gases is derived from natural-gasoline and cycle plants and from refinery production. Transfers from natural-gasoline and cycle plants rose from 25.5 million barrels in 1946 to 35.2 million in 1947, while the production of liquefied refinery gases increased from 15.4 million barrels in 1946 to 18.7 million in 1947. The refinery production of all other miscellaneous products amounted to 7.1 million barrels in 1946 and declined to 5.7 million in 1947.

INTERCOASTAL SHIPMENTS [2]

Shipments of mineral oils, crude and refined, from Gulf coast ports to east coast ports were 7 percent larger in 1947 than in 1946. Crude petroleum was the largest single item in these 1947 shipments; it

[2] By A. H. Redfield, Petroleum Economics Branch, Bureau of Mines.

Mineral oils, crude and refined, shipped commercially from Gulf coast to east coast ports of the United States, 1946–47, by classes [1]

[Thousands of barrels]

Class	January	February	March	April	May	June	July	August	September	October	November	December	Total
1946													
Crude petroleum	16, 870	17, 594	15, 686	14, 625	15, 806	17, 386	15, 807	15, 879	15, 145	14, 569	14, 864	15, 730	189, 961
Gasoline	10, 734	8, 809	9, 232	10, 751	10, 505	10, 742	11, 718	11, 703	9, 547	10, 016	9, 940	10, 270	123, 967
Kerosine	4, 096	3, 206	3, 340	2, 799	1, 945	2, 134	2, 863	2, 452	2, 062	2, 703	2, 724	4, 011	34, 335
Distillate fuel oil	6, 901	7, 323	6, 398	4, 663	4, 663	4, 417	5, 284	4, 812	5, 305	5, 004	5, 095	8, 986	68, 851
Residual fuel oil	4, 714	5, 048	4, 203	5, 035	4, 672	4, 681	3, 970	4, 303	3, 803	4, 035	4, 834	5, 888	55, 186
Lubricating oils	460	477	598	449	575	463	574	656	569	513	762	504	6, 600
Miscellaneous oils	235	166	364	135	257	266	199	387	234	152	274	121	2, 790
Total	44, 010	42, 623	39, 821	38, 457	38, 423	40, 089	40, 415	40, 192	36, 665	36, 992	38, 493	45, 510	481, 690
1947													
Crude petroleum	16, 378	13, 702	16, 383	15, 868	16, 999	18, 635	18, 953	18, 292	15, 142	15, 467	16, 837	14, 666	197, 322
Gasoline	10, 557	8, 584	11, 029	10, 156	10, 619	11, 397	12, 278	11, 519	11, 586	12, 015	11, 842	11, 048	132, 630
Kerosine	3, 984	3, 486	2, 819	2, 757	2, 081	2, 479	2, 542	2, 567	1, 671	2, 759	2, 967	4, 110	34, 222
Distillate fuel oil	9, 648	9, 188	7, 756	6, 013	4, 794	5, 071	4, 494	5, 340	5, 699	5, 132	7, 289	10, 109	80, 533
Residual fuel oil	5, 060	4, 613	4, 740	5, 389	4, 433	4, 818	4, 507	5, 077	4, 480	5, 019	5, 514	7, 539	61, 189
Lubricating oils	666	469	640	493	853	580	740	478	592	483	617	678	7, 289
Miscellaneous oils	208	235	202	239	339	242	265	534	215	251	201	340	3, 271
Total	46, 501	40, 277	43, 569	40, 915	40, 118	43, 222	43, 779	43, 807	39, 385	41, 126	45, 267	48, 490	516, 456

[1] Oil and Gas Division, U. S. Department of the Interior.

constituted 38 percent of the total shipments in 1947 compared with 39 percent (revised figure) in 1946. Gasoline occupied second place in importance; its shipments constituted 26 percent of the whole, both in 1946 and in 1947. Intercoastal shipments of nearly all varieties of mineral oils were larger in 1947 than in 1946. The one exception was kerosine, of which the intercoastal shipments in 1947 were little changed from those in 1946.

FOREIGN TRADE [3]

IMPORTS

Imports of mineral oils, crude and refined, into continental United States increased 16 percent from 1946 to 1947. They constituted 7 percent of the total new supply in continental United States both in 1946 and in 1947.

Crude petroleum, residual fuel oil, and distillate fuel oil together made up 99 percent of the total mineral-oil imports into continental United States in 1946 and 98 percent in 1947. Venezuela supplied 53 percent of the total imports in 1946 and 50 percent in 1947; the Netherlands West Indies 34 percent, both in 1946 and in 1947; Colombia 7 percent, both in 1946 and 1947; and Mexico 4 percent in 1946 and 7 percent in 1947.

Of the crude petroleum imported into continental United States, Venezuela furnished 81 percent of the total in 1946 and 77 percent in 1947, Netherlands West Indies 6 percent in 1946 and 5 percent in 1947, Colombia 10 percent (revised figure) in 1946 and 11 percent in 1947, and Mexico 3 percent in 1946 and 6 percent in 1947. Small shipments were received from Kuwait in 1946 and from Kuwait and Saudi Arabia in 1947.

The Netherlands West Indies provided 95 percent of the residual fuel oil imported into continental United States and the noncontiguous Territories in 1946 and 90 percent in 1947. Minor amounts were imported in 1945 from Mexico, Venezuela, Trinidad, Canada, and Colombia, and in 1947 from Saudi Arabia and Bahrein Island as well.

Caribbean countries and Mexico, which had shipped 77 percent of the distillate fuel oil received in continental United States and the noncontiguous Territories in 1946, accounted for 97 percent of such imports in 1947. Middle Eastern countries—Saudi Arabia, Bahrein Island, and Iran—which had supplied 23 percent of the distillate imports in 1946, furnished only 3 percent in 1947.

[3] By A. H. Redfield, Petroleum Economics Branch, Bureau of Mines.

Mineral oils, crude and refined, imported into continental United States, 1946–47, by months [1]

[Thousands of barrels]

Class	January	February	March	April	May	June	July	August	September	October	November	December	Total
1946													
Crude petroleum	6,917	6,787	6,812	7,466	7,508	6,880	6,978	8,296	7,508	7,001	6,852	7,061	86,066
Refined products:													
Gasoline, finished	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	1	1
Distillate fuel oil	582	480	528	251	674	342	668	507	408	330	264	170	5,204
Residual fuel oil	3,920	3,591	3,047	2,114	4,036	3,946	3,703	3,869	4,273	3,323	3,804	5,021	44,647
Lubricating oil	----------	----------	----------	----------	----------	13	11	27	1	12	2	22	88
Paraffin wax	----------	----------	----------	----------	----------	----------	1	----------	----------	----------	----------	----------	1
Asphalt	50	4	54	110	40	81	50	103	153	46	----------	----------	691
Unfinished oils, other	110	91	36	55	159	143	75	94	----------	20	145	50	978
	11,579	10,953	10,477	9,996	12,417	11,405	11,486	12,896	12,343	10,732	11,067	12,325	137,676
1947 [2]													
Crude petroleum	7,763	8,444	9,263	7,276	8,703	7,628	7,294	8,242	8,658	7,761	7,688	8,812	97,532
Refined products:													
Gasoline, finished	----------	----------	----------	----------	----------	101	----------	102	15	----------	18	122	358
Distillate fuel oil	543	406	365	215	386	265	129	372	234	474	474	312	4,175
Residual fuel oil	5,390	5,003	5,383	5,462	4,805	3,004	4,030	3,186	3,516	3,879	5,002	5,590	54,250
Lubricating oil	7	8	5	3	2	12	1	----------	----------	----------	6	----------	44
Paraffin wax	----------	1	----------	----------	----------	----------	----------	----------	1	----------	----------	2	4
Asphalt	69	118	66	121	165	68	175	144	56	303	----------	68	1,353
Unfinished oils, other	198	61	327	112	267	261	289	20	80	101	131	32	1,879
	13,970	14,041	15,409	13,189	14,328	11,339	11,918	12,066	12,560	12,518	13,319	14,938	159,595

[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.

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 15 million barrels (revised figure) in 1946 to 5 million barrels in 1947. In crude petroleum, however, imports were larger than exports in both years. The excess of crude imports increased from 44 million barrels (revised figure) in 1946 to 51 million barrels in 1947. Net exports of refined products decreased from 59 million barrels in 1946 to 56 million barrels in 1947. Although net exports of motor fuel increased from 45 million barrels in 1946 to 47 million barrels in 1947, of distillate fuel oil from 24 million barrels in 1946 to 26 million barrels in 1947, and of lubricating oils from 11 million barrels in 1946 to 14 million barrels in 1947, the excess of imports of residual fuel oil increased from 35 million barrels in 1946 to 44 million barrels in 1947.

Exports and Territorial shipments of crude petroleum increased 9 percent from 1946 to 1947; but the 46 million barrels of crude petroleum exported and shipped to the Territories in 1947 was only 59 percent of the 77 million barrels exported and shipped in 1938, the peak year for such outward shipments. Of the 1947 exports of crude petroleum, Canada received 84 percent, France 9 percent, Cuba 3 percent, and Argentina 2 percent.

Exports and Territorial shipments of refined oils were 7 percent larger in 1947 than in 1946. The greatest increase was in outward shipments of motor fuel, notably to Canada, Mexico, the Philippine Republic, Australia, New Zealand, and Hawaii. Exports to Europe, except the United Kingdom and Sweden, were less in 1947 than in 1946. Exports and shipments of distillate fuel oil were little changed

Crude petroleum exported from the United States, 1940–47, by countries, in thousands of barrels

[U. S. Department of Commerce]

	1940	1941	1942	1943	1944	1945	1946	1947
Canada	28,778	26,516	33,753	41,942	33,738	32,841	36,595	38,564
Cuba	822	1,219	825	791	574	824	1,158	1,354
Mexico	349	195	103	65	60	80	102	101
Argentina	779	423	113			70	724	1,052
Brazil	250	273	69	2	1	73	282	68
Colombia			85				1	
Chile	30							
Belgium							68	
Denmark								49
France	5,420						2,305	4,358
Italy	1,420							
Portugal	531	69				1		
Sweden	46					104	87	
United Kingdom	533	238	598	485	421	1,284	1,233	299
India				34			3	
China		5						
Kwantung	844	324						
Japan	11,529	5,208						
Siam	91							
British East Africa				1		1		
Egypt				6	5			
Gold Coast				3				
Union of South Africa			1	1		2	2	
Australia	9	7	1					
New Zealand				3			8	
Other countries	65	7	12	10	3	73	6	17
	51,496	34,484	35,560	43,343	34,802	35,353	42,574	45,862

Mineral oils, crude and refined, shipped from continental United States, including shipments to noncontiguous Territories, 1946–47, by classes and months [1]

[Thousands of barrels]

Class	January	February	March	April	May	June	July	August	September	October	November	December	Total
1946													
Crude petroleum	2,332	2,397	2,970	3,818	3,914	3,459	4,290	4,368	4,152	4,244	3,325	3,167	42,436
Refined products:													
Motor fuel [2]	4,974	4,900	5,546	3,532	3,038	2,859	2,752	3,945	3,925	2,676	3,249	3,938	45,334
Kerosine	612	403	450	702	800	1,614	1,012	803	744	337	444	716	8,637
Distillate fuel oil	2,560	1,905	1,957	3,606	4,138	4,115	2,738	3,018	2,064	1,028	877	1,481	29,487
Residual fuel oil	711	690	821	856	532	566	931	666	1,039	811	514	1,051	9,188
Lubricating oil	782	609	1,237	731	1,142	1,068	924	1,151	708	709	913	1,077	11,051
Paraffin wax	73	48	53	58	58	69	56	60	54	26	79	84	718
Coke	96	132	147	109	192	393	130	158	77	108	198	193	1,933
Asphalt	218	243	220	147	260	258	161	174	115	54	260	188	2,298
Miscellaneous oils	147	157	209	160	149	193	211	191	147	127	146	204	2,041
Total refined	10,173	9,087	10,640	9,901	10,309	11,135	8,915	10,166	8,873	5,876	6,680	8,932	110,687
Total crude and refined	12,505	11,484	13,610	13,719	14,223	14,594	13,205	14,534	13,025	10,120	10,005	12,099	153,123
1947													
Crude petroleum	2,872	2,440	3,424	3,842	4,789	3,758	5,184	4,139	4,087	3,699	3,844	4,039	46,117
Refined products:													
Motor fuel [2]	3,268	5,033	4,532	3,862	3,700	4,300	4,327	3,889	3,444	3,768	3,917	3,505	47,545
Kerosine	439	950	1,080	958	232	763	771	350	515	671	406	129	7,264
Distillate fuel oil	1,073	1,992	2,358	3,246	2,347	2,385	3,561	3,274	3,357	3,229	1,934	1,173	29,929
Residual fuel oil	901	1,015	776	1,112	893	992	844	945	1,030	908	545	784	10,745
Lubricating oil	1,051	1,273	1,294	1,283	1,372	1,355	1,318	1,117	910	1,106	979	1,178	14,236
Paraffin wax	97	87	89	82	88	77	83	92	95	100	103	115	1,108
Coke	137	142	133	193	225	220	197	166	121	121	175	272	2,102
Asphalt	296	292	258	284	457	332	310	364	192	117	124	203	3,229
Miscellaneous oils	195	183	234	228	209	213	195	155	126	161	150	139	2,188
Total refined	7,457	10,967	10,754	11,248	9,523	10,637	11,606	10,352	9,790	10,181	8,333	7,498	118,346
Total crude and refined	10,329	13,407	14,178	15,090	14,312	14,395	16,790	14,491	13,877	13,880	12,177	11,537	164,463

[1] Exports of crude as reported to Bureau of Mines; exports 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, 1945–47 [1]

[Thousands of barrels, except wax, which is in thousands of pounds]

[U. S. Department of Commerce]

Country	Motor fuel [2]			Kerosine			Fuel oil			Lubricating oil			Wax		
	1945	1946	1947	1945	1946	1947	1945	1946	1947	1945	1946	1947	1945	1946	1947
North America:															
Bermuda	16	(3)	37	(3)	(3)	(3)	------	(3)	------	2	2	3	(4)	(4)	------
Canada	2,329	4,734	6,087	241	602	3,300	1,560	3,573	8,204	292	303	488	24,273	31,776	52,364
Canal Zone	2	18	141	(3)	------	10	219	227	519	20	7	11	------	7	12
Cuba	436	833	1,431	1	(3)	(3)	1,064	1,304	967	68	79	112	2,644	3,126	4,157
Curacao (N. W. I.)	(3)	(3)	956	------	------	------	(3)	(3)	71	10	23	29	1	(4)	------
El Salvador	(3)	21	17	(3)	3	2	(3)	8	193	2	4	7	524	594	1,332
Iceland	119	(3)	(3)	------	------	------	9	------	------	12	8	15	53	57	111
Mexico	812	1,504	2,054	118	145	123	825	1,255	1,900	271	240	330	8,131	3,975	11,011
Trinidad and Tobago	(3)	(3)	(3)	------	------	------	(3)	------	------	16	17	19	120	116	140
Other North America	104	394	497	24	60	60	64	189	595	84	91	135	3,499	5,558	6,144
Total North America	3,818	7,504	11,220	384	810	3,495	3,741	6,556	12.449	777	774	1,149	39,245	45,209	75,271
South America:															
Argentina	1	10	415	1	1	5	170	178	114	23	53	100	334	2,342	10,024
Bolivia	7	7	13	(3)	(3)	(3)	(3)	(3)	(3)	8	14	16	2,205	2,258	2,088
Brazil	254	773	527	8	65	156	18	100	188	417	364	628	4,014	3,088	5,819
Chile	22	7	8	1	(3)	1	1	90	348	76	90	114	14,423	8,395	10,451
Colombia	(3)	19	3	(3)	(3)	------	------	------	(3)	35	39	65	12,681	15,284	22,098
Peru	32	1	1	(3)	------	------	------	1	------	25	41	38	6,241	3,210	6,418
Surinam	(3)	(3)	(3)	------	(3)	9	------	------	------	2	2	6	5	13	6
Uruguay	7	110	4	(3)	34	8	------	------	------	27	52	75	679	433	1,007
Venezuela	2	1	4	------	------	------	(3)	1	(3)	105	93	144	1,688	3,656	5,921
Other South America	3	7	20	------	------	------	2	------	1	19	23	32	2,366	2,035	2,278
Total South America	328	935	995	10	100	179	191	370	651	737	771	1,218	44,636	40,714	66,110
Europe:															
Belgium and Luxembourg	147	963	579	(3)	33	21	183	576	889	32	881	909	------	6,053	10,593
Denmark	9	568	428	------	66	24	99	908	1,369	------	228	295	------	1,888	951
Eire	(3)	(3)	(3)	------	------	------	------	------	------	1	1	3	526	738	4,763
France	1,898	5,489	2,558	150	341	------	699	2,234	675	102	1,284	853	539	6,801	15,546
Italy	------	554	295	------	39	45	------	111	370	(3)	111	876	34	2,748	22,274
Netherlands	263	1,069	233	103	847	118	48	744	807	1	316	288	(4)	5,725	8,291
Norway	(3)	628	218	------	42	42	100	64	103	(3)	109	150	654	2,211	2,546
Portugal	(3)	53	50	(3)	100	(3)	------	------	45	67	89	88	1,704	1,712	3,991
Spain	(3)	874	246	------	75	27	------	275	111	103	294	257	1,872	461	265
Sweden	555	1,328	1,834	56	380	115	671	1,761	3,106	145	487	430	1,282	8,269	12,196
Switzerland	1	138	71	------	------	(3)	223	199	70	21	129	96	331	4,236	2,993
U. S. S. R	4,581	488	222	51	20	42	1,210	1,950	648	268	57	66	26	------	------
United Kingdom	62,092	12,602	15,874	4,984	3,013	1,429	31,272	14,399	9,375	1,862	1,989	1,760	60,060	49,739	35,487
Other Europe	------	1,464	287	5	344	8	------	517	126	2	221	261	4	609	1,492
Total Europe	69,546	26,218	22,895	5,349	5,300	1,871	34.505	23,738	17,694	2,604	6,196	6,332	67,032	91,190	121,388

Asia:															
Ceylon	7,211	-----	-----	(3)	-----	-----	(3)	-----	-----	49	27	28	-----	-----	-----
China and Hong Kong	121	1,675	1,231	38	876	672	23	835	1,338	28	599	525	-----	11,048	12,568
India and Dependencies	1,158	(3)	(3)	-----	(3)	2	(3)	-----	(3)	917	537	1,208	57	1	21
Iran	(3)	-----	(3)	-----	-----	-----	-----	-----	-----	28	2	6	1	-----	-----
Iraq	-----	(3)	-----	-----	-----	-----	-----	-----	-----	39	15	23	-----	-----	23
Philippines, Republic of	(3)	267	1,289	-----	275	173	-----	91	212	1	132	225	574	2,054	4,470
Turkey	(3)	146	2	(3)	41	65	-----	1	19	51	75	145	587	1,094	1,479
Other Asia	2	82	153	1	23	-----	16	48	-----	66	251	579	260	465	416
Total Asia	8,492	2,170	2,675	39	1,215	912	39	975	1,569	1,179	1,638	2,739	1,479	14,662	18,977
Africa:															
Algeria	247	250	(3)	-----	85	-----	196	283	212	(3)	64	110	18	1,501	3,598
Belgian Congo	1	(3)	19	-----	1	-----	-----	2	(3)	24	32	41	4	40	5
Egypt	1,308	(3)	(3)	(3)	(3)	(3)	-----	-----	(3)	191	209	189	351	93	357
Gold Coast	(3)	(3)	54	-----	-----	38	-----	-----	4	14	17	27	6	-----	21
Liberia	(3)	3	1	1	1	2	-----	(3)	1	1	2	1	103	178	148
Morocco, French	124	723	454	27	326	36	174	411	214	(3)	22	88	(4)	562	2,500
Nigeria	(3)	(3)	(3)	(3)	-----	(3)	-----	-----	-----	11	15	31	1	1	(4)
Southern Rhodesia	-----	4	2	(3)	1	-----	-----	-----	-----	16	8	27	45	-----	6
Union of South Africa	4	1,016	116	18	37	(3)	-----	-----	2	261	332	482	5	3,993	14,103
Other Africa	6	488	181	3	9	8	3	3	2	127	199	361	318	932	2,624
Total Africa	1,690	2,484	827	49	460	84	373	699	435	645	900	1,357	851	7,300	23,362
Oceania:															
Australia	1,788	1,711	2,619	53	206	75	6	61	825	389	517	1,016	3,266	1,297	3,324
British Oceania	14	93	67	15	4	15	34	61	57	5	4	5	-----	-----	-----
New Guinea	-----	-----	2	-----	-----	12	-----	-----	3	-----	(3)	(3)	-----	-----	-----
New Zealand	336	786	1,166	15	86	34	17	544	342	94	121	247	1,793	353	1,171
Other Oceania	24	62	52	9	6	11	6	15	35	2	2	3	(4)	-----	-----
Total Oceania	2,162	2,652	3,906	92	302	147	63	681	1,262	490	644	1,271	5,059	1,650	4,495
Grand total	86,036	41,963	42,518	5,923	8,187	6,688	38,912	33,019	34,060	6,432	10,923	14,066	158,302	200,725	309,603
Shipments from continental United States to noncontiguous Territories:															
Alaska	327	508	783	-----	-----	-----	1,004	1,216	1,714	30	23	42	-----	-----	-----
Hawaii	1,547	1,533	2,526	204	160	184	5,235	4,298	4,704	64	52	101	117	175	137
Puerto Rico	143	1,431	1,571	45	313	369	17	194	150	47	34	55	109	242	30
Virgin Islands	20	20	22	6	7	7	5	7	7	1	(3)	7	-----	-----	-----
Other	1	(3)	76	1	(3)	5	-----	(3)	14	(3)	(3)	2	-----	5	-----
Total	2,038	3,492	4,978	256	480	565	6,261	5,715	6,589	142	109	207	226	422	167
Exports from noncontiguous Territories to foreign countries:															
Alaska	13	29	42	(3)	(3)	(3)	6	45	133	(3)	(3)	(3)	-----	-----	-----
Hawaii	(3)	(3)	1	(3)	(3)	(3)	(3)	(3)	(3)	-----	(3)	7	-----	-----	-----
Puerto Rico	2	81	10	-----	22	-----	4	15	1	(3)	(3)	(3)	-----	35	23
Total	15	110	53	(3)	22	(3)	10	60	134	(3)	(3)	7	-----	35	23
Total net shipments from continental United States	88,059	45,345	47,443	6,179	8,645	7,253	45,163	38,674	40,515	6,574	11,032	14,266	158,528	201,112	309,747

[1] Compiled by M. B. Price, of the Bureau of Mines from 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.

from 1946 to 1947; declines in shipments to the United Kingdom, France, and the U. S. S. R. offset increased exports to most destinations, notably to Canada and to other European countries. Exports and Territorial shipments of residual fuel oil increased from 1946 to 1947, especially to Canada, Mexico, Europe (except the U. S. S. R.), the Philippine Republic, and China. Exports and shipments of lubricating oil to most destinations were larger in 1947 than in 1946. France, the Netherlands, and the United Kingdom were the most noteworthy exceptions to the general increases. The decline in the outward shipments of kerosine from 1946 to 1947 was due chiefly to reduced exports to Europe, notably to the United Kingdom. Foreign and Territorial sales of paraffin wax to nearly all destinations were larger in 1946 than in 1947, chiefly because of the continued absence of Burma and Indonesia from the world market.

Of the total exports and Territorial shipments of major refined oils and paraffin wax, 59 percent in 1946 and 44 percent in 1947 went to Europe. The United Kingdom received 31 percent of the total in 1946 and 26 percent in 1947. To other European countries 28 percent went in 1946 and 19 percent in 1947.

North American countries received 15 percent of the total exports and Territorial shipments in 1946 and 26 percent in 1947. Canada's share of the whole increased from 9 percent in 1946 to 17 percent in 1947. South America took 2 percent of the total in 1946 and 3 percent in 1947.

To Asia went 6 percent of the total outward shipments of mineral oils in 1946 and 7 percent in 1947.

Exports and Territorial sales of major refined oils and wax from the United States to Oceania amounted to 4 percent of the total in 1946 and 6 percent in 1947. Australia received 2 percent of the whole in 1946 and 4 percent in 1947.

Africa accounted for 4 percent of the total exports and Territorial shipments of refined oils and wax in 1946 and for 2½ percent in 1947.

The noncontiguous Territories received 9 percent of the major refined oils and wax shipped out of continental United States in 1946 and 11 percent in 1947.

WORLD PRODUCTION [4]

The world production of crude petroleum continued in 1947 its long-range upward trend. It was 10 percent larger in 1947 than in 1946. While the United States increased its crude output 7 percent in 1947 over 1946, other countries produced 15 percent more petroleum in 1947 than in 1946.

The Western Hemisphere produced 81 percent of the total world output of crude petroleum in 1947, compared with 82 percent in 1946. The countries surrounding the Persian Gulf produced 10 percent of the world total in 1947, compared with 9 percent in 1946. Europe (including the U. S. S. R.) supplied 8 percent of the whole, both in 1946 and 1947.

Venezuela, second only to the United States in petroleum production, increased its output 12 percent in 1947 over 1946. Of the other Latin American countries only Mexico and Colombia produced appreciably more crude in 1947 than in 1946. Mexico's 14-percent increase in 1947 over 1946 may be attributed in part at least to a reorganiza-

[4] By A. H. Redfield, Petroleum Economics Branch, Bureau of Mines.

tion of Pemex, the Government producing and refining company. In Canada, in spite of the discovery of the Leduc field in Alberta, little more oil was produced in 1947 than in 1946.

Crude petroleum produced in principal countries of the world, 1942–47, in thousands of barrels

[Compiled by B. B. Mitchell]

Country	1942	1943	1944	1945	1946	1947
North America:						
Barbadoes	2	2	1	2	1	(1)
Canada	10,365	10,052	10,099	8,483	7,586	7,632
Cuba [2]	151	107	109	149	269	300
Mexico	34,815	35,163	38,203	43,547	49,235	56,284
Trinidad	22,069	21,385	22,139	21,093	20,173	20,521
United States	1,386,645	1,505,613	1,677,904	1,713,655	1,733,939	1,856,107
Total North America	1,454,047	1,572,322	1,748,455	1,786,929	1,811,203	1,940,844
South America:						
Argentina	23,704	27,714	24,230	22,881	20,604	21,846
Bolivia	308	334	314	382	363	375
Brazil	33	48	58	79	67	97
Colombia	10,487	13,261	22,291	22,449	22,518	25,882
Ecuador	2,278	2,315	2,967	2,664	2,323	2,282
Peru	13,629	14,654	14,386	13,744	12,456	12,764
Venezuela	147,675	177,631	257,046	323,156	388,486	434,885
Total South America	198,114	235,957	321,292	385,355	446,817	498,131
Europe:						
Albania	1,601	1,001	334	267	[3] 1,000	[3] 1,800
Austria	5,899	7,478	8,218	3,074	5,734	6,285
Czechoslovakia	271	[3] 200	[3] 185	91	196	210
France	463	[3] 356	[3] 300	197	367	363
Germany	5,191	4,973	6,154	3,935	4,539	4,035
Hungary	5,037	6,347	[4] 6,204	[4] 5,018	5,146	4,330
Italy	101	[3] 75	[3] 75	[3] 75	82	80
Netherlands	----	(5)	14	41	435	1,478
Poland	2,794	[3] 3,500	[3] 3,000	[6] 750	866	951
Rumania	42,094	39,182	26,191	34,772	31,434	28,552
U. S. S. R. [3] [7]	227,470	200,750	275,000	148,953	157,673	187,463
United Kingdom	605	839	703	532	412	351
Other Europe [3]	10	10	500	450	400	365
Total Europe [7]	291,536	264,711	326,878	198,155	208,284	236,263
Asia:						
Bahrein Island	6,241	6,572	6,714	7,309	8,010	9,411
Burma	2,500	1,000	[3] 750	[3] 725	[3] 700	[3] 800
China	340	447	505	484	513	378
Formosa	48	38	40	11	16	18
India	2,792	2,735	2,784	2,343	2,193	1,863
Iran	72,256	74,612	102,045	130,526	146,819	154,511
Iraq	19,726	24,848	30,943	35,112	35,665	35,834
Japan	1,652	1,727	1,601	1,519	1,343	1,258
Kuwait	----	----	----	----	5,931	16,225
Netherlands Indies	24,000	48,294	22,260	7,600	2,100	8,020
Sakhalin (U. S. S. R.) [3]	4,000	5,000	5,000	6,000	6,000	7,000
Sarawak and Brunei	[3] 3,000	[3] 4,500	[3] 6,000	2,100	2,050	12,970
Saudi Arabia	4,530	4,868	7,794	21,311	59,944	89,852
Total Asia [8]	141,085	174,641	186,436	215,040	271,284	338,140
Africa:						
Egypt	8,275	8,953	9,416	9,406	9,070	8,627
Morocco, French	41	39	32	26	20	23
Total Africa	8,316	8,992	9,448	9,432	9,090	8,650
Oceania: New Zealand	2	2	2	3	2	2
World total	2,093,100	2,256,625	2,592,511	2,594,914	2,746,680	3,022,030

1 Less than 500 barrels.
2 Natural naphtha and gas oil.
3 Estimate.
4 Data represent Trianon Hungary subsequent to October 1944.
5 Data not available.
6 Beginning in 1945, postwar borders.
7 Includes U. S. S. R. fields in Asia, other than Sakhalin.
8 Exclusive of U. S. S. R. fields in Asia (other than Sakhalin), which are included with U. S. S. R. in Europe.

Increased petroluem production in the countries surrounding the Persian Gulf was due primarily to a 50-percent growth in the output of Saudi Arabia from 1946 to 1947. The production of Bahrein Island was 17 percent larger in 1947 than in 1946. Kuwait, a newcomer in the petroleum industry, nearly trebled its output from 1946 to 1947. On the other hand, Iran, largest producer in the Middle East, increased its production only 5 percent; and Iraq, restricted by the capacity of the pipe line from Kirkuk to Haifa and Tripoli, maintained its output at virtually the same level as in 1946 and 1945.

Political disorders in Indonesia retarded the restoration of war-damaged equipment and the rehabilitation of the petroleum industry. Its production in 1947, though nearly four times as large as in 1946, constituted only 13 percent of the amount produced in 1940. In British Borneo, however, more than six times as much petroluem was produced in 1947 as in 1946.

Egypt, the only country in Africa which produces petroleum on a significant scale, decreased its output 5 percent from 1946 to 1947.

Phosphate Rock

By BERTRAND L. JOHNSON AND E. M. TUCKER

GENERAL SUMMARY

THE upward trend in demand for phosphate rock continued, and current production reached an abnormal height. Startlingly high new records were made in the domestic phosphate industry in 1947, according to reports submitted to the Bureau of Mines by

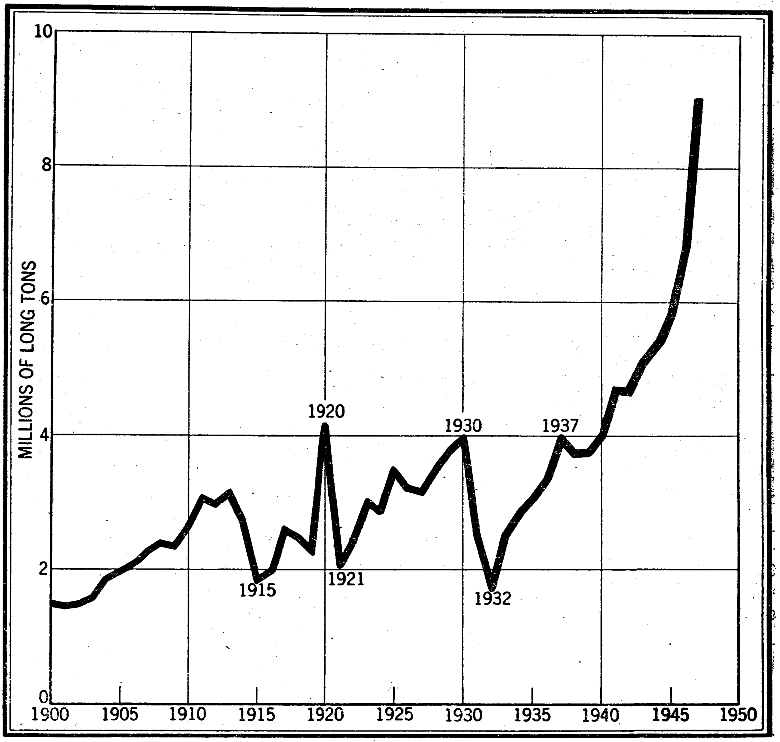

FIGURE 1.—Marketed production of domestic phosphate rock, 1900–47.

operators. Total mine production jumped nearly 2,000,000 tons—from 7,168,839 long tons in 1946 to 9,121,081 tons in 1947. Sales were correspondingly high. Total phosphate rock sold or used by producers in 1947 attained a new peak of 9,087,199 long tons, valued at $47,461,981, an increase of more than $16,000,000 over the 1946 total value. Imports declined both in quantity and value. Exports increased by nearly a million tons, and more phosphate rock was exported from the Western States than from Florida, because of Army purchases of phosphate rock for use in occupied territories. Apparent domestic consumption rose from 6,221,525 tons in 1946 to 7,445,948 tons in 1947. Stocks declined to 1,039,000 tons at the end of 1947. The P_2O_5 content of the domestic phosphate rock sold or used in 1947 reached a new high—2,921,137 long tons.

Salient statistics of the phosphate-rock industry in the United States, 1946–47

	1946				1947			
	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)	7,168,839	2,316,471	(1)	(1)	9,121,081	2,941,358	(1)	(1)
Sold or used by producers:								
Florida:								
Land pebble	4,807,563	1,615,919	$19,867,339	$4.13	6,314,077	2,108,702	$31,975,858	$5.06
Soft rock	97,067	19,652	387,708	3.99	88,620	17,976	326,064	3.68
Hard rock	100,881	36,627	762,127	7.55	79,330	28,850	618,330	7.79
Total Florida	5,005,511	1,672,198	21,017,174	4.20	6,482,027	2,155,528	32,920,252	5.08
Tennessee [2 3]	1,362,600	389,294	7,014,490	5.15	1,411,884	399,583	7,779,099	5.51
Idaho [4]	312,658	97,964	1,805,103	5.77	905,214	275,241	4,922,829	5.44
Montana	179,944	57,522	1,207,054	6.71	236,229	74,713	1,549,317	6.56
Wyoming					51,845	16,072	290,484	5.60
Total United States	6,860,713	2,216,978	31,043,821	4.52	9,087,199	2,921,137	47,461,981	5.22
Imports [5]	59,739	(1)	601,683	10.07	43,477	(1)	505,840	11.63
Exports [6]	698,927	(1)	4,435,964	6.35	1,684,728	(1)	9,820,168	5.83
Apparent consumption [7]	6,221,525	(1)			7,445,948	(1)		
Stocks in producers' hands, Dec. 31:								
Florida	630,000	210,000	(1)	(1)	518,000	170,000	(1)	(1)
Tennessee [2 3 8]	464,000	125,000	(1)	(1)	403,000	112,000	(1)	(1)
Western States	117,000	38,000	(1)	(1)	118,000	35,000	(1)	(1)
Total stocks	1,211,000	373,000	(1)	(1)	1,039,000	317,000	(1)	(1)

1 Data not available.
2 Includes sintered matrix.
3 Includes small quantity from Virginia.
4 Includes Utah.
5 Market value (or price) at port of shipment and time of exportation to the United States.
6 Exports 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.

International allocation of phosphate rock ceased July 1, 1947, at the end of the 1946–47 fertilizer year, according to an announcement of the International Emergency Food Council.

Several general papers relating to the phosphate-rock industry have been published recently.[1]

PRODUCTION

A startling new record was made in the quantity of phosphate rock mined in the United States in 1947—9,121,081 long tons. Again the increase was nearly 2,000,000 tons greater than in the previous year. Phosphate rock was mined in 1947 in Florida, Tennessee, Idaho, Montana, Utah, and Wyoming, and apatite in Virginia.

1 Emery, K. O., Phosphorite from the Sea Floor: Rocks and Minerals, vol. 22, No. 1, January 1947, pp. 8–9.
Farley, Franklin, Filling the Demand for Phosphate Rock: Fertilizer Review, vol. 22, No. 3, May–June 1947, pp. 3–6, 18.
Jacob, K. D., Development and Use of Fertilizer Materials in Relation to Higher Analysis Mixtures: Am. Fertilizer, vol. 107, No. 3, Aug. 9, 1947, pp. 7–9, 26, 28; vol. 107, No. 4, Aug. 23, 1947, pp. 9–10, 26, 28, 30.
Jacob, K. D., Phosphate Fertilizer Progress: Fertilizer Review, vol. 23, No. 1, January–February 1948, pp. 3–9, 19–20.
Sauchelli, Vincent, The Phosphate Industry: A National Asset: Am. Fertilizer, vol. 106, No. 7, Apr. 5, 1947, pp. 7–10, 30.
Sauchelli, Vincent, Great Asset Seen in U. S. Deposits of Phosphate: Reprint from Agricultural Chemicals, February 1947, 4 pp.

Phosphate rock mined in the United States, 1938–47, by States, in long tons

Year	Florida	Tennessee [1]	Western States	United States	Year	Florida	Tennessee [1]	Western States	United States
1938	2, 722, 927	999, 551	137, 998	3, 860, 476	1943	3, 274, 266	1, 868, 407	227, 294	5, 369, 967
1939	2, 791, 360	1, 057, 570	139, 040	3, 987, 970	1944	3, 486, 482	1, 413, 246	300, 274	5, 200, 002
1940	2, 782, 956	1, 120, 551	164, 570	4, 068, 077	1945	3, 814, 935	1, 260, 849	323, 955	5, 399, 739
1941	3, 417, 900	1, 301, 067	203, 216	4, 922, 183	1946	5, 280, 402	1, 316, 107	572, 330	7, 168, 839
1942	2, 984, 503	1, 568, 162	266, 273	4, 818, 938	1947	6, 381, 282	1, 489, 980	1,249,819	9, 121, 081

[1] Includes small quantity of apatite from Virginia and in 1938 small quantity of phosphate rock from South Carolina. Includes in 1938–43 some matrix of washer grade.

SALES

In 1947 another record was also made in the quantity of phosphate rock sold or used by producers—9,087,199 long tons—which exceeded the previous record, made in 1946, by nearly 2¼ million tons. The total value of the sales as reported by the producers was $47,461,981, more than $16,000,000 greater than in 1946.

Phosphate rock sold or used by producers in the United States, 1943–47

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1943	5, 126, 232	$18, 962, 021	$3. 70	1946	6, 860, 713	$31, 043, 821	$4. 52
1944	5, 376, 643	20, 856, 429	3. 88	1947	9, 087, 199	47, 461, 981	5. 22
1945	5, 806, 723	23, 951, 077	4. 12				

The following table shows the sales of phosphate rock, by grades, for 1946 and 1947.

Phosphate rock sold or used by producers in the United States, 1946–47, by grades and States

Grades—B. P. L.[1] content (percent)	Florida		Tennessee [2]		Western States		United States	
	Long tons	Percent of total	Long tons	Percent of total	Long tons	Percent of total	Long tons	Percent of total
1946								
Below 60	100, 938	2	637, 053	47	2, 433	1	740, 424	11
60 to 66	18, 759	(3)	286, 416	21			305, 175	4
68 basis, 66 minimum	213, 556	4	32, 581	2	203, 857	41	449, 994	7
70 minimum	838, 290	17	220, 299	16	357	(3)	1, 058, 946	15
72 minimum	1, 150, 749	23	184, 857	14	283, 899	58	1, 619, 505	24
75 basis, 74 minimum	1, 448, 156	29			2, 056	(3)	1, 450, 212	21
77 basis, 76 minimum	1, 077, 158	22	501	(3)			1, 077, 659	16
Above 85 (apatite) Undistributed	157, 905	3	893	(3)			158, 798	2
	5, 005, 511	100	1, 362, 600	100	492, 602	100	6, 860, 713	100
1947								
Below 60	93, 028	1	743, 219	53	2, 669	(3)	838, 916	9
60 to 66	5, 798	(3)	309, 572	22	314, 153	26	629, 523	7
68 basis, 66 minimum	761, 058	12	25, 186	2	144, 880	12	931, 124	10
70 minimum	976, 436	15	191, 153	13	149, 668	13	1, 317, 257	15
72 minimum	1, 526, 077	24	140, 797	10	443, 255	37	2, 110, 129	23
75 basis, 74 minimum	2, 281, 163	35			82, 938	7	2, 364, 101	26
77 basis, 76 minimum	837, 726	13	477	(3)	1, 092	(3)	839, 295	9
Above 85 (apatite) Undistributed	741	(3)	1, 480	(3)	54, 633	5	56, 854	1
	6, 482, 027	100	1, 411, 884	100	1, 193, 288	100	9, 087, 199	100

[1] Bone phosphate of lime. [2] Includes a small quantity from Virginia. [3] Less than 0.5 percent.

CONSUMPTION AND USES

The apparent consumption of phosphate rock in the United States in 1947 increased to 7,445,948 long tons from 6,221,525 (revised figure) in 1946, an increase of nearly 1¼ million tons.

Apparent consumption[1] of phosphate rock in the United States, 1943–47, in long tons

Year	Long tons	Year	Long tons
1943	4,814,727	1946	[2] 6,221,525
1944	5,061,924	1947	7,445,948
1945	5,457,648		

[1] Quantity sold or used by producers plus imports minus exports. [2] Revised figure.

Data on sales of phosphate rock by uses are shown in the accompanying table.

Phosphate rock sold or used by producers in the United States, 1946–47, by uses and States

Uses	Florida		Tennessee [1]		Western States		United States	
	Long tons	Percent of total	Long tons	Percent of total	Long tons	Percent of total	Long tons	Percent of total
1946								
Domestic:								
Superphosphates	3,959,108	79	449,496	33	195,838	40	4,604,442	67
Phosphates, phosphoric acid, phosphorus, ferrophosphorus	231,338	5	653,885	48	9,278	2	894,501	13
Direct application to soil	314,575	6	212,405	16	1,117	(2)	528,097	8
Fertilizer filler	32,303	1	18,454	1			50,757	1
Stock and poultry feed	52,501	1	500	(2)			53,001	1
Undistributed [3]	1,047	(2)	27,860	2	2,081	(2)	30,988	(2)
Exports [4]	414,639	8			284,288	58	698,927	10
	5,005,511	100	1,362,600	100	492,602	100	6,860,713	100
1947								
Domestic:								
Superphosphates	4,842,304	75	275,488	20	270,038	23	5,387,830	59
Phosphates, phosphoric acid, phosphorus, ferrophosphorus	327,151	5	799,422	57	8,035	1	1,134,608	13
Direct application to soil	485,517	7	278,280	20	328	(2)	764,125	9
Fertilizer filler	18,006	(2)	19,627	1			37,633	(2)
Stock and poultry feed	36,496	1	3,732	(2)			40,228	(2)
Undistributed [3]			35,335	2	2,712	(2)	38,047	(2)
Exports [4]	772,553	12			912,175	76	1,684,728	19
	6,482,027	100	1,411,884	100	1,193,288	100	9,087,199	100

[1] Includes a small quantity from Virginia.
[2] Less than 0.5 percent.
[3] Includes phosphate rock used in pig-iron blast furnaces, parting compounds, research, defluorinated phosphate rock, refractories, and other uses.
[4] As reported to the Bureau of Mines by domestic producers.

Certain details regarding the superphosphate industry are shown in the following table.

Production, shipments and stocks of superphosphates (18 percent available phosphoric acid), 1943–47, in short tons

[Bureau of the Census]

	1943	1944	1945	1946	1947
Production	6,292,955	6,692,368	7,372,104	7,847,591	9,292,677
Shipments	3,935,293	3,951,402	4,332,992	4,421,670	4,752,324
Stocks in manufacturers' hands Dec. 31	791,385	794,778	808,027	646,278	856,382

PRICES

All price controls on phosphate rock were ended November 10, 1946, by Office of Price Administration Supplementary Order 193. The accompanying table summarizes the quotations in the Oil, Paint and Drug Reporter at the beginning and end of 1947.

Prices per long ton of Florida and Tennessee unground, washed, and dried phosphate rock, in bulk f. o. b. cars at mine, by grades, in 1947

[Oil, Paint and Drug Reporter]

Grades—B. P. L.[1] content (percent)	Florida land pebble		Tennessee brown rock
	Jan. 13, 1947	Dec. 29, 1947	
68/66	$2.60	$3.34–3.49	----------
70/68	3.00	3.74–3.89	$5.50
72/70	3.60	4.34–4.42	6.00
75/74	4.60	5.34–5.49	----------
77/76	5.60	6.34–6.49	----------

[1] Bone phosphate of lime.

REVIEW BY STATES

Arkansas.—According to the Division of Geology of the Arkansas Resources and Development Commission, an extended field and laboratory study was made in 1947 of one of the numerous phosphate-rock deposits in the Batesville area of Independence County, Ark. Sixteen holes were drilled with a portable cable-tool rig, and a deposit of 141,540 long tons of phosphate rock with an average tricalcium phosphate content of 40.97 percent proved. This was believed suitable for use as a raw rock phosphate fertilizer in Arkansas.

Florida.—New and much higher records were made in 1947 in the total quantity of Florida phosphate rock sold or used—6,482,027 long tons—nearly 1½ million tons above the previous record high of 1946. The total value of this rock—$32,920,252—was $11,903,078 greater than the value of the phosphate rock sold in 1946. Increases occurred only in the quantity and value of the land-pebble phosphate rock sold or used.

The land-pebble phosphate-rock mining companies in operation in 1947 were the American Agricultural Chemical Co. (Pierce); American Cyanamid Co. (Brewster); Coronet Phosphate Co. (Plant City); Davison Chemical Corp. (Ridgewood); International Minerals & Chemical Corp. (Mulberry); Pembroke Chemical Corp. (Pembroke); Swift & Co. (Agricola); and the Virginia-Carolina Chemical Corp. (Nichols).

The International Minerals & Chemical Corp. operated its No. 2, No. 122, Peace Valley, and Achan mines and washers in 1947, but the No. 122 mine went out of operation in December. The rock produced was dried at the Mulberry drying plant. According to the annual report of the company for the year ended June 30, 1947, the Peace Valley mine produced more than a million long tons of phosphate rock in the fiscal year 1946–47—a reported record production for an individual mine in the phosphate-rock industry.

Florida phosphate rock sold or used by producers, 1943–47, by kinds

Year	Hard rock			Soft rock [1]		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
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
1946	100, 881	762, 127	7. 55	97, 067	387, 708	3. 99
1947	79, 330	618, 330	7. 79	88, 620	326, 064	3. 68

Year	Land pebble			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
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
1946	4, 807, 563	19, 867, 339	4. 13	5, 005, 511	21, 017, 174	4. 20
1947	6, 314, 077	31, 975, 858	5. 06	6, 482, 027	32, 920, 252	5. 08

[1] Includes material from waste-pond operations.

The American Agricultural Chemical Corp. operated its mines Nos. 2, 3, and 10, the Boyette tabling and No. 2 recovery plants, and the drier at Pierce. American Cyanamid Co. reports that phosphate rock was recovered at the Saddle Creek mine, washer, and flotation plant, and dried at Brewster. The Coronet Phosphate Co. operated its Hopewell and Eleanor mines and dried the phosphate-rock production at the Coronet drier. The Davison Chemical Corp. mined phosphate rock from its Bonny Lake, Pauway No. 3, and Pauway No. 4 mines and dried the washed rock at the Ridgewood drying plant.

Several illustrations picturing operations of this company appeared in a recent article.[2]

Swift & Co. Plant Food Division completed a new washer and flotation plant at its new phosphate-rock mine near Fort Meade, Fla. Production in 1947 came from its Agricola mine. The Pembroke Chemical Corp. operated its Pharr mine and washer and the Pembroke drier. The Virginia-Carolina Chemical Corp. operated its Homine and Phosmico mines and washers, drying plants at Phosmico and Nichols, and a calcining kiln at Nichols in 1947. At the latter locality the company also operated an electric furnace, a phosphoric acid unit, a contact sulfuric acid plant, a superphosphate plant, and a complete fertilizer plant. Descriptions of the Florida operations are given in the V-C News.[3]

[2] Chemical Engineering, Mining and Processing Florida Phosphate: Vol. 54, No. 8, August 1947, pp. 116–117.

[3] V-C News, Phosphate Rock: You Can't Live Without It: Vol. 1, No. 3, November 1947, pp. 4–9.
V-C News, Phosphorus Mirabilis: Vol. 1, No. 3, November 1947, p. 10.

The Victor Chemical Works continued its construction of an electric furnace plant for the manufacture of elemental phosphorus at Victor, on the Anclote River, north of Tarpon Springs, on the west coast of Florida.

In 1947 the Seaboard Air Line Railroad completed a new modern phosphate-rock elevator on Sedden Island, Tampa, said to be the largest and most modern in the world. This new elevator handles 1,500 tons of phosphate rock per hour from hopper car to ship's hold. Details of the elevator are given in mimeographed releases issued by the company.

In the hard-rock phosphate field, C. & J. Camp (P. O. Box 608, Ocala, Fla.) and J. Buttgenbach & Co. (P. O. Box 67, Lakeland, Fla.) operated jointly, as in recent years, and both mined and shipped hard-rock phosphate from the Section 12 mine near Dunnellon. All the shipments were for foreign consumption.

Several soft-phosphate companies were operating in the waste ponds of the hard-rock phosphate field, and one company mined and shipped a phosphatic clay from Bartow.

Tennessee.—The quantity of phosphate rock sold or used by Tennessee producers in 1947 (plus a small quantity of apatite from Virginia) was 1,411,884 long tons, an increase of only 49,284 tons over that of 1946, according to reports from producing companies. All of the production in 1947 was of brown rock. The total value of Tennessee phosphate rock sold or used in 1947 (plus a small quantity of apatite from Virginia) was $7,779,099, an increase of more than three-quarters of a million dollars over 1946.

Tennessee brown-rock phosphate was mined in 1947 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 1, Murfreesboro Road, Nashville, Tenn.); Hoover & Mason Phosphate Co. (8 South Michigan Avenue, Chicago, Ill.); International Mineral & Chemicals Corp. (20 North Wacker Drive Chicago, Ill.); Monsanto Chemical Co. (1700 South Second Street, St. Louis, Mo.); and Virginia-Carolina Chemical Corp. (Richmond, Va.).

Tennessee phosphate rock sold or used by producers, 1943–47 [1]

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1943	1,309,059	$5,822,249	$4.45	1946	1,362,600	$7,014,490	$5.15
1944	1,324,849	5,975,337	4.51	1947	1,411,884	7,779,099	5.51
1945	1,294,297	6,062,688	4.68				

[1] Includes small quantity of blue rock and also apatite from Virginia.

According to the annual report of the TVA for the fiscal year ended June 30, 1947, diverse phosphatic materials were being produced or investigated. The production of triple superphosphate during the fiscal year 1947 was 128,000 tons, of which almost 20,000 tons were used for tests and test demonstrations and about 92,000 tons were sold. Production of calcium metaphosphate during the fiscal year 1947 was nearly 7,800 tons, and 9,232 tons were shipped for use in test-demonstration programs. TVA produced more than 24,000 tons of fused tricalcium phosphate during the year. Estimates show that fused tricalcium phosphate can be produced more cheaply than ordinary superphosphate.

Phosphoric acid equivalent to more than 53,000 tons of P_2O_5 was produced by TVA in the fiscal year 1947, the highest annual production in its operations. Production of elemental phosphorus was hampered during the year by a shortage of boxcars from the Florida phosphate fields, but more than 25,000 tons were produced, a 30-percent increase over the previous year. A new furnace was placed in operation during the year.

TVA commenced the production of dicalcium phosphate as an animal feed supplement in 1944. Nearly 21,000 tons were supplied in 1947. A process for producing diammonium phosphate containing about 54 percent P_2O_5 and 21 percent nitrogen from electric-furnace phosphoric acid and synthetic ammonia was developed through the pilot stage in 1947. Two processes for the production of potassium metaphosphate (containing 55 percent phosphate and 35 percent potash) have been carried through the pilot-plant stage. Numerous other laboratory investigations were under way.

The Monsanto Chemical Co. announced early in 1947 that the building of electrically controlled and operated electric furnace facilities for additional elemental phosphorus production from phosphate rock had been begun and was scheduled for completion in 1948.

The Victor Chemical Works continued production of elemental phosphorus at its electric furnace plant in the brown-rock phosphate field.

Virginia.—Production of apatite was continued in 1947 from the Piney River apatite-ilmenite deposit by the Calco Chemical Division of the American Cyanamid Co. Some of the apatite recovered from the ore was shipped for the manufacture of superphosphate.

The origin of this deposit is still in dispute. It was originally described, in 1907, by Watson,[4] who considered it an igneous rock. Ross,[5] in 1941, decided, however, that hydrothermal replacement in a postmagmatic stage best explained the origin of the deposit. In November 1946, an article by Davidson, Grout, and Schwartz [6] appeared, in which the deposit was described as, in large part, an irregular apatite-ilmenite-bearing dike intruded into an earlier closely related anorthosite, and later sheared and hydrothermally altered. Ross[7] replied to this paper early in 1947 reaffirming his belief in the replacement origin of the deposits.

WESTERN STATES

New high records were established in 1947 for both the quantity and value of the marketed production of Western States phosphate rock, according to reports from producers to the Bureau of Mines. Marketed production jumped from 492,602 long tons in 1946 to

[4] Watson, T. L., Mineral Resources of Virginia: J. P. Bell, Lynchburg, Va., 1907, p. 300.

[5] Ross, Clarence S., Occurrence and Origin of the Titanium Deposits of Nelson and Amherst Counties, Va.: Geol. Survey Prof. Paper 198, 1941, 59 pp.

[6] Davidson, D. M., Grout, F. F., and Schwartz, G. M., Notes on the Ilmenite Deposit at Piney River, Va.: Econ. Geol., vol. 41, No. 7, November 1946, pp. 738–748.

[7] Ross, Clarence S., Virginia Titanium Deposits: Econ. Geol., vol. 42, No. 2, March-April 1947, pp. 194–198.

1,193,288 tons in 1947, an increase of 142 percent. This boom in Western States marketed production of phosphate rock is due very largely to purchases by the United States Government, through the United States Army, of hundreds of thousands of tons of phosphate rock from Idaho, Montana, and Wyoming for overseas shipments to occupied territories. The value of the marketed production of

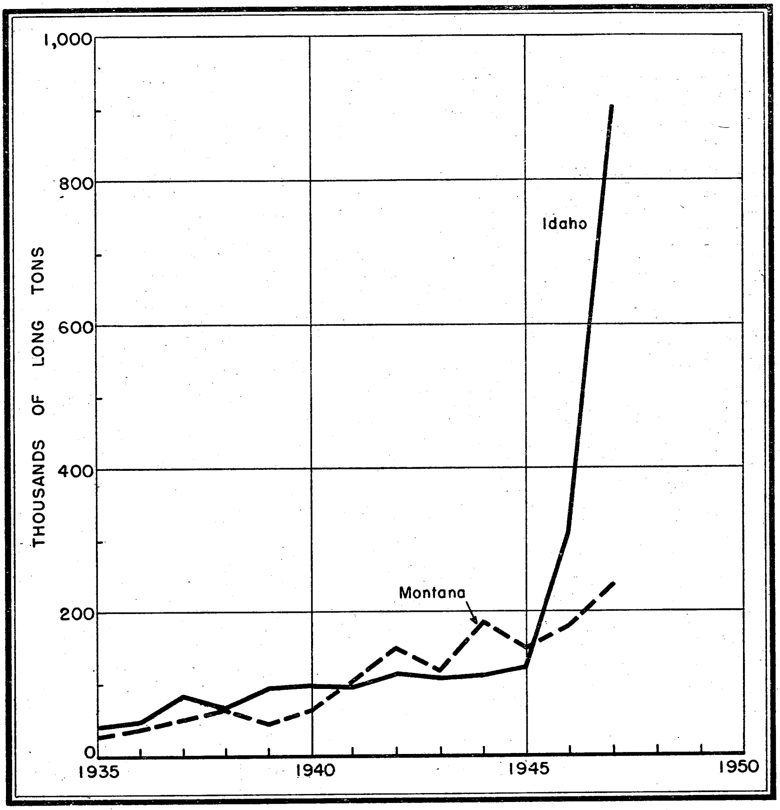

FIGURE 2.—Idaho and Montana phosphate rock sold or used by producers, 1935–47.

Western States rock more than doubled—rising from $3,012,157 in 1946 to $6,762,630 in 1947. The output in 1947 came from all four States of the Western field—Idaho, Montana, Utah, and Wyoming.

The average value per ton of the Western States phosphate rock sold or used, as reported by producers, decreased considerably in 1947—falling from $6.11 in 1946 to $5.67 in 1947. The lower grade of some of the rock marketed is believed to explain the lower average prices.

Permanente Metals Corp. is reported to have stepped up the output of its fused calcium magnesium phosphate fertilizer, made from serpentine and Idaho phosphate rock, at its Permanente, Calif., electric furnace plant during the year. No production of fused olivine–phosphate-rock fertilizer was reported from the plant of Manganese Products, Inc., Seattle, Wash.

Idaho.—The output of phosphate rock in Idaho in 1947 was nearly three times that of 1946. The State retained its position as the leading producer of the western region, its shipments (including a small quantity from Utah) being 905,214 long tons with a value of nearly 5 million dollars.

Western States phosphate rock sold or used by producers, 1943–47

Year	Idaho			Montana		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
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
1946	[1] 312,658	[1] 1,805,103	[1] 5.77	179,944	1,207,054	6.71
1947	[1] 905,214	[1] 4,922,829	[1] 5.44	236,229	1,549,317	6.56

Year	Wyoming			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1943				228,680	$1,050,295	$4.59
1944				298,999	1,346,145	4.50
1945				274,198	1,589,915	5.80
1946				492,602	3,012,157	6.11
1947	51,845	$290,484	$5.60	1,193,288	6,762,630	5.67

[1] Includes Utah.

Three companies operating in Idaho reported sales of phosphate rock in 1947. The largest producer—the Simplot Fertilizer Co., Pocatello, Idaho, continued its mining operations on the Fort Hall Indian Reservation, Bingham County. A large part of the production was exported; the balance went into the production of superphosphate at the Simplot plant in Pocatello.

The next largest producer (the San Francisco Chemical Co., 216 Pine St., San Francisco 4, Calif.) operated its Waterloo mine near Montpelier, Bear Lake County, Idaho, during the year. A 40-foot overburden of shale and limestone was stripped with a 2¼-cubic-yard Link-Belt shovel mounted on caterpillar treads, loading into rear-dump, Euclid quarry-type trucks with a capacity of 15 tons. After overburden was removed, open-pit mining was begun on a 6-foot bed of phosphate rock. The larger part of the production was exported; the balance went into the production of superphosphates. The Anaconda Copper Mining Co. operated its No. 3 mine at Conda, Caribou County, Idaho, shipping its production largely to the company plant at Anaconda, Mont.

During the year a report [8] was published embodying the results of a study at the University of Idaho of methods of beneficiating the lower-grade portions of the Phosphoria phosphate-bearing shales to produce a concentrate of a grade suitable for the preparation of superphosphate.

[8] Newton, Joseph, and Finkelnburg, O. C., Beneficiation of Idaho Phosphate Rock: School of Mines, University of Idaho, in cooperation with Idaho Bureau of Mines and Geology, Idaho Mineral Resources Rept. 3, June 1947; published by the University of Idaho, Moscow, Idaho, 22 pp.

Montana.—Shipments from Montana mines, reported by four companies, totaled 236,229 long tons, considerably above those of 1946 (179,944 tons). The value of the phosphate rock sold or used in 1947 was $1,549,317, which was $342,263 greater than in 1946. The Montana Phosphate Products Co., of Trail, British Columbia, was the largest producer. It operated its Anderson, Anaconda, and Graveley mines, as well as several Government leases, all in the Garrison district, Powell County. All of the phosphate rock shipped was exported. Mining operations were also carried on by George Relyea, Garrison, Mont., at the Relyea mine also in the Garrison district, and the production was shipped to Trail, British Columbia. In the Elliston district in Powell County the Silica Products Co., Inc., 433 Provident Bldg., Tacoma, Wash., is reported to have done some development work on the phosphate-rock deposits of that district.

In the Philipsburg district, Granite County, shipments were made by two companies. Manganese Products, Inc., 4260 West Marginal Way, Seattle 6, Wash., reported operating mines near Philipsburg and Hall, and the Moonlight Mining Co., Maxville, stated that it produced from the Moonlight mine near Princeton.

Utah.—Phosphate-rock operations in Utah in 1947 were confined to those of the Garfield Chemical & Manufacturing Corp., Salt Lake City, Utah, which mined and shipped phosphate rock from a Federal lease near Springville, Utah County, for use in iron-blast furnaces.

In January 1947 the United States Department of the Interior announced the return to the State of Utah of certain phosphate lands in Utah held by the Federal Government since 1938. The areas affected by this release include deposits on the north and south flanks of the Uintah Mountains and the eastern flank of the Wasatch Range. These are now said to be open for mining development.

Wyoming.—Wyoming became an important phosphate-rock producer in 1947 and shipped 51,845 long tons, valued at $290,484, from the Sage and Kemmerer regions of Lincoln County in the southwestern part of the State. Most of this output came from the Leefe mine of the San Francisco Chemical Co., San Francisco, Calif., in the Beckwith Hills syncline west of Sage, Wyo., on land leased from the owner, the Stauffer Chemical Co., San Francisco, Calif. Virtually all of this was exported. The other producer was Phosphate Mines, Inc., Kemmerer, Wyo., which in 1947 was developing a phosphate rock deposit 7 miles north of Kemmerer near the southern end of the Absaroka Ridge, on the eastern limb of the Fossil Creek syncline in secs. 4 and 16, T. 23 N., R. 116 W., of the Sixth principal meridian. Several tons of phosphate rock were shipped in the summer of 1947 from an open pit on the property.

The John M. Thomas claims and the Thomas Walker-Doerr Co. leases (H. F. Chaney claims) on the Sublette Range anticline in western Lincoln County are reported to have been leased to a Salt Lake City company. Only exploratory work was reported by Mrs. Thomas on the property in 1947.

Thin, low-grade, phosphate-rock beds on the northeast limb of the Wind River Mountains anticline near Lander, Fremont County, Wyo., were investigated in 1947 by the Bureau of Mines and the Geological Survey of the United States Department of the Interior. The deposits were described by King.[9]

A description of the phosphate-rock bearing Phosphoria formation of the Permian in parts of Teton County in northwestern Wyoming, was published late in 1947.[10]

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[9] King, R. H., Phosphate Deposits near Lander, Wyo.: Geol. Survey of Wyoming, Laramie, Wyo., Bull. 39, 1947, 84 pp.

[10] Foster, Helen L., Paleozoic and Mesozoic Stratigraphy of Northern Gros Ventre Mountains and Mount Leidy Highlands, Teton County, Wyo.: Bull. Am. Assoc. Petrol. Geol., vol. 31, No 9, September 1947, pp. 1537-1593. See pp. 1559-1561.

FOREIGN TRADE [11]

Data on imports and exports of phosphate rock and other phosphatic materials are shown in the following tables.

Phosphate rock and phosphatic fertilizers imported for consumption in the United States, 1943–47

[U. S. Department of Commerce]

Fertilizer	1943		1944		1945		1946		1947	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Apatite	6,114	$61,890	6,090	$52,758	12,804	$102,435				
Phosphates, crude, not elsewhere specified	40,391	315,268	117,324	952,374	128,854	1,010,091	59,739	$601,683	43,477	$505,840
Superphosphates (acid phosphate):										
Normal (standard), not over 25 percent P_2O_5 content	252	4,678	1,212	24,420	1,701	30,180	2,459	52,419	5,927	142,706
Concentrated (treble), over 25 percent P_2O_5 content	2,242	63,515	5	156	72	1,836	36	1,120	139	3,864
Ammoniated	60	3,698								
Total superphosphates	2,554	71,891	1,217	24,576	1,773	32,016	2,495	53,539	6,066	146,570
Ammonium phosphates, used as fertilizer	39,274	1,827,294	82,092	3,942,544	82,819	3,993,116	81,351	4,086,277	93,919	5,202,708
Bone dust, or animal carbon and bone ash, fit only for fertilizer	4,516	134,783	14,785	476,802	8,455	299,780	7,354	328,142	6,813	357,288
Guano	8,591	526,173	4,365	278,857	2,779	186,797	526	47,603		
Slag, basic, ground or unground	3	56								
Precipitated bone, fertilizer grade	75	2,730					670	63,782	186	17,700

[11] 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. Export figures exclude Army shipments to occupied territories.

Phosphate rock exported from the United States, 1943–47, by countries and grades

[U. S. Department of Commerce]

State of origin and country of destination	1943		1944		1945		1946		1947	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Florida:										
High-grade hard rock:										
Australia			3,997	$21,983	23,174	$169,222	5,400	$45,900		
Belgium and Luxembourg					21,000	175,750			1,200	$10,800
Canada			1,470	8,958	572	4,332	263	1,893	163	1,723
Cuba									5,608	29,161
Greece					3,500	23,625				
Italy									2,991	26,559
Netherlands									14,512	127,257
New Zealand							12,000	102,000		
Spain									21,130	181,170
Sweden					18,700	158,950	86,487	747,573	39,250	349,500
United Kingdom	42,815	$272,547	17,914	121,400	4,500	29,250			33,960	238,723
	42,815	272,547	23,381	152,341	71,446	561,129	104,150	897,366	118,814	964,893
Land pebble:										
Australia	24,457	128,628	27,011	163,983	46,526	272,139	45,800	382,705		
Belgium and Luxembourg									10,808	91,208
British Guiana							5	69	915	10,124
Canada	129,913	1,522,182	166,050	1,926,142	133,690	1,518,649	144,183	1,553,518	185,611	1,701,281
Canary Islands									1,627	14,447
Colombia									500	7,788
Czechoslovakia					6,279	39,298				
Eire	18,204	137,336	5,447	47,280						
Greece					10,996	65,980				
India									2,500	36,825
Italy									43,739	380,618
Mexico					51	620	2,000	11,391	7,136	31,546
Netherlands					296	1,776	7,992	70,970	9,969	87,991
New Zealand	13,248	72,864	33,886	190,569	31,193	219,519	58,209	473,433		
Poland and Danzig					2,997	17,964	3,492	24,444		
Spain							12,554	111,895	60,397	533,713
Sweden					5,200	44,200			24,232	215,179
United Kingdom	26,614	141,122			24,118	112,677	62,593	464,592	41,897	293,268
Yugoslavia					12,136	72,811	2,201	15,407		
	212,436	2,002,132	232,394	2,327,974	273,482	2,365,633	339,029	3,108,424	389,331	3,403,988
Other phosphate rock [1]	207	4,116	1,132	8,431	7,843	60,413	917	15,560	1,707	19,468
Total Florida	255,458	2,278,795	256,907	2,488,746	352,771	2,987,175	444,096	4,021,350	509,852	4,388,349
Tennessee, Idaho, and Montana rock:										
Canada	102,759	596,457	182,358	980,601	137,962	749,905	189,244	1,432,011	243,465	2,617,080
Grand total	358,217	2,875,252	439,265	3,469,347	490,733	3,737,080	633,340	5,453,361	753,317	7,005,429

[1] Includes sintered matrix.

Superphosphates (acid phosphates) exported from the United States, 1946–47, by countries

[U. S. Department of Commerce]

Country	1946		1947	
	Long tons	Value	Long tons	Value
Argentina	568	$15,018	5,658	$117,837
Brazil	21,244	468,253	34,524	865,194
British East Africa	1,283	63,801	976	46,206
Canada	84,561	1,475,202	120,030	2,221,204
Chile	782	33,396	315	23,624
China	26,711	737,773	4,469	87,450
Colombia			1,716	83,341
Costa Rica	339	11,141	802	36,567
Czechoslovakia	4,668	232,510		
Dominican Republic	779	16,540	400	28,688
El Salvador	879	28,630	881	32,669
Formosa	4,730	84,691	475	9,496
Greece	12,037	231,112		
Guatemala	531	13,879	1,740	70,957
Iceland	1,073	26,444	1,403	61,795
India	660	16,632		
Mexico	79	3,254	387	22,299
Netherlands	9,495	423,299		
Poland and Danzig	34,530	926,957		
United Kingdom	4,440	195,210		
Venezuela	183	6,320	1,946	83,440
West Indies:				
British:				
Leeward and Windward Islands	90	2,216	2,568	94,010
Trinidad and Tobago	1,169	38,100	2,296	65,318
Other British	224	9,524	21	1,256
Cuba	22,308	540,252	49,215	1,388,643
Haiti	2	275		
Yugoslavia	6,613	174,740		
Other countries	1,366	45,576	2,764	70,751
	241,344	5,820,745	232,586	5,410,745

Other phosphate materials [1] exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Long tons	Value	Year	Long tons	Value
1943	655	$90,275	1946	1,018	$144,478
1944	545	70,358	1947	1,129	220,906
1945	1,732	140,363			

[1] Class includes bone ash, dust, and meal; animal carbon for fertilizer; char dust; duplex basic phosphate; and South Carolina river rock.

TECHNOLOGY

Various papers on developments in phosphate rock technology that were published recently are listed below.[12]

[12] Barber, S., Mitchell, J., and Spinks, J. W. T., Soil Studies Using Radioactive Phosphorus: Canadian Chem. and Process Ind., vol. 31, No. 8, August 1947, pp. 757–758, 761.

Barr, J. A., Jr., Phosphate Concentration, part 6; New Flotation Methods Permit Profitable Concentration of Low-Grade Sands: Rock Products, vol. 50, No. 3, March 1947, pp. 89–91, 108.

Bridger, G. L., Wilson, R. A., and Burt, R. B., Continuous-Mixing Process for Manufacture of Concentrated Superphosphate: Ind. Eng. Chem., vol. 39, No. 10, October 1947, pp. 1265–1272.

Chemical Engineering, Isotopic Fertilizers: Vol. 54, No. 3, March 1947, p. 125.

Chemical Engineering, Phosphoric Glass Developed by Russian Scientists: Vol. 54, No. 3, March 1947, p. 206.

Chemical Engineering, Formation and Application of Phosphate Coatings: Vol. 54, No. 4, April 1947, p. 268. (Abs. of paper by V. M. Darsey and W. R. Cavanagh before the Electrochemical Society, Toronto, Canada, October 1946.)

Chemical Engineering, Composition of Strong Phosphoric Acids: Vol. 54, No. 6, June 1947, p. 268. (Abs. of paper by R. N. Bell before Division of Physical and Inorganic Chemistry, American Chemical Society, Atlantic City, N. J., Apr. 15, 1947.)

Hotson, A. E., Phosphorus Production: Chem. and Eng. News, vol. 25, No. 25, June 23, 1947, pp. 1832–1833.

Sauchelli, Vincent, The Atom Goes to Work for the Farmer; Am. Fertilizer, vol. 107, No. 6, Sept. 20, 1947, pp. 7–10, 26, 28, 30.

South African Mining and Engineering Journal, Phosphating Wearing Surfaces—Aid to Lubrication: Vol. 47, No. 2819, Feb. 22, 1947, p. 709. (Long abs. of paper by Shaw, R. E., The Phosphate Treatment of Wearing Parts of Machinery, read at meeting of Institute of Marine Engineers in London.)

WORLD PRODUCTION

The following table gives available figures on production of phosphate rock in various countries in recent years.

World production of phosphate rock, 1942–47 by countries, in metric tons[1]

[Compiled by P. Roberts]

Country [1]	1942	1943	1944	1945	1946	1947
Algeria	334,550	76,798	220,349	401,304	584,827	706,878
Australia:						
New South Wales	118	122			(2)	(2)
South Australia	14,182	12,976	4,167	725	20	(2)
Western Australia		43	2,251	8,619	(2)	
Austria	(2)	(2)	(2)	(2)	3,240	11,525
Belgium	103,300	108,900	52,270	17,990	(2)	(2)
Brazil (apatite)	(2)	6,111	5,216	7,463	10,421	(2)
British West Indies:						
Cayman Islands	203	102	(2)	(2)	(2)	(2)
Canada	1,147	1,316	437	271	52	
Chile (apatite)	24,909	37,924	50,840	13,203	15,210	(2)
Egypt	328,440	315,566	318,185	349,374	294,046	371,227
Eire	16,444	17,252	20,300	(2)	12,189	(2)
France	113,400	131,020	92,966	60,622	88,924	56,786
French Oceania (exports)	176,065	188,385	203,300	259,000	241,100	(2)
Germany	829	585	(2)	(2)	[3] 210	(2)
India	337	1,215	232	532	247	(2)
Indochina, French:						
Phosphate rock	29,050	19,890	6,850			(2)
Apatite	98,800	64,600	300			(2)
Japan [4]	1,400	1,200	3,000	2,000		(2)
Morocco, French	715,410	806,171	1,444,902	1,654,120	2,783,800	[5] 2,234,600
Netherlands Indies	[6] 24,000	[6] 24,000	[6] 24,000	(2)	(2)	(2)
Netherlands West Indies:						
Curacao (exports)	(2)	(2)	7,813	8,770	(2)	(2)
New Zealand		9,389	20,251	8,084	11,224	(2)
Palestine	2,818	[7] 5,384	[7] 4,961	[7] 4,867	[7] 4,024	(2)
Rumania			(2)	(2)	(2)	(2)
Seychelles Islands (exports)	22,347	1,849	5,941	7,090	21,397	(2)
South-West Africa	59	164		27	1,665	2,223
Spain	15,232	15,722	17,770	20,349	18,608	21,651
Sweden (apatite)	79,395	144,265	160,847	171,127	50,730	(2)
Tanganyika Territory	25	267	28	9	279	(2)
Tunisia	879,743	334,678	522,265	706,404	1,399,880	1,759,236
Uganda	(2)	(2)	(2)	8,648	7,213	7,269
Union of South Africa	9	5,801	21,088	27,342	(2)	(2)
U. S. S. R. (apatite)	[6] 2,000,000	(2)	(2)	(2)	(2)	(2)
United States (sold or used by producers)	4,718,780	5,208,508	5,462,938	5,899,921	6,970,827	9,233,049
Total [8]	9,701,000	7,540,000	8,673,000	9,638,000	12,520,000	14,404,000

[1] In addition to countries listed, Angaur Island, China, Christmas Island, Formosa, Italy, Madagascar, Nauru and Ocean Islands, New Caledonia, and Republic of the Philippines produce phosphate rock, but data of output are not available.
[2] Data not available.
[3] United States zone only.
[4] Preliminary data for Noto Peninsula, Honshu, for fiscal year ended March 31 of year following that stated.
[5] January to September, inclusive.
[6] Estimate.
[7] Exports.
[8] Totals represent only those countries for which statistics are shown.

BASIC SLAG

Basic slag does not form a very important source of agricultural phosphorus in the United States. Domestic production is small, and annual imports are negligible. None has been imported into the United States since 1943. The only domestic source is phosphatic iron ore of the Birmingham, Ala., district. Because there is only a single producing company, no exact production figures are available for publication.

Platinum-Group Metals

By HUBERT W. DAVIS

GENERAL SUMMARY

DEMAND substantially larger than the new supply of refined metal, greatly reduced inventory, fluctuation in price, and some speculation were features of the platinum industry in 1947. Noteworthy also was the much smaller demand for palladium, which interrupted an upward trend in sales that had persisted since 1939. The retail price of platinum and ruthenium ranged from $56 to $69 an ounce in 1947 and iridium from $70–$80 to $110. Quotations on palladium, osmium, and rhodium, however, were unchanged at $24, $100, and $125 an ounce, respectively.

Salient statistics of platinum-group metals in the United States, 1946–47, in troy ounces

	1946	1947		1946	1947
Production:			Stocks in hands of refiners, importers, and dealers, Dec. 31:		
Crude platinum-group metals from placers	22,949	13,836	Platinum	187,624	133,300
New metals:			Palladium	132,523	167,364
Platinum	92,947	54,011	Other	41,876	36,859
Palladium	3,858	4,156		362,023	337,523
Other	4,973	2,690	Imports for consumption:		
	101,778	60,857	Unrefined materials	76,012	51,209
Secondary metals:			Refined metals	331,198	257,656
Platinum	40,385	54,190		407,210	308,865
Palladium	27,856	27,492	Exports:		
Other	4,396	5,406	Ore and concentrates	134	42
	72,637	87,088	Refined metals and alloys, including scrap	19,762	25,549
			Manufactures (except jewelry)	6,669	6,327

Platinum was refined in the United States in 1947 at a rate 19 percent lower than in 1946 and greatly below the moderately larger domestic demand. The refined-metal deficiency was met partly by imports of 110,745 ounces, chiefly from Canada (54,728 ounces), U. S. S. R. (32,667 ounces), and United Kingdom (18,995 ounces) and partly by withdrawals from stocks of refiners and dealers. The jewelry trade was by far the largest outlet for platinum in 1947, taking

51 percent of the total sold to domestic consumers. Sales to the jewelry trade, however, were 20 percent smaller than in 1946. Less platinum was also sold to the electrical and dental industries in 1947 than in 1946. The smaller demands by the jewelry, electrical, and dental industries, however, were more than offset by larger sales to the chemical trade, increased exports, and by sales to the national strategic stock pile.

Palladium was refined in the United States at about the same rate in 1947 as in 1946. The quantity refined in 1947, however, was 77 percent less than domestic sales. Although sales of palladium were smaller in 1947 than in 1946, 1945, and 1944, nevertheless they were greater than in any other year. The deficit in domestic refining of palladium was more than met by imports of 133,962 ounces of refined metal, chiefly from Canada (71,048 ounces) and U. S. S. R. (57,563 ounces). All consuming industries purchased less palladium than in 1946 but the decline was not as pronounced in the electrical industry.

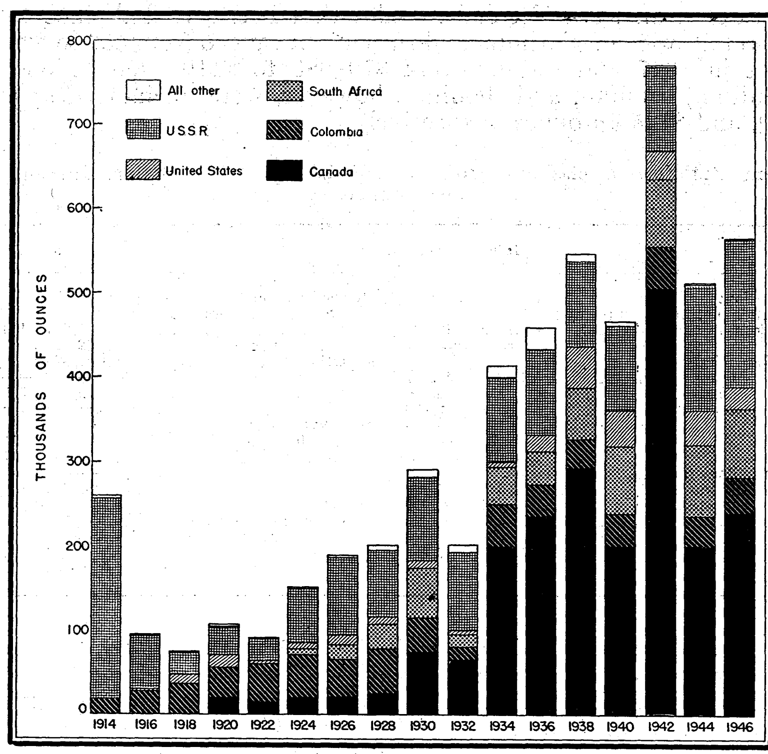

FIGURE 1.—Trend in world production of platinum-group metals, 1914–46.

Less iridium, osmium, and rhodium but more ruthenium were refined in the United States in 1947 than in 1946; more osmium and rhodium but less iridium and ruthenium were imported. Sales of osmium and ruthenium were much smaller than in 1946, those of iridium moderately lower, but those of rhodium were up appreciably.

Imports of platinum-group metals into the United States in 1947 were 24 percent less than the all-time high established in 1946.

Figure 1 shows graphically the trend in world production of platinum-group metals since 1914.

CRUDE-PLATINUM PRODUCTION

Mine returns for 1947 show a production of 13,512 ounces of crude platinum-group metals in Alaska and 324 ounces in California—a total of 13,836 ounces; comparable figures for 1946 are 22,882 ounces of crude platinum-group metals in Alaska and 67 ounces in California—a total of 22,949 ounces. The Alaskan production came from placer deposits in the Goodnews Bay district of southwestern Alaska; the 1947 output contained 86.5 percent platinum-group metals and 3 percent gold. The decline in Alaskan output resulted mainly from the dredge working temporarily in ground of lower platinum-group metals content. The output in California was a byproduct of gold placers in Butte, Merced, Sacramento, and Yuba Counties; the 1947 production contained about 94 percent platinum-group metals.

Many gold and copper ores in the United States contain small quantities of platinum-group metals. In 1947, 4,570 ounces of platinum-group metals were recovered as byproducts of refining gold and copper ores compared with 3,363 ounces in 1946.

Source of Purchases.—Purchases of domestic crude platinum-group metals by buyers in the United States were reported from the following sources in 1947: Alaska, 13,512 ounces, and California, 283 ounces—a total of 13,795 ounces (23,103 ounces in 1946). Domestic buyers also reported purchases of 40,587 ounces of foreign crude platinum-group metals from Colombia and 652 ounces from the Union of South Africa in 1947—a total of 41,239 ounces (43,384 ounces in 1946).

RECOVERY OF REFINED PLATINUM-GROUP METALS

New Metals Recovered.—Reports from refiners of crude platinum-group metals, gold bullion, nickel, and copper indicate that 60,857 ounces of platinum-group metals were recovered in the United States from such sources in 1947—a decrease of 40 percent from 1946. Of the new metals recovered in 1947, 71 percent was chiefly from concentrates and impure sponge from Canada and crude from Colombia, 21 percent from domestic crude (chiefly from Alaska), and 8 percent a byproduct of gold and copper ores.

New platinum-group metals recovered by refiners in the United States, 1943–45, and by sources in 1946–47, in troy ounces

	Platinum	Palladium	Iridium	Osmium	Rhodium	Ruthenium	Total
1943	234,320	82,441	5,286	1,193	7,131	4,885	335,256
1944	132,452	10,966	4,406	463	3,256	1,502	153,045
1945	162,032	28,649	5,783	845	4,731	2,466	204,506
1946							
Domestic from—							
Crude platinum	23,107	166	2,437	447	626	91	26,874
Gold and copper refining	555	2,735	73				3,363
	23,662	2,901	2,510	447	626	91	30,237
Foreign from— Crude platinum; Nickel and copper refining	69,285	957	485	28	770	16	71,541
Total recovery	92,947	3,858	2,995	475	1,396	107	101,778
1947							
Domestic from—							
Crude platinum	10,955	133	1,056	313	374	41	12,872
Gold and copper refining	1,098	3,471	1				4,570
	12,053	3,604	1,057	313	374	41	17,442
Foreign from— Crude platinum; Nickel and copper refining	41,958	552	548	106	189	62	43,415
Total recovery	54,011	4,156	1,605	419	563	103	60,857

Secondary Metals Recovered.—In 1947, 87,088 ounces of secondary platinum-group metals were recovered from the refining of scrap metal, sweeps, and other waste products of manufacture that contain platinum-group metals—a 20-percent increase over 1946.

Substantial quantities of worn-out catalysts, spinnerets, laboratory ware, and other products are returned by consumers to refiners for refining. The refined platinum-group metals recovered from these products (or their equivalent in refined metals) are returned to the consumers. The platinum-group metals so recovered are not included in the statistics of secondary metals.

Secondary platinum-group metals recovered in the United States, 1943–47, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1943	68,613	23,616	2,771	6,581	101,581
1944	85,942	29,684	965	2,805	119,396
1945	58,942	32,968	812	3,400	96,122
1946	40,385	27,856	2,002	2,394	72,637
1947	54,190	27,492	2,089	3,317	87,088

CONSUMPTION

As pure metals, combined, clad, or alloyed with other metals, the platinum-group metals are utilized in the electrical and chemical industries, in dentistry and jewelry, and for numerous miscellaneous purposes. Uses of the platinum-group metals are tabulated on page 801 of the Platinum and Allied Metals chapter in Minerals Yearbook,

1943. A series of articles on the production, properties, and engineering uses of the platinum-group metals were published in the Metal Industry.[1]

Sales of platinum-group metals to consumers in the United States were 387,454 ounces in 1947 compared with 484,575 ounces in 1946. Some platinum was sold to the national strategic stock pile in 1947, but the quantity so sold has not been included in the figures on sales.

The most widely used metal of the group is platinum, which constituted 223,450 ounces (57.7 percent) of the total platinum-group metals sold to consumers in the United States in 1947. The jewelry trade was again the chief buyer of platinum, taking 51 percent of the total, but its purchases (114,768 ounces) were 20 percent less in 1947 than in 1946. The chemical industry, which dropped to third place in 1946, was the second-largest outlet for platinum in 1947, taking 65,743 ounces (30 percent) of the total, or more than double the quantity purchased in 1946. Sales of platinum to the electrical and dental industries in 1947 were 13 and 55 percent, respectively, smaller than in 1946.

Next to platinum, palladium is the most extensively used metal of the group; it comprised 138,269 ounces (35.7 percent) of the total platinum-group metals sold to domestic consumers in 1947. Sales of palladium in 1947, however, were 36 percent smaller than in 1946 and interrupted an upward trend that had persisted since 1939. The electrical industry was again the chief outlet for palladium, taking 81,528 ounces (59 percent) of the total palladium sold; sales to the electrical industry, however, were 11 percent smaller than in 1946. The jewelry trade retained second place as a buyer of palladium in 1947, but its purchases (28,523 ounces) were 53 percent less than in 1946 and the smallest since 1942. Sales of palladium to the chemical and dental industries also declined drastically (54 and 50 percent, respectively) in 1947.

Sales of the other platinum-group metals—iridium, osmium, rhodium, and ruthenium—were comparatively small; they made up 6.6 percent (25,735 ounces) of the total for the group in 1947. Iridium, hardening addition for platinum, was the metal of this group most extensively sold in 1947, followed in order by ruthenium, rhodium, and osmium. Sales of iridium, osmium, and ruthenium were 9, 45, and 47 percent, respectively, smaller than in 1946, but sales of rhodium were 16 percent larger. The increasing popularity of rhodium plating for costume jewelry, razors, and lighters was partly responsible for the greater demand for rhodium in 1947.

The accompanying table shows reported sales of platinum-group metals to consuming industries in the United States for 1938–47. The figures for 1938 and 1939 do not include the sale of some imported metals and are not, therefore, exactly comparable with those for later years, which comprise sales by refiners, dealers, importers, and Office of Metals Reserve.

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[1] Jahn, C. A. H., Platinum Metals: A Survey of Their Production, Properties, and Engineering Uses: Metal Ind. (London), vol. 72, No. 10, Mar. 5, 1948, pp. 183–186; No. 11, Mar. 12, 1948, pp. 206–209; No. 12, Mar. 19, 1948, pp. 228–230, 234; No. 13, Mar. 26, 1948, pp. 249–250, 254; No. 14, Apr. 2, 1948, pp. 267–269.

Platinum-group metals sold to consuming industries in the United States, 1938–47 in troy ounces

Year	Chemical			Electrical			Dental and medical		
	Platinum	Palladium	Other platinum-group metals	Platinum	Palladium	Other platinum-group metals	Platinum	Palladium	Other platinum-group metals
1938	14,328	402	302	5,645	10,447	847	12,324	18,833	182
1939	20,306	468	813	11,952	21,510	1,346	13,755	22,989	139
1940	31,174	1,624	3,286	17,548	32,528	5,100	9,859	26,346	228
1941	68,285	3,342	4,154	28,368	35,456	5,214	19,426	31,440	270
1942	94,025	5,480	5,668	92,961	28,452	12,446	13,077	27,480	106
1943	131,716	14,162	4,154	185,281	25,907	15,851	27,044	41,522	160
1944	60,936	9,673	3,944	178,038	42,322	11,650	34,783	36,377	177
1945	115,816	8,988	6,182	107,260	69,300	5,572	30,871	42,259	900
1946	31,107	15,092	4,219	35,007	91,243	3,513	21,859	41,407	145
1947	65,743	6,899	3,580	30,469	81,528	2,906	9,774	20,876	74

Year	Jewelry and decorative			Miscellaneous and undistributed			Total			
	Platinum	Palladium	Other platinum-group metals	Platinum	Palladium	Other platinum-group metals	Platinum	Palladium	Other platinum-group metals	All platinum-group metals
1938	44,654	5,356	2,674	10,617	35	660	87,568	35,073	4,665	127,306
1939	47,385	5,899	3,446	6,868	540	941	100,266	51,406	6,685	158,357
1940	51,296	7,624	4,759	13,101	1,197	1,220	122,978	69,319	14,593	206,890
1941	66,151	7,999	6,228	7,845	667	3,552	190,075	78,904	19,418	288,397
1942	66,518	19,658	4,275	2,595	390	2,681	269,176	81,460	25,176	375,812
1943	438	45,218	2,080	240	10,900	4,559	344,719	137,709	26,804	509,232
1944	424	56,558	2,847	1,467	9,409	3,599	275,648	154,339	22,217	452,204
1945	81,305	56,578	10,026	1,599	8,107	5,282	336,851	185,232	27,962	550,045
1946	144,015	60,294	17,039	2,491	9,145	7,999	234,479	217,181	32,915	484,575
1947	114,768	28,523	15,172	2,696	443	4,003	223,450	138,269	25,735	387,454

STOCKS

Stocks of platinum-group metals in all forms in the hands of refiners, importers, and dealers totaled 337,523 ounces on December 31, 1947, compared with 362,023 ounces at the close of 1946.

Stocks of platinum-group metals held by refiners, importers, and dealers in the United States, Dec. 31, 1943–47, in troy ounces

Year	Platinum	Palladium	Iridium, osmium, rhodium, and ruthenium	Total
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
1946	187,624	132,523	41,876	362,023
1947	133,300	167,364	36,859	337,523

PRICES

Buyers reported purchases at $50 to $59.37 an ounce for domestic and foreign crude platinum-group metals in 1947. This price range results chiefly from variations in iridium contents of crudes and from market fluctuations for refined platinum and ruthenium in 1947.

The retail prices of refined platinum and ruthenium were advanced by $5 an ounce on January 8, 1947, to $61, where they remained until April 14, when another increase of $5 became effective. Subsequently, several price reductions were made, and on June 23 both metals were again quoted at $56; on August 19 the prices were raised to $59 an ounce and after August 27 fluctuated between $69 and $62. Iridium was quoted at $110 an ounce until April 10, when it was lowered to $95–$100; thereafter it fluctuated between $70–$80 and $90–$100. Quotations on palladium, osmium, and rhodium were unchanged at $24, $100, and $125 an ounce, respectively, throughout 1947.

FOREIGN TRADE [2]

Imports.—Imports of platinum-group metals into the United States in 1947 were 24 percent less than the all-time high established in 1946. The principal sources of imported platinum-group metals in 1947 were Canada (137,653 ounces), U. S. S. R. (94,367 ounces), Colombia

Platinum-group metals [1] (unmanufactured) imported for consumption in the United States, 1946–47

Material	1946		1947	
	Troy ounces	Value	Troy ounces	Value
Unrefined materials: [2]				
Ores and concentrates of platinum metals	28,639	$843,538	1,176	$90,771
Grains and nuggets (including crude, dust, and residues)	38,735	1,913,066	42,203	1,816,454
Sponge and scrap	7,962	524,005	7,431	384,817
Osmiridium	676	31,233	399	22,354
Total	76,012	3,311,842	51,209	2,314,396
Refined metals:				
Platinum	119,853	6,273,058	110,745	5,890,132
Palladium	187,555	3,421,815	133,962	2,585,115
Iridium	12,402	1,096,762	5,011	352,601
Osmium	1,969	177,030	2,189	239,605
Rhodium	525	52,816	2,122	239,625
Ruthenium	8,894	362,997	3,627	170,602
Total	331,198	11,384,478	257,656	9,477,680
Grand total	407,210	14,696,320	308,865	11,792,076

[1] On the basis of detailed information received by the Bureau of Mines from importers, certain items recorded by the U. S. Department of Commerce as "grains and nuggets" and "sponge and scrap" have been reclassified and included with other groups in this table.

[2] The concentrates 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.

[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.

(42,004 ounces), and United Kingdom (28,244 ounces). Imports of refined metals (257,656 ounces), which comprised 83 percent of the total, were 22 percent less than in 1946, whereas those of unrefined material (51,209 ounces) were 33 percent smaller. Imports of refined platinum, palladium, iridium, and ruthenium were 8, 29, 60, and 59 percent, respectively, less than in 1946, but imports of osmium and rhodium were 11 and 304 percent, respectively, more.

Platinum-group metals [1] (unmanufactured) imported for consumption in the United States, 1946–47, by countries, in troy ounces

Country	Unrefined materials [2]				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	
1946										
Australia					209					209
Canada	24,630	9	7,674		53,778	122,001	1,870		6,800	216,762
Colombia	2,025	36,618			15					38,658
Ecuador		1,465			191					1,656
Egypt					322					322
Ethiopia	1,929									1,929
Union of South Africa	43			438						481
U. S. S. R.					40,168	60,581	4,721	1,286	95	106,851
United Kingdom		643	169	238	25,158	4,973	5,811	683	2,524	40,199
Other countries	12		119		12					143
Total	28,639	38,735	7,962	676	119,853	187,555	12,402	1,969	9,419	407,210
1947										
Canada			6,262		54,728	71,048	1,660		3,955	137,653
Colombia		42,004								42,004
Ethiopia		195								195
France						625				625
Norway					395		32		225	652
Palestine and Trans-Jordan					1,075					1,075
Switzerland			1		1,248					1,249
Syria					1,506					1,506
Union of South Africa	793			115				141	61	1,110
U. S. S. R.					32,667	57,563	2,725	1,412		94,367
United Kingdom	383		1,128	284	18,995	4,716	594	636	1,508	28,244
Other countries		4	40		131	10				185
Total	1,176	42,203	7,431	399	110,745	133,962	5,011	2,189	5,749	308,865

[1] On the basis of detailed information received by the Bureau of Mines from importers, certain items recorded by the U. S. Department of Commerce as "grains and nuggets" and "sponge and scrap" have been reclassified and included with other groups in this table.

[2] The concentrates 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-group metals imported for consumption in the United States, 1943–47 [1]

Year	Troy ounces	Value	Year	Troy ounces	Value
1943	362, 251	$10, 936, 243	1946	407, 210	$14, 696, 320
1944	356, 212	10, 675, 303	1947	308, 865	11, 792, 076
1945	383, 298	11, 649, 933			

[1] See footnote 2 of preceding table.

Exports.—Exports of refined platinum (including scrap) increased to 17,766 ounces in 1947 (15,468 ounces in 1946) and those of the other platinum-group metals (including scrap) ascended to 7,783 ounces (4,294 ounces in 1946). In 1947 the chief foreign markets for platinum were Argentina (7,649 ounces), Brazil (4,017 ounces), Netherlands (1,515 ounces), and Canada (1,184 ounces) and for the other platinum-group metals Canada (3,749 ounces) and United Kingdom (1,662 ounces).

Platinum-group metals exported from the United States, 1943–47

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
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
1946	134	10, 377	15, 468	965, 406	4, 294	196, 808	6, 669	256, 382
1947	42	1, 322	17, 766	977, 468	7, 783	256, 150	6, 327	335, 797

Platinum-group metals exported from the United States, 1946–47, 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
1946						
Argentina	1,108	$73,891	63	$2,261	78	$13,305
Belgium and Luxembourg	436	29,239	19	1,700	380	29,306
Brazil	6,512	402,159	724	21,069	414	14,991
Canada	177	11,381	1,341	68,435	3,640	142,146
Chile	422	24,984	3	95	58	3,245
China	-----	-----	26	1,192	35	1,135
Colombia	215	13,651	54	1,470	48	2,104
Cuba	592	35,123	209	5,588	13	562
Czechoslovakia	25	221	-----	-----	41	194
France	1,519	77,116	277	6,233	994	25,530
Mexico	1,849	133,613	287	11,917	460	8,559
Netherlands	32	2,374	32	2,490	-----	-----
Peru	19	1,597	12	100	31	940
Poland and Danzig	-----	-----	-----	-----	51	194
Sweden	200	7,135	2	354	98	4,668
Switzerland	-----	-----	585	21,232	35	390
Turkey	-----	-----	-----	-----	66	2,798
United Kingdom	1,846	116,628	400	44,000	19	600
Uruguay	261	19,201	-----	-----	2	79
Venezuela	5	202	10	2,407	15	803
Other countries	250	16,891	250	6,274	191	4,833
Total	15,468	965,406	4,294	196,808	6,669	256,382
1947						
Argentina	7,649	376,360	453	12,809	58	3,071
Brazil	4,017	252,942	257	8,778	109	6,447
Canada	1,184	64,108	3,749	104,278	3,382	131,357
Chile	56	3,753	3	187	17	1,284
China	89	3,617	132	11,895	240	24,245
Colombia	59	1,676	178	4,627	6	493
Cuba	586	35,244	270	8,514	37	2,213
France	747	48,900	134	17,006	10	1,650
Germany	48	2,773	48	5,739	-----	-----
Hong Kong	49	3,002	101	7,657	70	6,679
Italy	-----	-----	-----	-----	1,477	113,393
Mexico	620	37,248	186	7,076	36	2,656
Netherlands	1,515	98,748	-----	-----	30	822
Palestine and Trans-Jordan	-----	-----	115	5,129	97	7,627
Philippines, Republic of	141	8,275	98	5,255	130	6,478
Poland and Danzig	80	1,828	-----	-----	6	486
Sweden	214	10,223	2	319	155	8,613
Switzerland	232	10,226	321	7,394	-----	-----
Uruguay	163	10,325	-----	-----	-----	-----
U. S. S. R	60	2,972	-----	-----	83	2,615
United Kingdom	-----	-----	1,662	46,750	24	400
Venezuela	71	1,446	12	291	17	364
Other countries	186	3,802	62	2,446	343	14,904
Total	17,766	977,468	7,783	256,150	6,327	335,797

WORLD REVIEW

Canada.—According to the Dominion Bureau of Statistics, production of platinum-group metals from the nickel-copper ores of the Sudbury district, plus a very small quantity from placers in British Columbia, was 94,540 ounces of platinum and 103,774 ounces of other platinum-group metals in 1947, compared with 121,771 ounces of platinum and 117,566 ounces of other platinum-group metals in 1946.

Sales of platinum-group metals by the International Nickel Co. of Canada, Ltd., were 191,761 ounces in 1947 compared with 320,794 ounces in 1946.

Colombia.—The South American Gold & Platinum Co. produced 25,241 ounces of crude platinum-group metals in 1947 (30,797 ounces in 1946). The crude material contains about 85 percent platinum-group metals. The production of crude platinum-group metals by other operators was 9,515 ounces in 1947 (13,742 ounces in 1946).

World production of platinum-group metals, 1939 and 1942–47, in troy ounces

[Compiled by B. B. Mitchell]

Country and product	1939	1942	1943	1944	1945	1946	1947
Australia:							
New South Wales: Placer platinum	7	2	3	2	2	(1)	(1)
Tasmania: Placer osmiridium	283	142	90	107	109	95	99
Belgian Congo: From refineries:							
Palladium	3,344					(1)	(1)
Platinum	1,157					(1)	(1)
Canada:							
Placer platinum	25	30					
From refineries: [2]			219,713	157,523	[3] 208,234	121,771	94,540
Platinum	148,877	285,198					
Other platinum-group metals	135,402	222,573	126,004	42,929	[3] 458,674	117,566	103,774
Colombia: Placer platinum (exports)	39,070	49,163	39,961	36,136	35,129	43,835	40,537
Ethiopia: Placer platinum	6,000	1,000	1,000	942		[4] 140	[4] 1,548
Italy: From refineries: Platinum	1,608	386	(1)	(1)	(1)	(1)	(1)
Netherlands Indies: Placer platinum	28	(1)			(1)	(1)	(1)
New Zealand: Placer platinum	13	21	5			14	
Papua: [5]							
Placer platinum	2	(1)	(1)	(1)	(1)	(1)	(1)
Placer osmiridium	4	(1)	(1)	(1)	(1)	(1)	(1)
Sierra Leone: Placer platinum	83				16	(1)	(1)
Union of South Africa:							
Platinum (content of platinum-group metals) [6]	18,068			22,509	22,884	22,900	23,000
Concentrates (content of platinum-group metals) [6]	41,243	73,797	73,745	58,070	52,030	51,900	52,900
Osmiridium [7]	7,031	7,770	5,993	6,142	6,259	6,794	6,243
U. S. S. R.:							
Placer platinum / From refineries [8] (estimate)	100,000	100,000	125,000	150,000	150,000	175,000	150,000
United States:							
Placer platinum	32,460	23,213	27,162	33,625	26,551	22,949	13,836
Ore (content of platinum-group metals)	66	26					
From refineries: [9]							
Platinum	5,270	4,333	5,205	3,286	1,068	555	1,098
Other platinum-group metals	3,364	5,472	5,185	3,638	3,427	2,808	3,472
Total (estimate)	543,000	773,000	629,000	515,000	[3] 965,000	567,000	491,000

[1] Data not available.
[2] Recovered from nickel-copper mattes. The figures for 1945–47 represent the platinum-group metals contained in the concentrates actually recovered, whereas those for 1939 and 1942–44 represent the metals refined from Canadian concentrates at Acton, England, plus the platinum-group metals content of concentrates sold.
[3] Includes certain adjustments to account for metals produced in Canada in 1938–44 but not previously accounted for in the statistics.
[4] Exports for year ended Sept. 10 of year stated.
[5] Year ended June 30 of year stated.
[6] Produced from platinum ores.
[7] Produced from treatment of gold ores on the Witwatersrand and Extensions.
[8] Recovered from nickel-copper ores.
[9] New platinum-group metals recovered in gold and copper refining of domestic materials.

Sierra Leone.—Platinum was discovered in Sierra Leone in 1926; mining commenced toward the end of October 1929 on rich alluvial deposits in the stream Big Water near York Pass, and 26 ounces were produced that year. Production reached a peak of 750 ounces in 1935; since that year output has declined almost progressively until

1941, when only 21 ounces were produced and mining ceased. According to the Mining Journal,[3] the sudden cessation of mining of platinum was due to war conditions which provided easier and more lucrative employment for labor, yet it is doubtful if production will soon again attain 100 ounces annually.

Union of South Africa.—According to the Department of Mines, 73,166 ounces of crude platinum containing 22,884 ounces of platinum-group metals and 1,222 short tons of concentrates containing 52,030 ounces of platinum-group metals were produced in South Africa in 1945, the latest year for which detailed information is available. Thus, total output of platinum-group metals was 74,914 ounces in 1945; sales were 58,543 ounces. The average composition of the 58,543 ounces sold was: Platinum, 59.72 percent; palladium, 28.59 percent; iridium, 0.74 percent; osmium and osmiridium, 0.12 percent; rhodium, 1.79 percent; ruthenium, 4.10 percent; and gold, 4.94 percent.

Outputs of crude platinum and concentrates were 73,758 ounces and 1,242 short tons, respectively, in 1947, compared with 74,696 ounces and 1,186 short tons, respectively, in 1946. No assay data are available for 1946 and 1947; in 1945 the crude platinum averaged 31.28 percent platinum-group metals, and the concentrates contained 42.58 ounces of platinum-group metals per ton. The crude platinum and concentrates are produced in the Rustenburg district. In 1946 and 1947 sales of platinum-group metals were 55,490 and 56,288 ounces, respectively, and those of osmiridium were 6,794 and 6,243 ounces, respectively.

Output of osmiridium, which is recovered in the treatment of gold ores on the Witwatersrand and Extensions, was 6,259 ounces in 1945; and sales were 6,678 ounces, with the following average composition: Osmium, 29.59 percent; iridium, 26.48 percent; ruthenium, 13.19 percent; platinum, 12.69 percent; rhodium, 0.73 percent; gold, 1.78 percent; and undetermined, 15.54 percent.

Because of the steady demand for platinum, the Rustenburg Platinum Mines, Ltd., was doubling the capacity of its mining and milling facilities in the Rustenburg district. It was anticipated that the expansion would be completed by the end of 1948.

The South African Government had approved the grant of a lease to the Union Platinum Mining Co. for the exclusive right of mining for precious metals under an area of 348 morgen (737 English acres) on the farm Zwartklip No. 988, Rustenburg district.[4] Pending construction of the main plant, a subsidiary plant was being erected to make possible an early start with crushing and milling about 150 tons of oxidized ore daily.

[3] Mining Journal (London), vol. 20, No. 5863, Jan. 3, 1948, p. 5.
[4] South African Mining and Engineering Journal, vol. 58, pt. 2, No. 2851, Oct. 4, 1947, p 117

Potash

By BERTRAND L. JOHNSON AND E. M. TUCKER

GENERAL SUMMARY

MORE new records were made in 1947 in the potash industry of the United States; production of marketable potassium salts and sales both reached new highs. Output in 1947 was 1,905,776 short tons of potassium salts containing 1,029,875 tons of potash (K_2O). This was an increase of 218,041 tons of potassium salts and 98,063 tons of K_2O over 1946. The production of marketable potassium salts in the United States has increased each year since 1934. Sales (1,953,307 short tons) in 1947 were 280,058 tons greater than in 1946 and contained 1,053,266 tons of K_2O. The value of the sales in 1947 exceeded 34 million dollars. The average value per ton of the potassium salts sold in 1947 was considerably less than in 1946, according to the reports by producers. Stocks of potassium salts in producers' hands at the end of 1947 were much lower than on December 31, 1946. Both imports and exports of fertilizer potash materials increased in 1947, but those for chemical uses declined. Domestic consumption of potash made a new high record, apparent consumption reaching 1,011,442 short tons of K_2O.

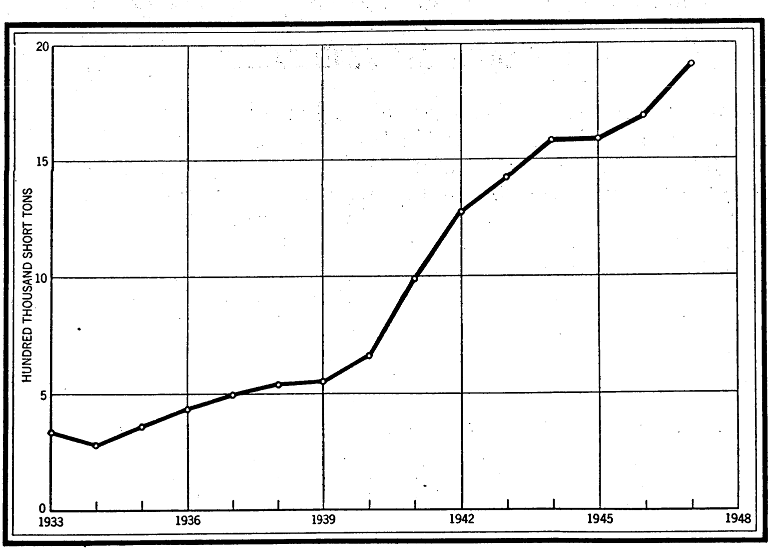

FIGURE 1.—Production of marketable potash salts in the United States, 1933–47.

Salient statistics of the potash industry in the United States, 1945–47

	1945	1946	1947
Production:			
Potassium salts (marketable) short tons	1,588,305	1,687,735	1,905,776
Approximate equivalent, K_2O do	874,243	931,812	1,029,875
Sales by producers:			
Potassium salts do	1,597,160	1,673,249	1,953,307
Approximate equivalent, K_2O do	870,370	928,374	1,053,266
Value at plant	$30,313,919	$32,175,716	$34,716,051
Average per ton	$18.98	$19.23	$17.77
Imports:			
Fertilizer materials short tons	6,885	7,872	47,815
Approximate equivalent, K_2O do	3,871	2,564	25,266
Value	$230,714	$249,819	$1,887,771
Chemical materials short tons	[1] 9,720	8,327	3,228
Approximate equivalent, K_2O do	[1] 2,030	1,801	712
Value	$3,079,761	$2,100,915	$587,580
Total imports short tons	[1] 16,605	16,199	51,043
Approximate equivalent K_2O do	[1] 5,901	4,365	25,978
Value	$3,310,475	$2,350,734	$2,475,351
Exports:			
Fertilizer materials short tons	104,687	96,822	102,939
Approximate equivalent, K_2O [2] do	58,310	53,930	57,337
Value	$2,986,990	$2,983,751	$3,251,645
Chemical materials short tons	18,966	23,905	21,970
Approximate equivalent, K_2O [2] do	9,273	11,713	10,765
Value	$3,648,795	$5,055,441	$5,434,462
Total exports short tons	123,653	120,727	124,909
Approximate equivalent, K_2O [2] do	67,583	65,643	68,102
Value	$6,635,785	$8,039,192	$8,686,107
Apparent consumption: [3]			
Potassium salts short tons	[1] 1,490,112	[1] 1,568,721	1,879,441
Approximate equivalent, K_2O do	[1] 808,688	[1] 867,096	1,011,142

[1] Revised figure.
[2] Estimate by Bureau of Mines.
[3] Quantity sold by producers, plus imports, minus exports.

The potash industry was discussed in recent articles.[1] A general discussion of potash concentration processes was also published during 1947.[2]

International allocation of potash was discontinued July 1, 1947.

PRODUCTION AND SALES

Production and sales of domestic marketable potassium salts were much larger in 1947 than in 1946; thus the upward trend in evidence since 1934 continued. The increases in 1947 over 1946 were very much larger than those shown in the latter year over 1945, both in production and sales. Production of potassium salts in 1947 totaled 1,905,776 short tons, with an equivalent K_2O content of 1,029,875 tons. Sales were 1,953,307 tons, with an equivalent K_2O content of 1,053,266 tons. Sales of potassium salts exceeded the production, and stocks in producers' hands at the end of the year showed a decrease from those on hand at December 31, 1946. The value of the sales exceeded 34 million dollars, more than 2 million dollars greater than

[1] Albright, H. M., Development of the Domestic Potash Industry: Min. Cong. Jour., vol. 33, No. 12, December 1947, p. 83.
Turrentine, J. W., Potash Aplenty: Fertilizer Rev., vol. 22, No. 2, March–April 1947, pp. 3–6, 11.
[2] Rock Products, Potash Concentration. Part 8: Novel Processes Used To Separate Water-Soluble Crystalline Salts by Froth Flotation Methods: Vol. 50, No. 8, April 1947, pp. 112–115.

in 1946. The average value per ton of the potassium salts sold in 1947, as calculated from returns by producers, was $17.77 as compared with $19.23 in 1946.

Potassium salts produced in the United States, 1945–47, by grades, in short tons

Grade	1945	1946	1947
Muriate of potash:			
60–62 percent K_2O minimum [1]	[2] 1,173,314	[2] [3] 1,251,088	[3] 1,394,202
48–50 percent K_2O minimum	117,677	122,257	125,120
Manure salts	115,798	98,333	174,145
Sulfate of potash and sulfate of potash-magnesia	[2] 181,516	[2] 216,057	212,309
	1,588,305	1,687,735	1,905,776

[1] Includes refined potash.
[2] Revised figure.
[3] Includes some 93–96 percent KCl.

Production of both grades of muriate of potash as well as manure salts was larger in 1947 than in 1946. The combined production of sulfate of potash and sulfate of potash-magnesia, however, declined. The increase in the production of the 60–62-percent muriate was much greater than that of the 48–50-percent grade. The tonnage produced of the latter grade was below that of the manure salts. (See fig. 2.)

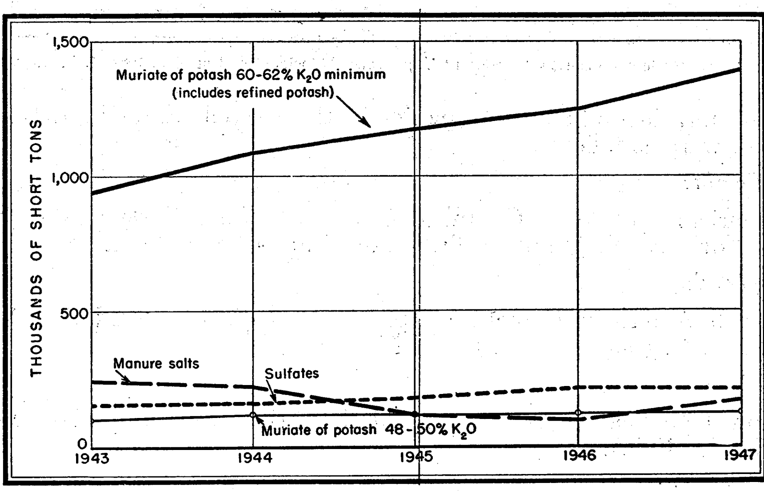

FIGURE 2.—Potassium salts produced in the United States, 1943–47, by grades, in short tons.

The dominant factor in the domestic potash industry is the production of the Western States. California, New Mexico, and Utah furnished virtually all of the 1947 output, the larger part coming from the deeply buried Permian saline sedimentary deposits of sylvite and langbeinite of the Carlsbad region, southeastern New Mexico. The Eastern and Central States supplied only a small quantity—as byproducts of cement operations in Maryland and from well brines in Michigan.

Stocks in producers' hands at the end of the year had declined to 14,697 short tons K_2O, the lowest point since 1943. (See fig. 3.)

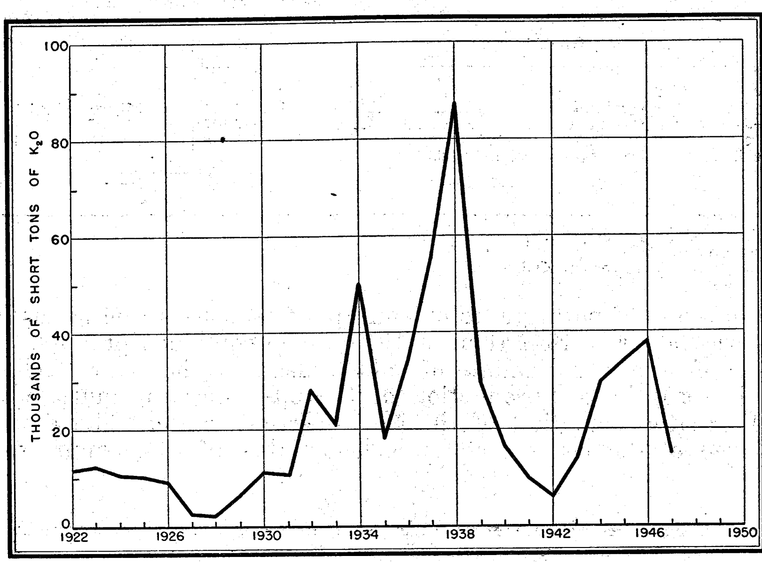

FIGURE 3.—Equivalent potash (K_2O) content in producers' stocks at end of year, 1922–47, in short tons.

The potash-producing companies in the United States in 1947, by States, were as follows:

California:

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 St., New York, N. Y. (plant at Security, Md.).

Michigan:

Dow Chemical Co., Midland, Mich. (brine wells and plant near Midland, Mich.).

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).

Production and sales of marketable potassium salts and stocks in the hands of producers at the end of the year for the last 5 years are summarized in the accompanying table.

Potassium salts produced, sold, and in producers' stocks in the United States, 1943–47

Year	Production			Sales				Producers' stocks, Dec. 31	
	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	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)
1943	7	1,428,840	739,141	7	1,401,271	732,151	$26,183,073	43,591	13,984
1944	6	1,578,498	834,568	6	1,543,420	817,892	29,487,413	76,123	29,763
1945	7	1,588,305	874,243	6	1,597,160	870,370	30,313,919	68,796	34,253
1946	7	1,687,735	931,812	7	1,673,249	928,374	32,175,716	82,554	37,999
1947	7	1,905,776	1,029,875	7	1,953,307	1,053,266	34,716,051	35,428	14,697

REVIEW BY STATES

Five States—California, Maryland, Michigan, New Mexico, and Utah—produced merchantable potash salts in 1947. 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 producing State, contributing 85 percent of the total. California furnished much more than the combined output of the other three States.

California.—The American Potash & Chemical Corp., New York, N. Y., was still the only potash-producing company on the Pacific coast. Potash is recovered from brines saturating the crystalline salt mass of Searles Lake in southeastern California, and potassium chloride and potassium sulfate are produced and marketed.

Maryland.—The only company producing potash in Maryland in 1947 was the North American Cement Corp., New York, N. Y. The byproduct potash recovered by this company came from cement-kiln flue dust at its plant at Security, Washington County, near Hagerstown. The product—an impure sulfate of potash of low potash content—was sold for agricultural use. This was the only operation of its kind reported in the United States in 1947.

Michigan.—The Dow Chemical Co. was the only potash-producing company in Michigan in 1947. It obtained potassium chloride from natural brine from wells at Midland.

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New Mexico.—Mine production of potash salts in the Carlsbad region of New Mexico continued to increase, and another new record was made. The three companies operating in the area mined 4,655,732 short tons of sylvinite and crude langbeinite combined—an increase of 346,083 tons over 1946. The equivalent K_2O content of the mine production in 1947 was 965,583 short tons. The average equivalent K_2O content of the mined salts remained at 20.7 percent in 1946, as in 1947.

All three companies mined sylvite (potassium chloride) and one—International Minerals & Chemical Corp.—also mined langbeinite (potassium-magnesium sulfate). The greater part of the mine production of the region was sylvite, most of which was processed to yield 60-percent or higher-grade muriate. The production of merchantable potash salts in New Mexico in 1947 was 1,625,870 short tons, with an equivalent K_2O content of 866,070 tons. Sales were 1,659,266 tons of salts (880,605 tons K_2O) valued at $28,035,675. Muriate of potash was produced by all three companies. Potassium sulfate and potassium-magnesium sulfate (sulfate of potash-magnesia) were produced from 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.

A detailed report of drilling operations in 1944 on the United States Potash Reserve by the Bureau of Mines was released in 1947.[3] Sixteen core holes outlined an estimated reserve of 16,017,290 tons of potash ore averaging 24.73 percent K_2O when using a 5-foot minimum thickness and a 15-percent lower potash limit. Costs of mining and beneficiating this potash were also estimated in this report, using 1944 price and wage data. Because costs of equipment and supplies, wages, and freight rates have increased largely since 1944, although potash prices have not increased, the estimated costs are not representative of current operations.

The mining methods in use at the mine of the United States Potash Co. in the Carlsbad area were described in a recent article.[4] The occurrence of bromine in the potash salts of the Carlsbad region was described in another article.[5]

A new potash concern, the Continental Potash Co., of Kansas City, Mo., has begun operations in the Carlsbad area. This company, operating under a Federal prospecting permit and drilling early in 1947 northeast of Carlsbad, is said to have cored a section of soluble potash salts rich enough to support trial of a solution mining process.

Utah.—Commercial production of potash in Utah in 1947 was restricted to the potassium-bearing brines of Salduro Marsh, where Bonneville, Ltd., continued to produce potassium chloride at its plant near Wendover, Tooele County, northwestern Utah.

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[3] Storms, W. R., Diamond Drilling of Postash Reserves in Eddy County, N. Mex.: Bureau of Mines Rept. of Investigations 4098, 1947, 108 pp.

[4] Mining World, Potash Mining Practice: Vol. 9, No. 5, May 1947, pp. 22–24.

[5] Lindberg, Marie Louise, Occurrence of Bromine in Carnallite and Sylvite from Utah and New Mexico: Am. Mineralogist, vol. 31, Nos. 9–10, September–October 1946, pp. 486–494.

The United States Department of the Interior, on May 21, 1947, revoked the withdrawals of 200,000 acres of potash and magnesium lands in east-central Utah, and the lands were returned to the public domain, where they became subject to filings under the Leasing Act.

Three bids to buy the war-surplus experimental potash and alumina plant in Salt Lake City, Utah, formerly operated by Kalunite, Inc., were set aside on December 23, 1947, by War Assets Administration, and the plant offered to one of the bidders, J. R. Simplot Co., Boise, Idaho, for $752,000, on the ground that sale to him would aid small business. The rejected bids—all more than the $611,000 appraised fair value of the property and all proposing to convert the plant to fertilizer production—were those of the American Potash & Chemical Corp., $752,000; Columbia Metals Corp., $635,000; and J. R. Simplot Co., $625,000. The Simplot company accepted the offer and raised its bid to meet the figure proposed, and the sale is said to have been consummated on December 31, 1947. The American Potash & Chemical Co. is reported to have protested the sale.

CONSUMPTION

Apparent consumption of potash salts in the United States and its possessions increased from 867,096 short tons (corrected figure) of potash (K_2O) in 1946 to 1,011,142 tons in 1947, as determined by subtracting exports from the sum of the imports and the producers' sales. The relationship of the apparent consumption to sales of domestic producers, as reported to the Bureau of Mines, for a period of years, is shown in figure 4.

According to the American Potash Institute, the five leading domestic producers and two importers delivered 1,980,324 tons of potash salts in North America in 1947. These contained the equivalent of 1,071,268 tons of K_2O, a 16-percent increase over 1946. European potash salts of French and German origin appeared on the United States market again for the first time since World War II and are included in these figures. Deliveries for agricultural purposes in continental United States for 1947 were 898,150 tons of equivalent K_2O, an increase of 134,560 tons over 1946. Canada received 39,205 tons of K_2O, Cuba 4,811 tons, Puerto Rico 21,293 tons, Hawaii 13,183 tons, and other countries 11,920 tons. Eighty percent of the total K_2O delivered for agricultural purposes was in 60-percent muriate, 7 percent in 50-percent muriate, 5 percent in manure salts, and 8 percent in sulfate of potash and sulfate of potash-magnesia. Deliveries in North America for chemical purposes in 1947 were 82,707 tons of K_2O, an increase of 9 percent over 1946; 80,134 tons of K_2O were in muriate of potash and 2,573 in sulfate of potash. All of the deliveries for chemical use were to the United States (except 639 tons of 60-percent muriate to Canada).

Deliveries of agricultural potash and chemical potash in the calendar year 1947 are shown, by State of destination, in the accompanying tables. Georgia retained its leading position for receipts of agricultural potash and Illinois its second place. New York remained by far the leading recipient of chemical potash.

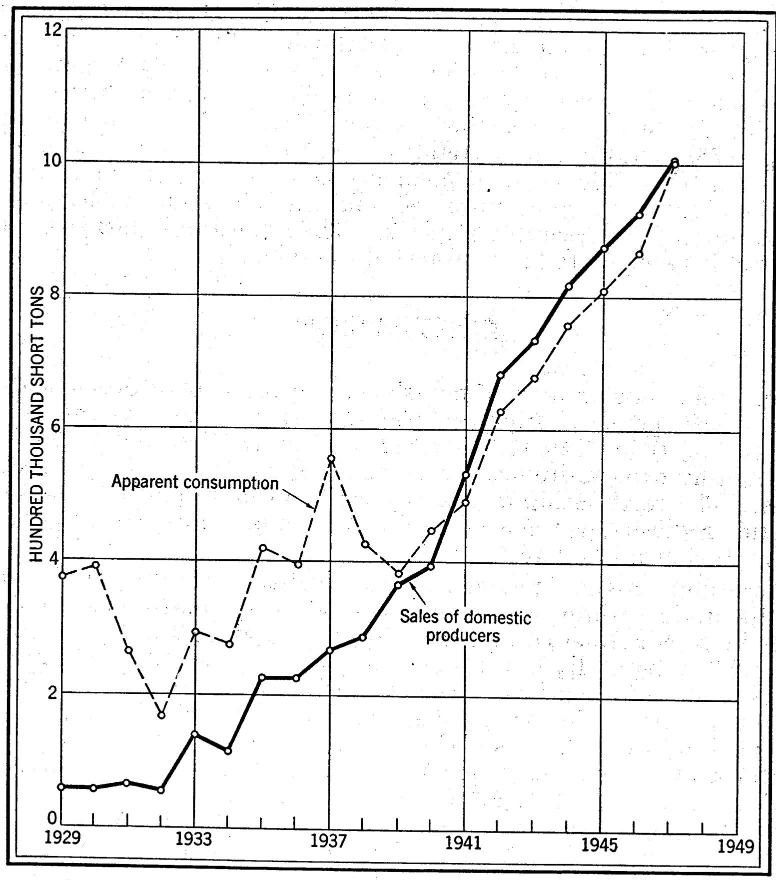

FIGURE 4.—Comparison of apparent domestic consumption of potash (K_2O) and sales by domestic producers of potash in the United States, 1929–47.

Deliveries of agricultural potash salts, by State of destination, in 1947, in short tons of K_2O

[American Potash Institute]

Georgia	86, 663	Kentucky	8, 264
Illinois	77, 486	Texas	8, 149
Ohio	74, 819	Minnesota	6, 508
Virginia	71, 336	Iowa	5, 416
North Carolina	65, 985	Connecticut	5, 020
Florida	60, 032	Missouri	4, 859
Maryland	52, 986	Delaware	3, 654
South Carolina	52, 813	Washington	3, 468
Indiana	48, 990	Oregon	2, 246
Alabama	35, 970	Colorado	641
New Jersey	32, 603	Vermont	569
Tennessee	27, 509	North Dakota	454
California	19, 517	West Virginia	398
Pennsylvania	19, 029	Idaho	286
Louisiana	17, 748	Utah	230
Maine	16, 809	Arizona	222
Mississippi	16, 535	District of Columbia	97
New York	15, 858	Kansas	88
Wisconsin	15, 518	New Hampshire	81
Arkansas	13, 535	Montana	51
Massachusetts	12, 831	Nebraska	26
Michigan	12, 827	Rhode Island	24

Deliveries of chemical potash salts, by State of destination, in 1947, in short tons of K_2O

[American Potash Institute]

New York	59, 860	Tennessee	390
Texas	4, 463	Oklahoma	304
West Virginia	3, 544	Georgia	287
California	3, 375	Michigan	270
New Jersey	2, 021	Iowa	262
Ohio	1, 973	Missouri	232
Maryland	1, 130	Kansas	206
Virginia	763	Connecticut	181
Pennsylvania	714	Massachusetts	81
Oregon	539	Washington	31
Illinois	522	Florida	20
Delaware	476	Louisiana	5
Nevada	419		

PRICES

Prices for potash at the beginning of 1947 were those listed on the producers' price schedules for the 1946–47 season (see Minerals Yearbook, 1946, p. 1024). In March 1947, however, supplemental price schedules were issued by New Mexico companies; changes (applicable only to the "spot" or "list" season of that spring) were made in prices of agricultural-grade muriate of potash, which was reduced 13.5 cents per unit K_2O from the ex-vessel port price and quoted f. o. b. seller's plant, Carlsbad, N. Mex. The Potash Company of America also announced f. o. b. Carlsbad prices of manure salts (22 percent K_2O minimum) of 20 cents per unit K_2O for the same period, and discontinued the ex-vessel price basis.

The regular price schedules for New Mexico potash for agricultural purposes for the 1947–48 season were issued in April and May 1947 by the producers. The ex-vessel price basis was discontinued. Quotation basis became bulk, f. o. b. cars, seller's plant, Carlsbad, N. Mex. These prices, as reported by producing companies, were:

Muriate of potash (62 to 63 percent K_2O; 62 percent minimum)	37½ cents per unit K_2O.
Muriate of potash (60 percent K_2O minimum)	
Muriate of potash (50 percent K_2O minimum)	
Muriate of potash (48 to 52 percent K_2O; 48 percent minimum)	
Manure salts (22 to 26 percent K_2O; 22 percent minimum)	20 cents per unit K_2O.
Manure salts (22 percent K_2O minimum)	
Sulfate of potash (90 to 95 percent K_2SO_4, basis 90 percent K_2SO_4)	\$30.00 per short ton.
Sulfate of potash-magnesia (basis 40 percent K_2SO_4, 18.50 percent MgO)	\$14.50 per short ton.

The price schedule of the American Potash and Chemical Corp., issued May 1, 1947, announced the price on Searles Lake muriate of potash, 60 percent K_2O minimum, for agricultural purposes, bulk, carlots, f. o. b. Trona, Calif., for the season June 1, 1947, to May 31, 1948, at 45.5 cents per unit K_2O, and for sulfate of potash, 95–98 percent K_2SO_4, at 74 cents per unit K_2O. The list prices ex-vessel basis were discontinued.

FOREIGN TRADE [6]

Imports.—Imports of potash salts in 1947 rose from the low level of 16,199 tons (4,365 tons K_2O) in 1946 to 51,043 tons (25,978 tons K_2O) in 1947, largely as a result of much larger importations of the muriate (chloride). The total value of the imports likewise increased, rising from \$2,350,734 in 1946 to \$2,475,351 in 1947. France, Belgium and Luxembourg, and Germany, in the order given, were the principal sources of the imports in 1947.

Potash (K_2O) for fertilizer use constituted 97 percent of the imports in 1947, whereas in 1946 fertilizers had formed only 59 percent of the total. Imports for chemical use fell abruptly in 1947 to only 3 percent of the total compared with 41 percent in 1946.

The principal potash salt imported in 1947 for fertilizer use was the muriate, which came from Belgium and Luxembourg, France, Germany, and Canada. A large tonnage (10,031 tons) of potassium sulfate entered from Germany; none was imported in 1946. Marked declines occurred in 1947 in the imports of all other kinds of potash salts itemized in the accompanying tables, except cream of tartar, the quantity of which imported nearly doubled.

[6] Figures on imports and exports 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, 1946–47 [1]

[U. S. Department of Commerce]

Material	Approximate equivalent as potash (K_2O) (percent)	1946				1947			
		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	3,452	1,947	44.6	$103,217	35,284	19,900	76.6	$1,321,367
Potassium nitrate, crude	40.0					(2)	(2)		26
Potassium-sodium nitrate mixtures, crude	14.0	4,400	616	14.1	146,312	2,500	350	1.4	64,968
Potassium sulfate, crude	50.0					10,031	5,016	19.3	501,410
Other potash fertilizer material [3]	6.0	20	1	0	290				
Total fertilizer		7,872	2,564	58.7	249,819	47,815	25,266	97.3	1,887,771
Used chiefly in chemical industries:									
Bicarbonate	46.0	50	23		8,313				
Bitartrate:									
Argols	20.0	7,617	1,523		1,935,796	2,820	564		430,271
Cream of tartar	25.0	60	15		44,113	117	29		69,408
Bromide	39.6	(2)	(2)		42				
Carbonate	61.0	2	1		2,104	10	6		7,294
Caustic	80.0	45	36	41.3	17,684	33	26	2.7	13,538
Chlorate and perchlorate	36.0	525	189		69,353	200	72		25,848
Cyanide	70.0					22	2		17,948
Iodide	28.0	(2)	(2)		5				
Nitrate	46.0	(2)	(2)		364	(2)	(2)		1
Permanganate	29.0					(2)	(2)		75
All other	50.0	28	14		23,141	26	13		23,197
Total chemical		8,327	1,801	41.3	2,100,915	3,228	712	2.7	587,580
Grand total		16,199	4,365	100.0	2,350,734	51,043	25,978	100.0	2,475,351

1 Changes for 1945 in Minerals Yearbook, 1946, p. 1027, are as follows: Muriate (chloride), percent of total should read 65.6. Total fertilizer, 65.6. Argols, 9,198 tons, approximate equivalent as potash 1,839 tons. Percent of total 34.4. Total chemical, 9,720 tons; approximate equivalent as potash, 2,030 tons. Percent of total 34.4. Grand total, 16,605 tons; approximate equivalent as potash, 5,901 tons.

2 Less than 1 ton.

3 Chiefly wood ashes from Canada.

Potash materials, imported for consumption in the United States, 1946–47,[1] by countries, in short tons

[Figures in parentheses in column headings indicate, in percent, approximate equivalent as potash (K_2O)]

[U. S. Department of Commerce]

Country	Bicarbonate	Muriate (chloride)	Bitartrate: Argols or wine lees	Bitartrate: Cream of tartar	Potassium sulfate, crude	Potassium sodium nitrate mixtures, crude	Chlorate and perchlorate	All other[2]	Total: Short tons	Total: Value
	(46)	(56.4)	(20)	(25)	(50)	(14)	(36)			
1946										
Argentina			382						382	$167,308
Australia								7	7	1,108
Belgium and Luxembourg							17		17	3,482
Canada			1	(3)				23	24	2,319
Chile			247			4,400	40		4,687	241,143
China		(3)						2	2	2,496
Czechoslovakia	50								50	8,313
France			4,662				343		5,005	1,271,170
Hong Kong								(3)	(3)	64
Italy			1,373	1					1,374	205,607
Morocco, French			57						57	7,800
Portugal			763	29					792	234,352
Spain				30					30	22,716
Sweden							28	38	66	21,105
Switzerland			22				97		119	19,601
Tunisia			110						110	17,500
U. S. S. R.		3,452							3,452	102,831
United Kingdom								25	25	21,819
	50	3,452	7,617	60		4,400	525	95	16,199	2,350,734
1947										
Argentina			1						1	75
Belgium and Luxembourg		14,466						6	14,472	455,550
Canada		224	6						230	11,164
Chile						2,500	10		2,510	66,664
China								9	9	6,619
Cuba				8					8	5,292
France		18,922					118		19,040	792,946
Germany		1,672			10,031				11,703	584,997
Hong Kong								1	1	776
Italy			2,036	32					2,068	335,897
Morocco, French			60						60	7,675
Portugal			274	39					313	70,462
Spain				38					38	21,766
Sweden								33	33	13,523
Switzerland							53		53	7,516
Tunisia			443						443	56,432
U. S. S. R.							19		19	2,488
United Kingdom				(3)				42	42	35,509
		35,284	2,820	117	10,031	2,500	200	91	51,043	2,475,351

[1] Changes for 1945 in Minerals Yearbook, 1946, p. 1028, are as follows: Argols or wine lees, Argentina 794 tons, Chile 552, Italy 551, French Morocco 477, total 9,198; Grand total, Argentina 794 tons ($336,606), Chile 552 ($202,372), Italy 551 tons, French Morocco 477 tons, total 16,605 tons.
[2] Approximate equivalent as potash (K_2O)—1946: 45 percent; 1947: 54 percent.
[3] Less than 1 ton.

Exports.—The total value of the export trade in potash materials increased in 1947 to $8,686,107 from $8,039,192 in 1946, increases being shown in the values of both fertilizers and chemicals. The quantity of fertilizer potash materials rose to 102,939 tons in 1947 as against 96,822 tons in 1946, whereas the quantity of potash chemicals declined in 1947—to 21,970 tons from 23,905 tons in 1946. The exports of both fertilizer and chemical potash salts were widely distributed. Fertilizer materials went largely to Canada, with much smaller quantities to numerous other countries, mostly in the Western Hemisphere. Exports of chemical potash salts were more uniformly distributed; Canada, Brazil, and Mexico (in the order named) were the leading recipients.

Potash materials exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Fertilizer		Chemical		Year	Fertilizer		Chemical	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1943	111, 541	$3, 168, 446	20, 133	$3, 950, 542	1946	96, 822	$2, 983, 751	23, 905	$5, 055, 441
1944	110, 057	3, 139, 631	15, 444	3, 142, 096	1947	102, 939	3, 251, 645	21, 970	5, 434, 462
1945	104, 687	2, 986, 990	18, 966	3, 648, 795					

Potash materials exported from the United States, 1946–47,[1] by countries

[U. S. Department of Commerce]

Country	Fertilizers				Chemicals			
	1946		1947		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Algeria	1	$90			229	$57, 843		
Argentina	(2)	122	50	$1, 888	1, 255	242, 495	1, 274	$361, 299
Australia					1, 146	164, 658	1, 319	212, 214
Barbados	318	11, 028	5, 794	222, 554	(2)	66		
Belgium and Luxembourg	1	65			893	181, 236	771	346, 634
Brazil	5, 311	236, 206	6, 002	257, 651	1, 915	356, 064	2, 577	507, 127
Canada	77, 616	2, 263, 041	71, 968	2, 088, 021	3, 848	604, 265	3, 840	549, 524
Chile					160	40, 527	155	44, 969
China			6	2, 160	2, 759	711, 625	1, 433	368, 095
Colombia	350	11, 610	1, 960	77, 971	619	143, 055	852	190, 538
Cuba	5, 173	176, 522	8, 614	284, 874	280	89, 950	166	53, 838
Greece	(2)	93			630	126, 275	262	55, 583
Guatemala	3	140			69	18, 346	125	47, 763
Hong Kong					1, 216	316, 393	979	234, 323
Iceland	504	19, 476	651	25, 792	79	14, 017	43	9, 474
India					392	115, 197	697	191, 752
Mexico	1, 106	34, 317	1, 864	53, 407	2, 199	477, 310	1, 608	358, 303
Netherlands					456	107, 694	634	241, 284
New Zealand	3, 640	115, 279	2, 550	93, 131	3	794	119	25, 908
Norway	112	4, 204			489	66, 747	141	30, 611
Peru	850	32, 733			153	55, 245	166	57, 436
Philippines, Republic of	50	2, 525	747	32, 841	45	17, 665	137	33, 371
Portugal					328	86, 080	184	72, 230
Sweden	(2)	371	2	200	1, 265	229, 478	601	169, 101
Switzerland					1, 121	189, 480	851	398, 662
Turkey					412	87, 847	579	125, 037
Union of South Africa	(2)	141			355	82, 185	457	120, 210
United Kingdom			50	7, 760	50	33, 715	622	122, 175
Venezuela	135	6, 214	108	4, 451	239	90, 062	182	84, 689
Yugoslavia					67	10, 899	160	29, 984
Other countries	1, 652	69, 574	2, 573	98, 944	1, 233	338, 228	1, 036	392, 328
	96, 822	2, 983; 751	102, 939	3, 251, 645	23, 905	5, 055, 441	21, 970	5, 434, 462

[1] Changes for 1945 in Minerals Yearbook, 1946, p. 1029, are as follows: Chemicals: Canada $494,037; Iceland 69 tons ($14,705); other countries 3,868 tons ($702,561).

[2] Less than 1 ton.

WORLD PRODUCTION

The accompanying table shows available statistics on potash output in the various producing countries.

World production of potassium salts, 1942–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1942 Potassium salts	1942 Equivalent K_2O	1943 Potassium salts	1943 Equivalent K_2O	1944 Potassium salts	1944 Equivalent K_2O
North America: United States, potassium salts	1,149,810	616,162	1,296,215	670,534	1,431,982	757,103
South America: Chile, crude potassium nitrate	63,828	(2)	63,828	(2)	(2)	(2)
Europe:						
France (Alsace), crude potassium salts	3,835,395	619,000	4,195,111	664,497	2,951,355	466,657
Germany, crude potassium salts:						
Carnallite [3]						
Kainite, sylvinite, and hartsalz	}16,802,179	2,078,785	16,976,952	2,086,639	15,861,933	1,925,530
Spain, crude potassium salts	[4] 413,799	89,654	[4] 439,657	87,000	[4] 675,836	115,830
Asia:						
China	2,939	(2)	3,048	(2)	1,732	(2)
India, nitrate of potash	7,110	2,980	[5] 2,358	[5] 1,219	[5] 2,152	[5] 1,118
Korea, alunite	(2)	(2)	(2)	(2)	18,951	(2)
Palestine, crude potassium salts [6]	104,200	52,100	93,750	46,900	105,050	52,500
Australia, alunite	1,155	(2)	435	(2)	20,185	(2)
Total (estimated)	----------	3,564,000	----------	3,637,000	----------	3,383,000

Country [1]	1945 Potassium salts	1945 Equivalent K_2O	1946 Potassium salts	1946 Equivalent K_2O	1947 Potassium salts	1947 Equivalent K_2O
North America: United States, potassium salts	1,446,879	793,096	1,531,079	845,321	1,772,011	955,507
South America: Chile, crude potassium nitrate	(2)	(2)	----------	----------	(2)	(2)
Europe:						
France (Alsace), crude potassium salts	852,733	[7] 145,000	3,250,000	622,488	4,168,000	714,000
Germany, crude potassium salts:						
Carnallite [3]						
Kainite, sylvinite, and hartsalz	} (2)	(2)	(2)	955,400	(2)	(2)
Spain, crude potassium salts	710,496	[8] 113,700	365,207	135,479	622,153	153,809
Asia:						
China	(2)	(2)	(2)	(2)	1,000	(2)
India, nitrate of potash	[9] 3,280	(2)	[9] 6,466	(2)	(2)	(2)
Korea, alunite	----------	----------	----------	----------	(2)	(2)
Palestine, crude potassium salts [6]	93,625	46,800	90,571	45,300	(2)	(2)
Australia, alunite	22,616	(2)	36,427	(2)	(2)	(2)
Total (estimated)	----------	1,482,000	----------	2,709,000	----------	2,989,000

[1] In addition to countries listed, Eritrea, Iran, Italy, Poland, and U. S. S. R. are reported to produce potash salts, but statistics of production are not available; estimates by senior author of chapter included in total.
[2] Data not available; estimate by author of chapter included in total.
[3] Includes some natural kieserite.
[4] Salable.
[5] Exports plus consumption.
[6] Extracted from waters of Dead Sea.
[7] Equivalent K_2O content estimated at approximately 17 percent.
[8] Unofficial estimate.
[9] Exports only.

Salt

By FLORENCE E. HARRIS AND E. M. TUCKER

GENERAL SUMMARY

SALT production in the United States in 1947 topped all previous records, with 16,138,374 short tons valued at $52,276,180. In 1946 it totaled 15,132,145 short tons valued at $44,912,586. The million-ton increase in output occurred principally in salt of brine; output of rock salt increased 342,345 tons, whereas evaporated-salt production declined 90,739 tons. This represents a net increase of 7 percent in the total output. Evaporated salt decreased 3 percent, rock salt increased 10 percent, and brine salt increased 9 percent.

Exports and imports of salt declined. Exports were at about the usual level immediately before the war, whereas imports were down almost to the low record of 1943.

Salient statistics of the salt industry in the United States, 1935–39 (average) and 1943–47

	1935–39 average	1943	1944	1945	1946	1947
Sold or used by producers:						
Dry salt:						
Evaporated (manufactured) short tons	2,507,374	3,476,501	3,448,578	3,182,570	3,249,457	3,158,718
Rock salt do	1,947,254	3,259,138	3,448,238	3,505,740	3,412,008	3,754,353
Total do	4,454,628	6,735,639	6,896,816	6,688,310	6,661,465	6,913,071
Value	$21,730,339	$35,324,899	$37,355,192	$37,335,488	$38,294,396	$43,032,621
Average per ton	$4.88	$5.24	$5.42	$5.58	$5.75	$6.22
In brine:						
Short tons	4,205,587	8,478,513	8,820,355	8,705,831	8,470,680	9,225,303
Value	$1,675,273	$6,204,789	$6,360,300	$6,578,918	$6,618,190	$9,243,559
Total salt:						
Short tons	8,660,215	15,214,152	15,717,171	15,394,141	15,132,145	16,138,374
Value [1]	$23,405,612	$41,529,688	$43,715,492	$43,914,406	$44,912,586	$52,276,180
Imports for consumption:						
For curing fish short tons	[2] 21,250				1,407	
Value	[2] $43,722				$5,011	
In bags, barrels, etc. short tons	1,385	129	14	1,572	275	377
Value	$11,813	$2,425	$700	$36,343	$4,456	$8,571
In bulk short tons	24,131	1,129	5,540	2,981	2,571	1,533
Value	$55,876	$10,325	$31,459	$37,047	$20,161	$14,322
Total:						
Short tons	46,766	1,258	5,554	4,553	4,253	1,910
Value	$111,411	$12,750	$32,159	$73,390	$29,628	$22,893
Exports:						
Short tons	90,214	145,803	198,368	190,524	223,426	188,307
Value	$521,652	$1,173,139	$1,620,226	$1,509,301	$1,889,522	$1,588,847
Apparent consumption [3] short tons	8,616,767	15,069,607	15,524,357	15,208,170	14,912,972	15,951,977

[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—1938: 93 tons, $673.
[3] Quantity sold or used by producers plus imports minus exports.

In 1947, 73 plants owned by 49 companies were in active production. Almost without exception, producers reported that demand for salt was strong and steady throughout the year. Although prices of salt were advanced in most sectors, the increase in cost of packing materials, wages, and operating costs in many instances more than absorbed the increase. Several operators closed or did not reopen their works in 1947 because the prices realized from the sale of their output would not cover the labor and material charges.

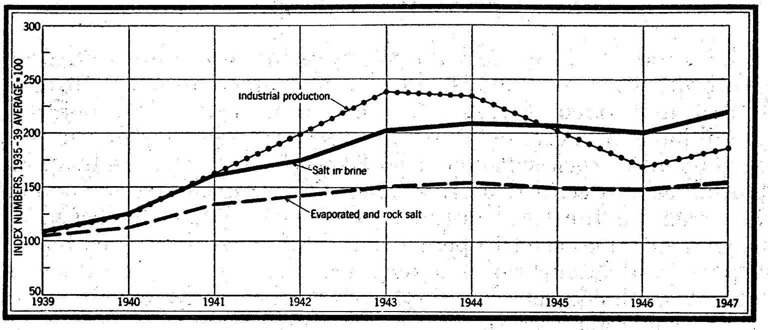

FIGURE 1.—Index of salt in brine and of evaporated and rock salt sold or used compared with industrial production, 1939–47. Index of industrial production from Federal Reserve Board.

The unprecedented high to which salt in brine rose in 1947 is shown by the index in figure 1. After dropping 6 points in 1946 to 201, it rose again, climbing to 219 in 1947. This portion of the salt industry has increased more than general industrial activity, which advanced from 170 to 187. Evaporated and rock salt combined rose from 149 to 155.

The three types of salt production are shown in the bar chart (fig. 2), which carries the information from 1939 to 1947.

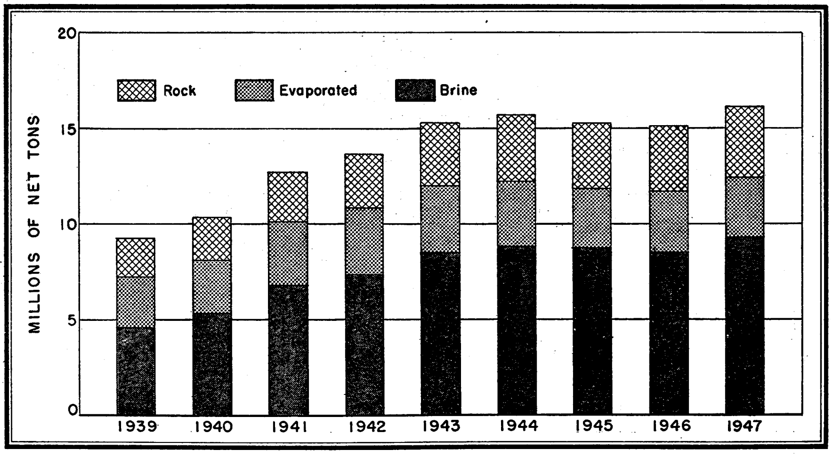

FIGURE 2.—Trends in the quantity of rock salt, evaporated salt, and brine (in terms of salt content) sold or used by producers in the United States, 1939–47.

DOMESTIC PRODUCTION

PRODUCTION BY STATES

California.—California Rock Salt Co., Amboy, reported that in May 1947 it purchased a processing plant from the Reconstruction Finance Corporation (Defense Plant Corporation). Desert Chemical Co., Twentynine Palms, is now the Dale Chemical Co., which took possession November 1, 1947. No salt was produced by the Imperial Salt Co., Niland, in 1947. Leslie Salt Co.'s new project of enlarging the area of ponds continued during 1947. When the project near Redwood City is completed, the company will have a total of 22,000 acres of pond area in salt production on San Francisco Bay. Long Beach Salt Co. operations at Long Beach were abandoned July 1, 1947. The Long Beach Salt Co. now operates solely at Saltdale. C. C. Miller's operation at Leenvining was still working on an experimental basis only. None of the small quantity produced was sold but was used in experimental work in connection with food uses.

Kansas.—The new plant of the American Salt Corp., Lyons, was completed the first part of 1947; evaporated as well as rock salt was produced.

Louisiana.—The Myles Salt Co., Ltd., Weeks, is now Myles Salt Co., Inc. It was purchased by the Morton Salt Co. July 1, 1947. It was operated as a separate subsidiary, not consolidated in 1947. This company is expanding its operations by cutting a second level in its present mine. The new level will be connected to the hoisting system by an inclined shaft equipped with a conveyor system. (See note regarding Solvay Process Co. operations at Plaquemine in New York paragraph of this section.)

Michigan.—See note regarding Solvay Process Co. operations at Detroit in New York paragraph of this section.

Nevada.—Leslie Salt Co. reported that (as in 1946) the dry-lake operation at Fallon was inactive but that there were some small sales for the convenience of neighbors.

New Mexico.—Curtis Salt Co. stated that it was in business but that its supplies of salt were dwindling. Labor was scarce.

New York.—Solvay Process Co., Syracuse, announced that, as a result of a corporate merger, it was succeeded by the Allied Chemical & Dye Co. on November 1, 1947, including the operations at Plaquemine, La., and Detroit, Mich.; wells at Tully, N. Y.; and plant at Solvay, N. Y.

Ohio.—The Union Salt Co., Cleveland, a wholly owned subsidiary of the Morton Salt Co., was consolidated with the Morton Salt Co. on January 1, 1947.

Puerto Rico.—Sobrinos de Gonzales, Salinas, P. R., stated that his shut-down is permanent. At present only four salt works are operating in Puerto Rico.

Texas.—The Freeport operations of the Dow Chemical Co. (headquarters, Midland, Mich.) now include the facilities acquired from the Dow Magnesium Corp., Velasco, February 8, 1947, which were owned by the Defense Plant Corporation. After several years operation, the Imperial Salt Co., Henderson, in 1947 discontinued production of rock salt, and the shaft mine was abandoned. After wells are completed, evaporated salt will be produced.

Utah.—A journal [1] contains a short description and two illustrations of the method used at Royal Crystal Salt Co. mine near Redmond, showing the open pit and Diesel-powered loader at work. In Utah vast supplies of salt are available, including annually a large tonnage of unutilized sodium chloride produced on the Bonneville salt flats near Wendover. Bonneville, Ltd., is working the brine-saturated saline deposit for potassium chloride. The residual sodium chloride going to the tailing pile is quite pure but to be marketed as table salt would require further refining. This byproduct salt available is not included in the national production total reported herein.

West Virginia.—The J. Q. Dickenson & Co. plant at Malden, was shut down during 1947. The Ohio River Corp., Mason, also was idle in 1947.

Salt sold or used by producers in the United States, 1945–47, by States

State	1945			1946			1947		
	Quantity			Quantity			Quantity		
	Short tons	Percent of total	Value	Short tons	Percent of total	Value	Short tons	Percent of total	Value
California	694, 609	4	$3, 424, 711	729, 092	5	$3, 358, 060	768, 397	5	$3, 810, 898
Kansas	855, 806	6	3, 837, 850	815, 018	5	4, 014, 919	904, 398	6	4, 534, 406
Louisiana	1, 867, 689	12	4, 465, 643	1, 846, 522	12	4, 612, 359	1, 955, 382	12	5, 898, 828
Michigan	4, 285, 493	28	14, 942, 443	4, 334, 202	29	15, 711, 074	4, 531, 761	28	15, 127, 549
New Mexico	9, 980	(1)	20, 694	8, 677	(1)	16, 399	12, 006	(1)	19, 239
New York	2, 862, 224	19	10, 327, 013	2, 813, 782	19	10, 153, 274	2, 923, 023	18	11, 875, 485
Ohio	2, 764, 926	18	3, 997, 759	2, 645, 995	17	4, 160, 011	2, 975, 676	18	6, 815, 639
Puerto Rico	12, 513	(1)	81, 200	12, 411	(1)	83, 494	13, 344	(1)	101, 287
Texas	1, 100, 791	7	1, 336, 162	1, 098, 589	7	1, 356, 676	1, 191, 621	7	2, 090, 098
Utah	122, 997	1	363, 997	121, 669	1	339, 505	113, 285	1	340, 028
West Virginia	370, 260	2	903, 759	272, 841	2	896, 894	279, 300	2	1, 161, 429
Other States [2]	446, 853	3	213, 175	433, 347	3	209, 921	470, 181	3	501, 294
	15, 394, 141	100	43, 914, 406	15, 132, 145	100	44, 912, 586	16, 138, 374	100	52, 276, 180

[1] Less than 0.5 percent.
[2] Includes Nevada, Oklahoma, and Virginia.

PRODUCTION BY METHODS OF RECOVERY

There was no change in the United States in basic methods of recovery of salt in 1947. Production obtained by these methods is shown in the accompanying table.

[1] Pit and Quarry, vol. 39, No. 10, April 1947, p. 53.

Salt sold or used by producers in the United States, 1946–47, by method of recovery

Method of recovery	1946		1947	
	Short tons	Value	Short tons	Value
Evaporated:				
Bulk:				
Open pans or grainers	558,026	$5,905,704	526,041	$6,336,068
Vacuum pans	1,840,061	14,165,778	1,790,346	15,824,364
Solar	553,056	1,971,947	581,932	2,173,652
Pressed blocks	298,314	2,942,966	260,399	2,708,857
Rock:				
Bulk	3,314,948	12,479,589	3,685,190	15,350,722
Pressed blocks	97,060	828,412	69,163	638,958
Salt in brine (sold or used as such)	8,470,680	6,618,190	9,225,303	9,243,559
Total	15,132,145	44,912,586	16,138,374	52,276,180

Evaporated Salt.—Evaporated salt was produced in 13 States and Puerto Rico. The output was from 47 plants of 33 companies and in 1947 declined 90,739 short tons from the total obtained in 1946 from 49 plants of 37 companies.

About 133,000 tons of table salt (all evaporated salt except a small quantity) and 81,000 tons of livestock salt were reported to have been iodized in 1947.

In March 1947 a bill was introduced in the United States House of Representatives to amend the Federal Food Drug and Cosmetic Act, by providing for the compulsory use of "not less than 80 parts and not more than 160 parts of iodine per million parts" of table salt sold in interstate commerce. The bill remained in committee and was not enacted in 1947.

Evaporated salt sold or used by producers in the United States, 1946–47, by States

State	1946		1947	
	Short tons	Value	Short tons	Value
California	595,747	$2,988,775	625,379	$3,452,309
Kansas	338,532	2,829,111	345,178	2,961,140
Louisiana	87,834	584,815	74,843	591,330
Michigan	953,183	8,162,183	896,555	8,645,977
New York	466,115	5,025,740	432,505	5,192,627
Ohio	456,227	3,615,003	446,568	4,285,469
Puerto Rico	12,411	83,494	13,344	101,287
Utah	115,248	310,610	(1)	(1)
West Virginia	136,320	883,393	134,872	1,017,001
Other States [2]	87,840	503,271	189,474	795,801
	3,249,457	24,986,395	3,158,718	27,042,941

[1] Included with "Other States."
[2] Includes Nevada, New Mexico, Oklahoma, and Texas, 1946–47, and Utah in 1947.

Rock Salt.—Output of rock salt, which was produced by 21 plants in 8 States compared with 19 plants in 1946, increased 342,345 short tons in 1947.

Rock salt sold by producers in the United States, 1943–47

Year	Short tons	Value	Year	Short tons	Value
1943	3,259,138	$11,180,884	1946	3,412,008	$13,308,001
1944	3,448,238	12,225,057	1947	3,754,353	15,989,680
1945	3,505,740	12,964,391			

Pressed Blocks.—After reaching an all-time high in 1946, the total output of pressed blocks declined to 329,562 short tons, the lowest of the pentad 1943–47. Evaporated-salt blocks were supplied by 22 plants and rock-salt blocks by 8 plants in 1947.

Pressed-salt blocks sold by original producers of the salt in the United States, 1943–47

Year	From evaporated salt		From rock salt		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	298,314	2,942,966	97,060	828,412	395,374	3,771,378
1947	260,399	2,708,857	69,163	638,958	329,562	3,347,815

Brine.—Fifteen plants in 7 States produced 9,225,303 short tons of brine salt valued at $9,243,559 in 1947 compared with 8,470,680 tons valued at $6,618,190 in 1946. The sharp increase in salt of brine raised the total of salt production in the United States to an unprecedented level, salt of brine constituting 57 percent of the total.

The valuation shown is an estimate arrived at from information received from producers, partly estimated values, and partly actual sales records. The average value shown by actual sales records for a relatively small tonnage sold was $1.20. An estimated value of $1 per ton was used in 1947 for most of the output.

DISTRIBUTION

The accompanying table shows salt shipped from local sources to destinations within the State in which it is produced, totaled with that shipped into the State from other sources. 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, 1946–47, by States of destination, in short tons

Destination	1946		1947	
	Evaporated	Rock	Evaporated	Rock
Alabama	14,670	40,181	12,938	88,323
Arizona	17,011	4,614	16,230	3,038
Arkansas	11,625	30,144	11,652	44,130
California	365,791	65,079	331,693	53,709
Colorado	37,654	16,805	37,565	60,384
Connecticut	15,598	14,749	13,818	17,397
Delaware	4,283	14,519	4,725	16,387
District of Columbia	5,728	2,075	5,706	2,220
Florida	11,046	36,825	10,450	36,179
Georgia	22,669	57,888	21,670	46,710
Idaho	18,782	811	15,996	1,571
Illinois	241,328	207,409	235,427	246,046
Indiana	99,555	63,086	100,056	72,907
Iowa	116,272	95,402	114,256	108,675
Kansas	53,459	135,976	53,741	142,970
Kentucky	34,863	96.974	30,325	70,209
Louisiana	13,932	133,062	16,277	138,949
Maine	13,886	56,203	13,382	58,706
Maryland	40,337	25,473	35,250	52,827
Massachusetts	55,470	71,478	55,738	84,764
Michigan	145,865	75,871	139,660	115,967
Minnesota	119,168	72,192	111,455	69,688
Mississippi	10,421	33,212	8,664	26,238
Missouri	82,168	78,148	69,914	78,025
Montana	23,475	3,280	20,194	3,478
Nebraska	[1] 54,629	58,266	55,960	63,835
Nevada	[1] 5,030	66,208	4,019	88,181
New Hampshire	5,191	52,778	4,628	55,561
New Jersey	113,680	141,116	103,478	138,421
New Mexico	3,312	20,324	7,291	23,355
New York	230,705	503,452	222,149	554,376
North Carolina	55,047	56,866	49,432	57,599
North Dakota	12,677	4,952	11,654	6,177
Ohio	213,335	132,489	212,762	160,876
Oklahoma	32,050	32,841	29,639	26,228
Oregon	42,625	415	50,775	5,144
Pennsylvania	160,844	134,577	156,237	131,069
Rhode Island	10,169	11,601	7,796	10,725
South Carolina	12,633	24,157	9,638	17,658
South Dakota	25,106	17,142	21,609	18,346
Tennessee	30,139	64,407	28,042	73,300
Texas	71,243	239,236	60,835	220,111
Utah	25,077	2,635	22,068	2,233
Vermont	5,028	15,428	5,066	19,143
Virginia	56,507	95,634	50,517	92,726
Washington	161,809	1,525	178,661	1,530
West Virginia	155,284	80,755	156,967	83,032
Wisconsin	133,638	38,238	126,476	39,670
Wyoming	11,704	4,233	11,042	3,535
Other [2]	46,939	181,277	85,195	222,025
	3,249,457	3,412,008	3,158,718	3,754,353

[1] Revised.
[2] Includes salt used in Puerto Rico (evaporated salt), shipments to noncontiguous Territories of the United States, exports, and some shipments to unspecified destinations.

Salt shipped to noncontiguous Territories of the United States, 1945–47 [1]

[U. S. Department of Commerce]

Territory	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Alaska	[2] 3,952	$92,292	[2] 4,816	$111,965	[2] 4,055	$119,614
American Samoa	9	459	6	338	2	285
Guam					133	3,899
Hawaii	4,830	143,933	2,528	91,790	2,810	90,495
Puerto Rico	8,959	293,594	4,741	170,798	6,711	345,681
Virgin Islands	95	5,408	76	4,730	85	5,447
	17,845	535,686	12,167	379,621	13,796	565,421

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

CONSUMPTION AND USES

As for many years, soda ash and chlorine were first and second on the list of uses to which the national total salt production was devoted. Meat packing moved up to third place because of a large increase over 1946. The totals for "other chemical," canning and preserving, textile processing, and agriculture remained in the same positions as in 1946. Highways, other food processing, dyes, organic chemicals, and metallurgy moved up on the list compared with 1946. Water treatment, hides and leather, refrigeration, dairy products, fish curing, and soap moved down. Salt has many widely divergent uses, but it is practical only to break down the total tonnage into its chief uses.

The most notable increases in quantity of salt used for specific purposes were for soda ash and chlorine—more than half a million tons in the former and more than 350,000 tons in the latter. The gap between demand and supply, which producers strained to bridge in 1946, was reduced in 1947 by greater production of both soda ash and chlorine. Statistics [2] show that the United States led the world in output and exports of chemicals. Alkalies made from salt contributed a large part. Although the salt chemicals were derived chiefly from the brine stage, about 800,000 short tons of dry salt of both evaporated and rock salt also were used.

Total salt used for highways, dust and ice control which, except for 1944, has increased steadily in the last 6 years, increased by 154,000 tons over 1946.

Meat-packing requirements increased more than 90,000 tons. Salt used in metallurgy increased 38,000 tons over 1946 needs. Water-treatment requirements rose almost 27,000 tons.

Decreases were registered in salt used for livestock (58,000 tons), table salt (56,000), hides and leather (35,000), refrigeration (33,000),

[2] Foreign Commerce Weekly, Significant Realignment of International Chemical Trade: Vol. 29, No. 4, Oct. 25, 1947, p. 3.

canning and preserving (22,000), and dairy products; other food processing, agriculture, and textile processing ranged from 14,000 to 8,000 tons less than in 1946.

The accompanying table giving the break-down combines synthetic rubber with "Undistributed." Again the annual quantity of dry salt used for this purpose was about half of the total so used in the year immediately preceding, or in the neighborhood of 50,000 short tons.

Additional commodities included with "Undistributed" uses were: Purchases by the Government, totaling nearly 100,000 short tons, some of which was intended for shipment to the countries occupied by the United States Army, for use in curing fish, and for chemicals. Other uses in the category were lumber, brick and tile, tobacco, pulp and paper, and oil wells.

The quantity of domestic salt used for salting fish, it will be noted, declined from 73,163 tons in 1946 to 62,993 tons in 1947. The salted-fish industry has declined sharply in the last 2 years, principally because of larger sales of fresh fish and better refrigeration facilities. Also more fish is being canned than formerly. A great part of the salted fish demanded is now imported. No salt for fish curing was imported in 1947. Domestic salt is purer than the solar salt formerly imported from the West Indies, Portugal, and elsewhere and therefore better for fish curing.

Salt sold or used by producers in the United States, 1946–47, by classes and uses, in short tons

Use	1946				1947			
	Evaporated	Rock	Brine	Total	Evaporated	Rock	Brine	Total
Chlorine, bleaches, chlorates, etc.	337,513	594,659	1,454,682	2,386,854	368,430	711,439	1,661,943	2,741,812
Soda ash			6,957,592	6,957,592	(1)		7,467,138	7,467,138
Dyes and organic chemicals	56,991	53,547		110,538	59,683	67,100		126,783
Soap (precipitant)	48,412	15,185		63,597	43,445	16,733		60,178
Other chemicals	104,484	430,987	(2)	[2] 535,471	96,958	510,747	(2)	[2] 607,705
Textile processing	37,050	121,176		158,226	33,518	117,724		151,242
Hides and leather	108,029	178,083		286,112	95,438	155,370		250,808
Meat packing	354,365	331,482		685,847	368,670	408,019		776,689
Fish curing	37,856	35,307		73,163	40,267	22,726		62,993
Butter, cheese, and other dairy products	121,447	5,647		127,094	108,323	5,236		113,559
Canning and preserving	167,249	21,725		188,974	150,482	16,694		167,176
Other food processing	240,799	24,885		265,684	231,408	24,271		255,679
Refrigeration	48,042	221,635		269,677	40,730	196,242		236,972
Livestock	599,537	192,344		791,881	528,481	205,375		733,856
Highways, railroads, dust and ice control	7,960	312,164		320,124	6,942	466,762		473,704
Table and other household	498,166	209,684		707,850	478,647	173,411		652,058
Water treatment	212,248	213,197	(2)	[2] 425,445	220,330	231,812	(2)	[2] 452,142
Agriculture	16,380	15,492		31,872	14,785	9,198		23,983
Metallurgy	17,566	31,403		48,969	22,094	65,027		87,121
Undistributed [3]	235,363	403,406	58,406	697,175	250,087	350,467	96,222	696,776
Total	3,249,457	3,412,008	8,470,680	15,132,145	3,158,718	3,754,353	9,225,303	16,138,374

[1] Data for evaporated salt included with "Undistributed."
[2] Data for salt in brine included with "Undistributed."
[3] Comprises miscellaneous uses and data not presentable by classes (footnotes 1 and 2), including most exports.

PRICES

New York prices of salt, bagged and delivered, were quoted as follows in 1947, in dollars per short ton:

	Jan.-Mar.	*Apr.-Dec.*
Rock salt, carlots	$15. 80	$17. 50
Rock salt, less than carlots	20. 60	21. 70
Vacuum fine, carlots	16. 90	18. 60
Vacuum fine, less than carlots	23. 40	25. 10

FOREIGN TRADE [3]

A comparison of trends in imports and exports of salt in recent periods is shown in the following table.

Salt imported and exported from the United States in 1925–44 (5-year averages) and 1945–47, in short tons

Period	Imports	Exports	Period	Imports	Exports
1925–29 (average)	53, 205	144, 487	1945	4, 553	190, 524
1930–34 (average)	39, 701	88, 862	1946	4, 253	223, 426
1935–39 (average)	46, 766	90, 214	1947	1, 910	188, 307
1940–44 (average)	12, 080	146, 567			

Imports.—Salt imports in 1947 continued to be relatively insignificant. Entries in recent years were the lowest on record (the series was begun in 1867); the low was 1,258 short tons in 1943.

Salt imported for consumption in the United States, 1943–47, by classes

[U. S. Department of Commerce]

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
1943	129	$2, 425	1, 129	$10, 325		
1944	14	700	[2] 5, 540	[2] 31, 459		
1945	1, 572	36, 343	2, 981	37, 047		
1946	275	4, 456	2, 571	20, 161	1, 407	$5, 011
1947	377	8, 571	1, 533	14, 322		

[1] Includes 12,939 pounds valued at $493 imported free in 1943, 9,001 pounds valued at $356 in 1944, 1,500 pounds valued at $40 in 1945, 2,000 pounds valued at $20 in 1946, and 1,152 pounds valued at $19 in 1947.
[2] Includes 3,818,644 pounds valued at $9,244 imported free.

[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.

Shipments of salt were received from a dozen countries in the 1925–29 period, but only half the number contributed in 1947, as shown in the accompanying table.

Salt imported for consumption in the United States, 1946–47, by countries

[U. S. Department of Commerce]

Country	1946		1947	
	Short tons	Value	Short tons	Value
North America:				
Canada	2,067	$19,084	957	$16,221
Curacao (N. W. I.)	110	3,050		
Jamaica	2,075	7,464	494	1,411
Europe:				
Spain			345	2,334
Switzerland	(1)	10		
United Kingdom	1	20	1	15
Asia: India			(1)	31
Africa: Cape Verde Islands			113	2,881
	4,253	29,628	1,910	22,893

1 Less than 1 ton.

Common salt brine, never having been imported, has not been subject to a tariff nor has it been mentioned in tariff regulations. However, in 1947 brine importation was discussed as being probable in the near future, and early in 1948 the Congress moved to draw up legislation. It is now proposed (H. R. 5641 and S. 2656 bills) to allow free importation of salt brine and that paragraph 1766 (regarding certain chemicals) of the Tariff Act of 1930 be amended by including the clause, "salt brine containing not less than 15 per centum nor more than 28 per centum of sodium chloride." If such brine were imported it would be used exclusively for chemical products and would not be used for the extraction of table or commercial salt, according to the report (No. 1913) of the Ways and Means Committee recommending its passage.

Exports.—Total exports of salt, never very large compared with production, declined in 1947 to 188,307 short tons, the lowest recorded since 1943. However, some salt that was purchased for shipment to Japan and Korea does not show in the table.

Salt exported from the United States, 1946–47, by countries

[U. S. Department of Commerce]

Country	1946		1947[2]	
	Short tons	Value	Short tons	Value
North America:				
Bermuda	26	$1,377	14	$800
Canada	182,764	1,130,780	157,523	943,373
Central America:				
British Honduras	625	7,975	528	8,940
Canal Zone	1,243	42,792	733	31,642
Costa Rica	189	5,267	140	3,555
Guatemala	49	1,435	64	1,621
Honduras	261	7,176	203	6,102
Nicaragua	412	9,697	334	7,137
Panama, Republic of	64	1,817	132	2,736
Mexico	10,912	213,342	9,192	205,823
Newfoundland and Labrador	6,465	45,143	5,484	27,200
West Indies:				
British:				
Jamaica	675	10,239	38	778
Other British	58	1,574	10	547
Cuba	5,194	75,435	6,539	117,467
Curacao (N. W. I.)	209	10,076	191	11,769
Dominican Republic	151	6,144	134	5,118
Haiti	8	612	22	1,572
Other North America	91	1,930	73	2,081
South America:				
Argentina	77	1,206	33	779
Brazil	1,321	40,817	546	20,953
Chile	(1)	77	17	1,213
Ecuador	148	2,227	(1)	54
Surinam	250	4,652	616	11,378
Venezuela	61	3,052	4	81
Other South America	41	950	23	1,924
Europe:				
Belgium and Luxembourg	4,283	41,065	77	6,890
Czechoslovakia	2,779	62,885		
Sweden	31	2,324	116	7,581
Yugoslavia	2,655	72,779	18	671
Other Europe	18	1,117	18	943
Asia:				
China	152	6,524	15	4,301
Hong Kong	281	7,362	40	785
Japan			71	1,492
Philippines, Republic of	636	23,908	3,779	96,872
Saudi Arabia	8	394	45	2,034
Other Asia	38	2,324	12	981
Africa:				
Belgian Congo	18	1,677	15	648
Liberia	827	26,390	850	31,161
Union of South Africa	143	7,132	15	893
Other Africa	32	2,128	13	1,127
Oceania:				
French Pacific Islands	231	5,721	298	8,016
New Zealand			332	9,801
Other Oceania			(1)	8
	223,426	1,889,522	188,307	1,588,847

1 Less than 1 ton.

2 Excludes a considerable quantity shipped as a part of the Army Civilian Supply Program.

WORLD REVIEW

Figures on salt production in 1947 and other years, available for many countries, are given in the accompanying world table. Brief notes concerning developments in various countries are contained in the following text. Metric tons are designated unless otherwise stated.

North and South America.—In *Canada* new developments include construction of a salt plant at Elk Point, 35 miles north of Vermillion, Alberta, where a large supply of salt occurs in three beds having a total thickness of more than 1,000 feet beginning at a depth of about 2,600 feet.[4] According to the agreement between the Prairie Salt

4 Chemical Age, Sept. 20, 1947, p. 406.

Co. and the Provincial Government, the latter part of 1946, the 25-ton daily salt-recovery plant near Unity, Saskatchewan, will be completed by June 30, 1948.[5] An increase in prices of salt was reported.[6] A description of the development of the Canadian salt industry was published.[7] *Cuba,* in September 1947, decreed a reduction in taxes on imports of salt from 9 to 6 percent.[8] The recovery of salt from the sodium compounds operations at Lake Texcoco, *Mexico,* and the new alkali plant of Sosa Texcoco, S. A., in partial operation in 1947, was described in a Bureau of Mines report.[9]

World production of salt, 1943–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1943	1944	1945	1946	1947
North America:					
Canada	619,528	632,841	610,601	488,049	663,616
Costa Rica	3,414	6,197	6,033	8,000	6,252
Guatemala	12,618	12,645	(2)	(2)	(2)
Honduras	2,500	2,700	900	850	726
Mexico	156,000	126,267	130,380	131,972	122,235
Nicaragua	[3] 6,000	[3] 6,000	[3] 6,000	[3] 6,000	7,503
Panama	----------	10,000	2,437	7,958	4,412
Salvador	1,894	(2)	(2)	(2)	16,483
United States:					
Rock salt	2,956,625	3,128,173	3,180,337	3,095,305	3,405,874
Other salt	10,845,349	11,130,131	10,784,920	10,632,274	11,234,536
West Indies:					
British:					
Bahamas	790	60,960	38,825	36,580	60,960
Turks and Caicos Islands	[4] 8,512	33,779	21,229	31,571	----------
Cuba	18,416	15,422	63,504	58,967	54,431
Dominican Republic	12,620	[3] 11,300	[3] 15,100	[3] 15,750	13,519
Haiti [3]	8,000	8,000	8,000	8,000	8,000
Netherlands West Indies [4]	4,791	5,150	3,109	889	(2)
South America:					
Argentina:					
Rock salt	751	2,237	3,275	(2)	(2)
Other salt	441,016	449,038	433,116	384,000	384,000
Brazil	416,121	453,601	506,626	609,198	(2)
Chile	37,111	46,157	47,689	59,405	(2)
Colombia:					
Rock salt	5,260	133,862	105,072	124,367	121,247
Other salt	107,575				
Ecuador	11,947	35,958	27,600	35,070	24,943
Peru	49,027	53,818	55,143	56,615	[3] 57,000
Venezuela	33,838	[3] 25,000	44,166	90,555	35,794
Europe:					
Austria:					
Rock salt	381	3,600	(2)	554	4,348
Other salt	240,656	247,414	82,648	168,150	183,764
Bulgaria:					
Rock salt	(2)	(2)	(2)	13,659	(2)
Other salt	(2)	(2)	(2)	(2)	(2)
Czechoslovakia [5]	(2)	(2)	4,235	9,232	(2)
France:					
Rock salt and salt from springs	1,143,080	546,323	559,968	1,211,255	(2)
Other salt	561,010	410,506	(2)	(2)	(2)
Germany	5,434,401	3,677,247	(2)	1,541,228	(2)
Greece	71,000	21,000	90,000	105,000	51,000
Hungary [6]	341,690	(2)	(2)	----------	----------
Italy	(2)	(2)	(2)	708,586	(2)
Malta	3,112	3,350	3,350	1,402	(2)
Netherlands	193,706	124,184	53,600	(2)	243,000
Poland	(2)	(2)	(2)	280,099	346,715
Portugal:					
Rock salt	74	80	71	46	(2)
Other salt	(2)	(2)	(2)	(2)	(2)
Rumania: Rock salt	360,240	154,090	277,183	345,000	314,485
Spain:					
Rock salt	266,226	243,076	228,029	262,651	(2)
Other salt	500,392	449,058	562,453	510,121	(2)

See footnotes at end of table.

[5] Canadian Mining Journal, vol. 29, No. 2, February 1948, p. 94.
[6] Work cited in footnote 5.
[7] Wilson, H. A., An Outline of the History and Development of the Salt Industry in Canada: Canadian Min. and Met. Bull., October 1947, No. 426, pp. 527–32.
[8] Bureau of Mines, Mineral Trade Notes: Vol. 26, No. 1, January 1948, p. 55.
[9] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 1, July 1947, pp. 40–49.

World production of salt, 1943–47, by countries, in metric tons [1]—Continued

Country [1]	1943	1944	1945	1946	1947
Europe—Continued					
Switzerland	76,686	84,689	81,113	93,000	95,435
United Kingdom:					
Great Britain:					
Rock salt	21,514	17,771	17,062	(2)	40,639
Other salt	3,406,017	3,407,791	3,268,083	(2)	(2)
Ireland, Northern [7]	11,183	11,220	12,679	13,474	12,603
Asia:					
Aden	202,434	208,603	142,191	114,856	197,672
Burma	(2)	(2)	(2)	[3] 56,000	(2)
Ceylon	13,781	28,686	42,364	43,666	23,231
China	[8] 1,516,805	[8] 1,004,248	[8] 800,435	[8] 2,267,345	(2)
Cyprus [9]	[3] 3,000	[3] 3,000	(2)	3,429	15,622
India:					
Rock salt	332,843	233,339	256,366	266,447	(2)
Other salt	1,624,976	1,661,315	1,974,788	1,948,894	(2)
Indochina, French	219,772	148,100	(2)	(2)	(2)
Iraq:					
Rock salt	(2)	(2)	2,521	2,521	(2)
Other salt	21,356	11,792	12,364	12,364	[3] 12,500
Japan [10]	415,442	353,153	193,845	(2)	[3] 170,000
Korea	[3] 350,000	(2)	[3] 63,200	[3] 152,000	[3] 131,000
Lebanon	7,168	7,135	6,959	(2)	(2)
Netherlands Indies	------	------	(2)	(2)	12,000
Palestine:					
Rock salt	1,822	1,181	2,144	1,571	(2)
Other salt	17,955	19,055	16,350	23,163	(2)
Portuguese India [4]	10,290	11,013	9,146	15,428	13,267
Siam	105,788	61,309	23,774	78,017	(2)
Syria	17,099	21,783	[3] 12,000	[3] 34,000	(2)
Turkey:					
Rock salt	22,976	266,330	16,193	225,917	278,742
Other salt	243,353		255,303		
Africa:					
Algeria	25,820	50,937	49,969	------	82,055
Belgian Congo	------	1,711	------	[3] 900	[3] 900
Canary Islands [3]	2,500	2,500	(2)	(2)	(2)
Egypt	[4] 106,901	[4] 199,116	[4] 255,107	[4] 226,090	600,000
Eritrea	8,101	10,721	[3] 35,000	140,000	(2)
Ethiopia: Rock salt	[3] 10,000	(2)	(2)	(2)	10,000
French West Africa [3]	48,000	53,000	55,000	55,000	(2)
Kenya	15,318	14,054	15,491	15,635	14,058
Libya: Tripolitania	------	[4] 284	[4] 28	(2)	(2)
Mauritius [3]	1,500	1,500	(2)	(2)	(2)
Morocco, French:					
Rock salt	12,208	34,945	12,930	42,153	37,238
Other salt	31,963		------	------	26,762
Nigeria [3]	400	400	(2)	(2)	(2)
Portuguese East Africa	379	221	10	71	(2)
Portuguese West Africa	43,419	37,652	49,552	61,657	38,783
Somaliland:					
British (exports)	------	------	------	(2)	(2)
French	22,244	42,657	55,000	45,000	48,000
Italian	(2)	(2)	(2)	114	715
South-West Africa:					
Rock salt	2,096	2,870	3,238	3,533	2,954
Other salt	8,616	9,049	10,011	10,590	7,939
Sudan, Anglo-Egyptian	40,488	35,969	44,471	40,982	(2)
Tanganyika	11,542	11,214	9,546	13,014	10,837
Tunisia	10,053	52,478	61,289	(2)	(2)
Uganda	5,243	(2)	(2)	5,679	7,003
Union of South Africa	[11] 108,690	[11] 123,560	(2)	(2)	(2)
Australia: South Australia	187,270	167,531	173,813	160,753	157,563
Total [12]	40,536,000	36,956,000	33,290,000	37,268,000	40,309,000

[1] In addition to the countries listed, salt is produced in Albania, Bolivia, Formosa, Gold Coast, Leeward Islands, Madagascar, Republic of the Philippines, Southern Rhodesia, U. S. S. R., Yugoslavia, and 2 Australian States (Victoria and Western Australia), but figures of production are not available. Russian production however is known to exceed 4½ million metric tons annually. Estimates by senior author of chapter are included in total.
[2] Data not available; estimates by author of chapter are included in total.
[3] Estimate. [4] Exports.
[5] Excludes Sub-Carpathia, ceded to Hungary and U. S. S. R.
[6] Includes Eastern Hungary, Northern Territories, Southern Territories, Sub-Carpathia, and Transylvania. Data represent Trianon Hungary subsequent to October 1944.
[7] Excluding rock salt.
[8] Data represent areas designated as Free China during the period of Japanese occupation.
[9] Incomplete data.
[10] Fiscal year ended Mar. 31 of year following that stated.
[11] Fiscal year ended June 30 of year stated. [12] Estimated by author of chapter.

Europe.—A range of prices in *Belgium* was given in a ministerial decree effective August 3, 1947.[10] In 1947 *Denmark* continued[11] gravity and seismograph prospecting of the salt deposits discovered in 1947 (Minerals Yearbook, 1946, p. 1045). The surveys have revealed the existence of salt domes at two places—Hostebro and Saldrup, the drilling having pierced 6,000 feet without finding the bottom of the salt. The presence of 10 or more other salt domes is indicated. Information obtained by the United States Army from German industry, on the purification and utilization of rock-salt brines in *Germany* has been published in several reports.[12] The I. G. Farbenindustrie electrolytic process for recovery of chlorine was described elsewhere.[13] Salt installations in the *Netherlands,* grouped near the German border, attained a record output in 1947. Some 150,000 tons, or 63 percent, were exported. *Spain,* throughout the decade 1938–47, was able to maintain a fairly substantial production, averaging about half a million tons.[14]

Africa.—*French Morocco* is interested financially in the large deposit of salt uncovered near Guercif in 1947.[15] It was hoped that, by the end of the year, the mine would be producing 1,500 tons a month. The deposit is being worked by a newly formed Societe Cherifienne des Sels. In the *Union of South Africa* a chemical company expects to produce salt for chemicals and farming, as well as purer grades for human consumption.[16]

Asia and Oceania.—The salt situation in *China* has been disrupted further by war conditions. Total production in *French Indochina* is not known, as most of the Annam and Tonkin salt works are not in the control of the French Administration at present. Output is believed to be much less than the average of 260,000 tons reported in 1940–42. Production in those years (not shown in previous chapters) was: 189,350 tons in 1940, 316,622 in 1941, and 275,910 in 1942. According to reports[17] of the Supreme Commander for the Allied Powers, output of common salt in *Japan* approximated 9,000 tons per annum in midsummer 1947 compared with 53,000 tons in 1939. Although far less than prewar, imports began to increase early in 1947, totaling 191,372 tons in the first quarter alone, whereas for entire 1946 salt imports totaled 275,324 tons. *Australia* conducted an inquiry into salt resources and the salt industry in 1947. According to the findings, no surveys have as yet revealed deposits of rock salt in the Commonwealth. Salt output is by solar evaporation in South Australia and Victoria.

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[10] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 6, December 1947, p. 31.

[11] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 6, December 1947, p. 41.

[12] Purification of Rock-Salt Brines by Means of Phosphate as Precipitating Agent: PB 66514, pp. 226–30.
The Determination of Ca-Ions in the Presence of Mg-Ions in Saturated Rock Salt Brines: PB 66516, pp. 238–244.
The Determination of Al-Ions in Saturated Rock-Salt Brines: PB 66527, pp. 358–363.
The Determination of Silicic Acid in Saturated Rock-Salt Brines and the Influence of This Impurity on the Functioning of Hg Cells: PB 66529, pp. 380–385.
The Specific Detection of Mg-Ions in Presence of Ca-Ions in Saturated Rock-Salt Brines: PB 66535, pp. 431–435.
Photostats of these reports, in German, are obtainable from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

[13] Gardiner, W. C., Hydroelectric Acid Electrolysis: Chem. Eng., Vol. 54, No. 1, January 1947, pp. 100–101

[14] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 5, November 1947, p. 46.

[15] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 4, October 1947, p. 30.

[16] Chemical Engineering News: Vol. 25, No. 36, Sept. 8, 1947, p. 2588.

[17] Bureau of Mines, Mineral Trade Notes: Vol. 26, No. 1, July 1947, p. 39, and Vol. 26, No. 6, December 1947, p. 41.

Sand and Gravel

By D. G. RUNNER AND G. E. TUCKER[1]

GENERAL SUMMARY

IN 1947, as in 1946, the sand and gravel industry had a successful year, due largely to the expanding highway-and building-construction program. As indicated in figure 1, the output of sand and gravel exceeded the production of any other peacetime year, the greatest having occurred during the war years 1941 and 1942. The value for 1947 exceeded that for any previous year and for the first time passed the 200-million-dollar mark.

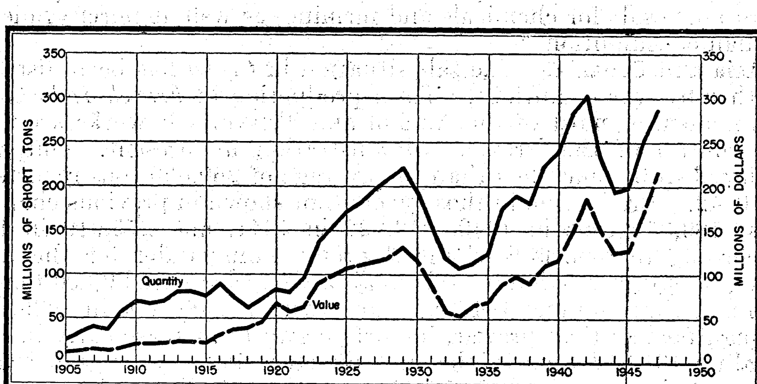

FIGURE 1.—Production of sand and gravel in the United States, 1905–47.

Inasmuch as stocks of sand and gravel are relatively small and more or less constant from year to year, production virtually equals sales. Therefore these terms are used interchangeably in this report.

As indicated in the salient statistics table, 1947 sales of all kinds of sand by commercial operators, with the exception of engine and other (miscellaneous), increased over those for 1946. Sales of gravel by this class of operators likewise increased over 1946. The combined total of sand and gravel used on Government-and-contractor operations also showed a substantial increase in 1947. The upward trend was caused largely by the increase in sand operations, as indicated by the 35-percent increase over 1946 figures.

Sand and gravel sold or used by producers in the United States, 1946–47, by commercial and Government-and-contractor operations and by uses

	1946			1947			Percent of change in—	
	Short tons	Value		Short tons	Value		Tonnage	Average value
		Total	Average		Total	Average		
COMMERCIAL OPERATIONS								
Sand:								
Glass	4, 848, 602	$9, 541, 405	$1. 97	5, 321, 247	$11, 395, 245	$2. 14	+9. 7	+8. 6
Molding	6, 973, 906	9, 531, 263	1. 37	8, 308, 434	11, 944. 228	1. 44	+19. 1	+5. 1
Building	48, 237, 949	31, 653, 529	. 66	52, 475, 831	39. 982, 460	. 76	+8. 8	+15. 2
Paving	24, 360, 044	16, 373. 892	. 67	28, 386, 749	20, 988. 676	. 74	+16. 5	+10. 4
Grinding and polishing [1]	906, 889	1, 379, 954	1. 52	1, 099, 253	1, 801, 989	1. 64	+21. 2	+7. 9
Fire or furnace	248, 866	333, 643	1. 34	373, 917	426, 956	1. 14	+50. 2	−14. 9
Engine	2, 797, 132	1, 924, 779	. 69	2, 683, 333	2, 092, 656	. 78	−4. 1	+13. 0
Filter	157, 511	284, 991	1. 81	211. 646	366, 905	1. 73	+34. 4	−4. 4
Railroad ballast [2]	714, 884	262. 089	. 37	852, 076	382, 278	. 45	+19. 2	+21. 6
Other [3]	1, 548, 620	1, 747, 921	1. 13	1, 406, 677	1, 739, 367	1. 24	−9. 2	+9. 7
Total commercial sand	90, 794, 403	73, 033, 466	. 80	101, 119, 163	91, 120, 760	. 90	+11. 4	+12. 5
Gravel:								
Building	40, 424, 515	32, 958, 822	. 82	43, 494, 575	40, 005, 616	. 92	+7. 6	+12. 2
Paving	46. 894, 010	34, 325, 134	. 73	51, 863, 727	42, 974, 456	. 83	+10. 6	+13. 7
Railroad ballast [4]	12, 009, 960	6, 341, 133	. 53	13, 935, 934	6, 790, 456	. 49	+16. 0	−7. 5
Other [5]	1, 969, 678	1, 438, 147	. 73	2, 149, 018	1, 480, 350	. 69	+9. 1	−5. 5
Total commercial gravel	101, 298, 163	75, 063, 236	. 74	111, 443, 254	91, 250, 878	. 82	+10. 0	+10. 8
Total commercial sand and gravel	192, 092, 566	148, 096, 702	. 77	212, 562, 417	182, 371, 638	. 86	+10. 7	+11. 7
GOVERNMENT-AND-CONTRACTOR OPERATIONS [6]								
Sand:								
Building	894, 000	313, 000	. 35	1, 551, 000	717, 000	. 46	+73. 5	+31. 4
Paving	4, 752, 000	1, 629, 000	. 34	6, 049, 000	2, 316, 000	. 38	+27. 3	+11. 8
Total Government-and-contractor sand	5, 646, 000	1, 942, 000	. 34	7, 600, 000	3, 033, 000	. 40	+34. 6	+17. 6
Gravel:								
Building	2, 752, 000	1, 416, 000	. 51	2, 208, 000	1, 541, 000	. 70	−19. 8	+37. 3
Paving	53, 641, 000	19, 932, 000	. 37	65, 289, 000	29, 923, 000	. 46	+21. 7	+24. 3
Total Government-and-contractor gravel	56, 393, 000	21, 348, 000	. 38	67, 497, 000	31, 464, 000	. 47	+19. 7	+23. 7
Total Government-and-contractor sand and gravel	62, 039, 000	23, 290, 000	. 38	75, 097, 000	34, 497, 000	. 46	+21. 0	+21. 1
COMMERCIAL AND GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand	96, 440, 000	74, 975, 000	. 78	108, 719, 000	94, 154, 000	. 87	+12. 7	+11. 5
Gravel	157, 691, 000	96, 411, 000	. 61	178, 940, 000	122, 715, 000	. 69	+13. 5	+13. 1
Grand total	254, 131, 000	171, 386, 000	. 67	287, 659, 000	216, 869, 000	. 75	+13. 2	+11. 9

[1] Includes blast sand as follows—1946: 292,899 tons valued at $736,819; 1947: 308,128 tons, $958,023.
[2] Includes ballast sand used by railroads for fills and similar purposes as follows—1946: 83,422 tons valued at $10,562; 1947: 5,760 tons, $450.
[3] Includes some sand used by railroads for fills and similar purposes as follows—1946: 164,061 tons valued at $30,658; 1947: 159,983 tons, $31,886.
[4] Includes ballast gravel produced by railroads for their own use as follows—1946: 4,077,115 tons valued at $1,640,726; 1947: 5,424,388 tons, $1,813,184.
[5] Includes some gravel used by railroads for fills and similar purposes as follows—1946: 637,462 tons valued at $107,938; 1947: 1,058,333 tons, $298,249.
[6] Approximate figures for States, counties, municipalities, and other Government agencies directly or under lease.

PRODUCTION

The production of sand and gravel in 1947 amounted to 287,659,000 short tons valued at $216,869,000, an increase of 13 percent in quantity and 27 percent in value over the 254,131,000 tons valued at $171,386,000 reported in 1946. The greatest increases were reported for fire or furnace and filter sand, and gravel for railroad ballast.

In 1947, as in 1946, California was the largest producer, and Michigan, Wisconsin, Illinois, Ohio, New York, Minnesota, Texas, and Pennsylvania follow in that order. These nine States—each with an output greater than 11,000,000 short tons—accounted for 52 percent of the total production. The following tables show details of production, by States and uses, in 1947.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States, 1943–47

Year	Sand		Gravel (including railroad ballast)		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	96,440,000	74,975,000	157,691,000	96,411,000	254,131,000	171,386,000
1947	108,719,000	94,154,000	178,940,000	122,715,000	287,659,000	216,869,000

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1947, by States

State	Short tons	Value	State	Short tons	Value
Alabama	3,400,103	$2,271,534	Nevada	963,253	$1,460,251
Alaska	(1)	(1)	New Hampshire	[1] 1,737,084	[1] 198,748
Arizona	1,607,758	1,368,080	New Jersey	[1] 5,532,011	[1] 6,335,343
Arkansas	[1] 2,690,163	[1] 2,267,203	New Mexico	540,794	492,583
California	31,386,826	25,338,967	New York	13,820,196	10,906,224
Colorado	3,524,653	2,323,736	North Carolina	4,171,553	2,956,800
Connecticut	2,329,198	1,384,675	North Dakota	2,383,021	920,111
Delaware	235,464	195,002	Ohio	15,388,990	14,195,288
Florida	2,067,401	1,880,866	Oklahoma	1,670,205	1,125,322
Georgia	927,330	575,115	Oregon	6,020,440	5,541,373
Idaho	3,209,766	2,067,891	Pennsylvania	11,543,971	13,006,644
Illinois	16,292,527	13,155,971	Puerto Rico	(1)	(1)
Indiana	9,231,649	6,687,082	Rhode Island	[1] 44,363	[1] 25,261
Iowa	6,473,087	2,795,887	South Carolina	601,313	278,021
Kansas	4,351,920	2,330,435	South Dakota	3,122,409	1,672,253
Kentucky	2,454,492	1,997,368	Tennessee	3,891,251	3,805,669
Louisiana	[1] 4,055,834	[1] 4,277,499	Texas	13,198,728	10,540,980
Maine	3,777,147	1,241,377	Utah	2,945,943	1,612,354
Maryland	4,624,094	4,792,554	Vermont	780,192	561,862
Massachusetts	4,942,920	3,511,855	Virginia	4,570,620	3,852,669
Michigan	16,845,431	10,758,243	Washington	8,380,571	5,700,960
Minnesota	13,510,136	4,194,268	West Virginia	3,796,253	5,782,988
Mississippi	[1] 2,036,136	[1] 1,393,218	Wisconsin	16,335,238	9,938,778
Missouri	[1] 4,597,495	[1] 4,193,474	Wyoming	2,268,381	1,490,702
Montana	4,203,797	3,129,921	Undistributed [1]	11,385,000	8,199,000
Nebraska	3,792,622	2,135,625			
				287,659,000	216,869,000

[1] Output of commercial producers in New Hampshire and Rhode Island and of Government-and-contractor operations in Alaska, Arkansas, Louisiana, Mississippi, Missouri, New Jersey, and Puerto Rico comprises "Undistributed."

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1947, 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	([1])	([1])	([1])	([1])	629,274	$491,922	13,500	$15,000
Alaska	-----	-----	-----	-----	-----	-----	([1])	([1])
Arizona	-----	-----	-----	-----	360,396	316,232	1,100	1,565
Arkansas	([1])	([1])	([1])	([1])	562,752	398,238	-----	-----
California	([1])	([1])	76,621	$253,471	9,050,550	6,928,980	1,240	519
Colorado	-----	-----	10,556	9,989	330,066	260,973	266,544	87,012
Connecticut	([1])	([1])	-----	-----	636,335	430,844	455,718	32,551
Delaware	-----	-----	-----	-----	29,002	20,633	-----	-----
Florida	-----	-----	-----	-----	1,162,708	947,575	-----	-----
Georgia	([1])	([1])	([1])	([1])	([1])	([1])	-----	-----
Idaho	-----	-----	-----	-----	134,210	130,559	259	96
Illinois	([1])	([1])	1,166,333	1,745,023	3,049,988	2,032,565	-----	-----
Indiana	-----	-----	485,328	546,302	1,228,075	896,268	100	50
Iowa	-----	-----	-----	-----	901,901	572,675	270	200
Kansas	-----	-----	-----	-----	1,240,825	692,960	4,130	1,540
Kentucky	-----	-----	([1])	([1])	770,998	697,674	-----	-----
Louisiana	-----	-----	35,766	31,792	543,991	440,690	-----	-----
Maine	-----	-----	-----	-----	99,753	69,961	-----	-----
Maryland	([1])	([1])	-----	-----	915,972	897,618	-----	-----
Massachusetts	-----	-----	([1])	([1])	1,490,641	1,025,501	6,210	4,140
Michigan	166,400	$380,165	2,175,918	1,213,583	1,607,971	1,088,208	24,275	4,171
Minnesota	([1])	([1])	([1])	([1])	1,400,526	827,314	601	261
Mississippi	-----	-----	29,112	25,877	436,120	276,122	-----	-----
Missouri	499,465	894,958	91,136	104,203	1,175,118	909,534	([1])	([1])
Montana	-----	-----	-----	-----	102,087	120,286	3,627	4,985
Nebraska	-----	-----	1,643	2,054	367,040	189,305	11,294	1,310
Nevada	([1])	([1])	([1])	([1])	105,684	162,089	13,711	6,180
New Hampshire	-----	-----	-----	-----	([1])	([1])	-----	-----
New Jersey	([1])	([1])	1,612,691	2,873,156	1,512,018	942,798	-----	-----
New Mexico	-----	-----	-----	-----	([1])	([1])	8,061	20,651
New York	-----	-----	503,091	1,009,294	5,467,026	4,037,937	462	136
North Carolina	([1])	([1])	-----	-----	710,131	348,244	191,000	47,750
North Dakota	-----	-----	-----	-----	103,204	85,188	12,268	609
Ohio	([1])	([1])	840,189	1,685,097	3,471,966	2,825,888	-----	-----
Oklahoma	([1])	([1])	-----	-----	430,894	220,707	-----	-----
Oregon	-----	-----	([1])	([1])	748,931	826,962	1,946	1,717
Pennsylvania	([1])	([1])	316,354	585,585	2,875,276	3,129,063	-----	-----
Puerto Rico	-----	-----	-----	-----	-----	-----	([1])	([1])
Rhode Island	-----	-----	([1])	([1])	([1])	([1])	745	552
South Carolina	-----	-----	-----	-----	([1])	([1])	-----	-----
South Dakota	-----	-----	-----	-----	189,019	128,638	46,030	46,730
Tennessee	([1])	([1])	209,078	505,573	888,476	962,757	54,150	19,000
Texas	([1])	([1])	400	280	2,439,826	1,824,719	4,323	2,450
Utah	-----	-----	([1])	([1])	258,340	171,931	286	226
Vermont	-----	-----	-----	-----	9,300	6,500	3,150	4,515
Virginia	([1])	([1])	([1])	([1])	665,822	539,080	-----	-----
Washington	-----	-----	([1])	([1])	939,856	720,508	277,049	178,831
West Virginia	([1])	([1])	([1])	([1])	546,844	635,535	-----	-----
Wisconsin	-----	-----	([1])	([1])	1,774,753	1,075,373	62,521	22,668
Wyoming	-----	-----	-----	-----	31,542	51,090	6,403	15,621
Undistributed [1]	4,655,382	10,120,122	754,218	1,352,949	1,080,624	624,816	80,000	196,000
	5,321,247	11,395,245	8,308,434	11,944,228	52,475,831	39,982,460	1,551,000	717,000

[1] Figures that may not be shown separately are combined as "Undistributed."

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1947, by States and uses—Continued

State	Sand—Continued							
	Paving				Grinding and polishing [2]		Fire or furnace	
	Commercial		Government-and-contractor					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	388,490	$205,184	116,537	$9,469			(1)	(1)
Alaska			(1)	(1)				
Arizona	128,120	94,776	13,645	21,662				
Arkansas	446,574	327,731	(1)	(1)				
California	4,161,940	3,118,748	640,149	296,211	(1)	(1)		
Colorado	59,478	54,700	10,102	3,732	1,533	$2,184	2,057	$1,318
Connecticut	308,856	217,029	10,850	2,750	6,820	5,580	114	71
Delaware	(1)	(1)			(1)	(1)		
Florida	143,050	100,200	33,550	18,050	(1)	(1)		
Georgia	(1)	(1)	8,400	6,000	20,595	6,548		
Idaho	118,723	98,385	237,448	177,347				
Illinois	1,478,453	1,082,488	13,451	10,062	(1)	(1)	(1)	(1)
Indiana	1,420,541	949,361	2,307	734			(1)	(1)
Iowa	426,760	201,744	90,339	10,878	(1)	(1)		
Kansas	877,645	488,974	168,534	43,268	640	460	(1)	(1)
Kentucky	341,056	322,309						
Louisiana	355,321	318,238	(1)	(1)	(1)	(1)		
Maine	(1)	(1)	196,244	63,078				
Maryland	1,147,018	1,111,833	28,036	1,661				
Massachusetts	622,881	422,156	74,925	22,375	140	50		
Michigan	2,021,754	1,263,825	60,956	7,548	(1)	(1)		
Minnesota	502,416	259,606	80,777	37,828	725	425		
Mississippi	174,231	110,226	(1)	(1)				
Missouri	530,572	362,850	(1)	(1)	(1)	(1)		
Montana	(1)	(1)	1,526	2,810				
Nebraska	323,516	188,154	248	128	220	88	55,140	22,056
Nevada	22,876	46,583	6,099	6,402	(1)	(1)		
New Hampshire	45,439	16,856	378,218	46,755				
New Jersey	959,557	629,136	(1)	(1)	70,905	208,054	(1)	(1)
New Mexico			1,770	1,200	(1)	(1)		
New York	1,610,074	1,232,507	108,375	16,831			(1)	(1)
North Carolina	289,115	161,603	1,398,683	402,230	(1)	(1)		
North Dakota	6,963	5,490	40,451	7,534				
Ohio	2,097,294	1,588,980	932	690	(1)	(1)	(1)	(1)
Oklahoma	260,242	122,366	3,970	1,044				
Oregon	222,101	237,768	137,805	71,750	(1)	(1)		
Pennsylvania	1,680,338	1,735,349			(1)	(1)	43,331	61,481
Puerto Rico								
Rhode Island	(1)	(1)	9,215	5,806				
South Carolina	(1)	(1)	26,398	12,442	(1)	(1)		
South Dakota	84,286	57,178	22,568	24,025				
Tennessee	421,740	424,300			(1)	(1)		
Texas	1,685,016	1,284,798	55,445	12,029	(1)	(1)	250	500
Utah	98,631	72,719	10,532	7,252				
Vermont	(1)	(1)	15,362	7,407	(1)	(1)		
Virginia	764,912	419,733	371,568	105,409	4,221	3,171		
Washington	242,728	162,577	114,844	70,794				
West Virginia	463,883	541,159			(1)	(1)		
Wisconsin	720,352	474,195	1,149,028	654,337	(1)	(1)		
Wyoming	25,439	26,484	20,457	15,153				
Undistributed [1]	708,368	450,378	389,000	111,000	993,454	1,575,429	273,025	341,530
	28,386,749	20,988,676	6,049,000	2,316,000	1,099,253	1,801,989	373,917	426,956

[1] Figures that may not be shown separately are combined as "Undistributed."
[2] Includes 308,128 tons of blast sand valued at $958,023.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1947, by States and uses—Continued

State	Sand—Continued							
	Engine		Filter		Railroad ballast [3]		Other [4]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)					11,500	$23,000
Alaska								
Arizona	6,167	$6,167					(1)	(1)
Arkansas	(1)	(1)						
California	39,565	21,931	5,907	$41,263	3,680	$3,045	25,901	56,653
Colorado	36,268	39,000			(1)	(1)	(1)	(1)
Connecticut			8,746	4,657	3,000	1,800	18,377	7,562
Delaware	(1)	(1)	(1)	(1)			1,550	1,550
Florida	(1)	(1)						
Georgia	48,385	14,344					65,112	70,509
Idaho	(1)	(1)					995	398
Illinois	153,747	123,525	(1)	(1)	(1)	(1)	166.520	340,710
Indiana	198,923	99,086			79,434	21,182	15,244	10,455
Iowa	(1)	(1)	(1)	(1)	3,520	1,936	(1)	(1)
Kansas	94,516	56,607	(1)	(1)	46,614	27,845	24,728	7,813
Kentucky	(1)	(1)					16,161	17,771
Louisiana	19,640	14,056	200	108	(1)	(1)		
Maine	(1)	(1)						
Maryland	(1)	(1)					9,555	5,733
Massachusetts	56,109	26,643	5,359	3,404			92,897	46,753
Michigan	3,896	2,925	31,260	10,420	53,936	20,672	20,437	7,551
Minnesota	41,709	20,028			(1)	(1)	34,919	13,037
Mississippi	18,720	9,440						
Missouri	55,058	35,486	(1)	(1)	83,037	21,566	(1)	(1)
Montana							(1)	(1)
Nebraska	111,804	43,729	1,467	440			(1)	(1)
Nevada							15,100	38,378
New Hampshire			2,668	4,002				
New Jersey	(1)	(1)	62,077	177,693			(1)	(1)
New Mexico	1,440	1,440			4,424	632		
New York	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
North Carolina	(1)	(1)	(1)	(1)			18,030	12,252
North Dakota							(1)	(1)
Ohio	78,879	97,169	(1)	(1)	21,776	7,249	77,576	167,150
Oklahoma	(1)	(1)						
Oregon	(1)	(1)			(1)	(1)	5,984	3,351
Pennsylvania	307,629	404,478	(1)	(1)			220,238	387,414
Puerto Rico								
Rhode Island							(1)	(1)
South Carolina	(1)	(1)	(1)	(1)			(1)	(1)
South Dakota								
Tennessee	(1)	(1)					(1)	(1)
Texas	87,590	65,735	(1)	(1)	81,504	66,927	23,157	11,439
Utah	(1)	(1)	(1)	(1)	270	202	(1)	(1)
Vermont	3,785	2,647						
Virginia	(1)	(1)					74,706	56,441
Washington	(1)	(1)			(1)	(1)	27,176	23,359
West Virginia	389,113	469,495					(1)	(1)
Wisconsin	(1)	(1)	(1)	(1)			8,947	10,517
Wyoming							3,575	650
Undistributed [1]	930,390	538,725	93,962	124,918	470,881	209,222	428,292	418,921
	2,683,333	2,092,656	211,646	366,905	852,076	382,278	1,406,677	1,739,367

[1] Figures that may not be shown separately are combined as "Undistributed."
[3] Includes 5,760 tons of ballast sand valued at $450, produced by railroads for their own use.
[4] Includes 159,983 tons of sand valued at $31,886, used by railroads for fills and similar purposes.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1947, 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	937,183	$746,759	-----	-----	688,778	$517,731	383,947	$49,071
Alaska	-----	-----	(1)	(1)	-----	-----	(1)	(1)
Arizona	387,675	427,834	3,297	$5,128	(1)	(1)	523,151	343,790
Arkansas	326,795	297,457	-----	-----	779,057	707,415	(1)	(1)
California	8,409,266	7,195,970	28,587	11,981	5,796,920	4,930,480	2,540,335	1,677,200
Colorado	(1)	(1)	350,180	91,826	118,446	103,415	1,750,196	1,177,187
Connecticut	433,438	372,828	-----	-----	272,676	169,921	56,800	22,000
Delaware	17,099	26,919	-----	-----	47,691	55,905	-----	-----
Florida	535,416	648,577	-----	-----	(1)	(1)	-----	-----
Georgia	-----	-----	-----	-----	1,700	3,700	400	200
Idaho	231,520	212,548	7,290	1,367	493,298	356,824	1,732,821	1,048,016
Illinois	3,171,831	2,060,708	38,313	16,287	3,477,236	2,170,615	634,544	403,545
Indiana	1,544,431	1,372,898	58,800	35,564	2,924,439	2,034,571	333,573	156,524
Iowa	517,771	561,570	405	450	1,512,822	869,169	2,708,842	364,743
Kansas	164,937	134,958	5,800	400	789,679	544,124	688,025	229,218
Kentucky	433,547	473,558	21,600	12,900	178,522	180,634	556,422	172,838
Louisiana	1,173,655	1,339,045	-----	-----	1,714,788	2,013,046	(1)	(1)
Maine	134,090	115,144	8,138	2,713	179,533	130,913	3,017,015	796,445
Maryland	722,962	967,065	-----	-----	1,221,635	1,680,366	489,539	49,186
Massachusetts	1,103,124	1,124,943	-----	-----	897,465	550,777	391,350	54,500
Michigan	2,161,447	1,671,039	328,231	133,962	4,394,081	3,051,825	3,044,342	1,477,840
Minnesota	710,944	836,285	455	565	1,221,857	772,621	7,371,875	754,256
Mississippi	612,034	440,399	(1)	(1)	560,822	466,535	(1)	(1)
Missouri	763,570	688,603	(1)	(1)	974,521	693,650	(1)	(1)
Montana	109,372	127,611	80,000	25,207	195,326	225,897	2,641,877	2,192,233
Nebraska	660,042	397,869	14,175	6,720	1,860,240	1,069,968	340,164	179,585
Nevada	31,991	68,445	36,061	17,110	15,995	34,222	227,650	64,406
New Hampshire	(1)	(1)	966	69	(1)	(1)	1,357,900	151,924
New Jersey	566,137	593,309	-----	-----	270,041	171,692	(1)	(1)
New Mexico	(1)	(1)	9,552	19,925	-----	-----	174,181	175,193
New York	2,021,910	1,903,991	9,062	1,101	2,366,240	2,226,342	1,282,014	206,060
North Carolina	446,316	631,726	-----	-----	647,947	843,040	345,111	345,113
North Dakota	123,628	130,781	71,659	3,385	61,500	37,847	1,413,037	376,137
Ohio	2,397,117	2,146,378	270	200	4,180,492	3,324,927	540,841	295,246
Oklahoma	(1)	(1)	21,725	9,070	(1)	(1)	309,864	98,169
Oregon	1,044,579	971,198	63,279	9,973	2,037,936	2,033,993	1,505,084	1,227,352
Pennsylvania	2,522,973	2,437,343	-----	-----	1,562,451	1,462,773	668,941	77,487
Puerto Rico	-----	-----	(1)	(1)	-----	-----	-----	-----
Rhode Island	(1)	(1)	1,335	989	(1)	(1)	33,068	17,914
South Carolina	(1)	(1)	-----	-----	-----	-----	52,796	24,884
South Dakota	41,312	55,858	50,272	5,991	355,612	417,063	2,169,906	889,715
Tennessee	627,605	768,832	73,389	90,711	611,384	488,166	611,830	177,596
Texas	2,829,007	3,099,496	1,890	1,750	2,995,745	2,986,140	1,495,203	275,269
Utah	337,557	239,149	184	130	215,055	126,245	1,645,608	959,873
Vermont	(1)	(1)	10,925	7,945	(1)	(1)	546,034	396,359
Virginia	786,122	999,199	-----	-----	1,088,723	1,374,274	594,481	164,263
Washington	1,445,533	1,065,177	283,642	202,566	1,346,472	1,127,457	2,547,911	1,624,133
West Virginia	492,136	572,982	-----	-----	580,685	677,147	159,976	139,717
Wisconsin	1,432,613	1,026,106	230,323	84,881	2,241,080	1,464,066	7,466,066	3,995,060
Wyoming	59,654	73,149	10,858	26,750	400,008	374,713	1,102,448	563,033
Undistributed [1]	1,026,236	981,910	388,000	713,000	584,829	504,247	9,834,000	6,530,000
	43,494,575	40,005,616	2,208,000	1,541,000	51,863,727	42,974,456	65,289,000	29,923,000

[1] Figures that may not be shown separately are combined as "Undistributed."

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1947, by States and uses—Continued

State	Gravel—Continued				Sand and gravel			
	Railroad ballast [5]		Other [6]		Total commercial		Total Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	-----	-----	2,886,119	$2,197,994	513,984	$73,540
Alaska	-----	-----	-----	-----	-----	-----	(1)	(1)
Arizona	732	$732	1,463	$1,463	1,066,565	995,935	541,193	372,145
Arkansas	357,769	209,205	(1)	(1)	2,690,163	2,267,203	(1)	(1)
California	124,322	64,755	277,210	214,357	28,176,515	23,353,056	3,210,311	1,985,911
Colorado	(1)	(1)	1,973	2,531	1,147,631	963,979	2,377,022	1,359,757
Connecticut	104,239	83,558	(1)	(1)	1,805,830	1,327,374	523,368	57,301
Delaware	4,005	5,006	-----	-----	235,464	195,002	-----	-----
Florida	156,139	134,155	4,000	2,000	2,033,851	1,862,816	33,550	18,050
Georgia	-----	-----	-----	-----	918,530	568,915	8,800	6,200
Idaho	(1)	(1)	(1)	(1)	1,231,948	841,065	1,977,818	1,226,826
Illinois	1,356,439	671,588	52,436	28,477	15,606,219	12,726,077	686,308	429,894
Indiana	723,460	442,519	(1)	(1)	8,836,869	6,494,210	394,780	192,872
Iowa	198,790	73,631	18,626	28,614	3,673,231	2,419,616	2,799,856	376,271
Kansas	(1)	(1)	(1)	(1)	3,485,431	2,056,009	866,489	274,426
Kentucky	-----	-----	35,453	38,984	1,876,470	1,811,630	578,022	185,738
Louisiana	94,730	49,847	323	764	4,055,834	4,277,499	(1)	(1)
Maine	(1)	(1)	3,665	1,209	555,750	379,141	3,221,397	862,236
Maryland	-----	-----	(1)	(1)	4,106,519	4,741,707	517,575	50,847
Massachusetts	(1)	(1)	48,453	28,165	4,470,435	3,430,840	472,485	81,015
Michigan	563,775	366,428	(1)	(1)	13,387,627	9,134,722	3,457,804	1,623,521
Minnesota	1,655,419	506,173	408,159	114,548	6,056,428	3,401,358	7,453,708	792,910
Mississippi	205,097	64,619	-----	-----	2,036,136	1,393,218	(1)	(1)
Missouri	220,021	146,608	5,540	4,986	4,597,495	4,193,474	(1)	(1)
Montana	819,427	288,700	(1)	(1)	1,476,767	904,686	2,727,030	2,225,235
Nebraska	-----	-----	(1)	(1)	3,426,741	1,947,882	365,881	187,743
Nevada	(1)	(1)	-----	-----	679,732	1,366,153	283,521	94,098
New Hampshire	-----	-----	-----	-----	(1)	(1)	1,737,084	198,748
New Jersey	(1)	(1)	15,090	46,523	5,532,011	6,335,343	(1)	(1)
New Mexico	(1)	(1)	-----	-----	347,230	275,614	193,564	216,969
New York	19,591	11,289	(1)	(1)	12,420,283	10,682,096	1,399,913	224,128
North Carolina	(1)	(1)	(1)	(1)	2,236,759	2,161,707	1,934,794	795,093
North Dakota	(1)	(1)	(1)	(1)	845,606	532,446	1,537,415	387,665
Ohio	1,006,154	600,956	204,433	359,088	14,846,947	13,899,152	542,043	296,136
Oklahoma	-----	-----	-----	-----	1,334,646	1,017,039	335,559	108,283
Oregon	206,205	129,087	17,888	2,230	4,312,326	4,230,581	1,708,114	1,310,792
Pennsylvania	100,000	52,500	28,252	52,476	10,875,030	12,929,157	668,941	77,487
Puerto Rico	-----	-----	-----	-----	-----	-----	(1)	(1)
Rhode Island	-----	-----	-----	-----	(1)	(1)	44,363	25,261
South Carolina	-----	-----	-----	-----	522,119	240,695	79,194	37,326
South Dakota	157,691	46,137	5,713	918	833,633	705,792	2,288,776	966,461
Tennessee	284,826	187,684	(1)	(1)	3,151,882	3,518,362	739,369	287,307
Texas	1,451,776	790,726	6,577	9,518	11,641,867	10,249,482	1,556,861	291,498
Utah	(1)	(1)	(1)	(1)	1,289,333	644,873	1,656,610	967,481
Vermont	23,934	25,912	-----	-----	204,721	145,636	575,471	416,226
Virginia	-----	-----	14,356	21,235	3,604,571	3,582,997	966,049	269,672
Washington	718,763	370,725	336,597	109,825	5,157,125	3,624,636	3,223,446	2,076,324
West Virginia	(1)	(1)	(1)	(1)	3,636,277	5,643,271	159,976	139,717
Wisconsin	707,704	298,168	61,606	40,838	7,427,300	5,181,832	8,907,938	4,756,946
Wyoming	(1)	(1)	(1)	(1)	1,128,215	870,145	1,140,166	620,557
Undistributed [1]	2,674,926	1,169,748	601,205	371,601	694,236	649,221	10,691,000	7,550,000
	13,935,934	6,790,456	2,149,018	1,480,350	212,562,417	182,371,638	75,097,000	34,497,000

[1] Figures that may not be shown separately are combined as "Undistributed."
[5] Includes 5,424,388 tons of ballast gravel valued at $1,813,184, produced by railroads for their own use.
[6] Includes 1,058,333 tons of gravel valued at $298,249, used by railroads for fills and similar purposes.

Government-and-Contractor Production.—As indicated in the accompanying chart and tables, the output of sand and gravel from noncommercial or Government-and-contractor operations in 1947 comprised 26 percent of the total tonnage, compared with 24 percent in 1946. The value of this tonnage in 1947 constituted 16 percent of the total for the industry. The substantial gain in the over-all output was explained by the increased tonnage of gravel for paving. States reported 49 percent of the total in 1947, counties 36, municipalities 2, and other agencies 13. The average value per ton increased 8 cents in 1947.

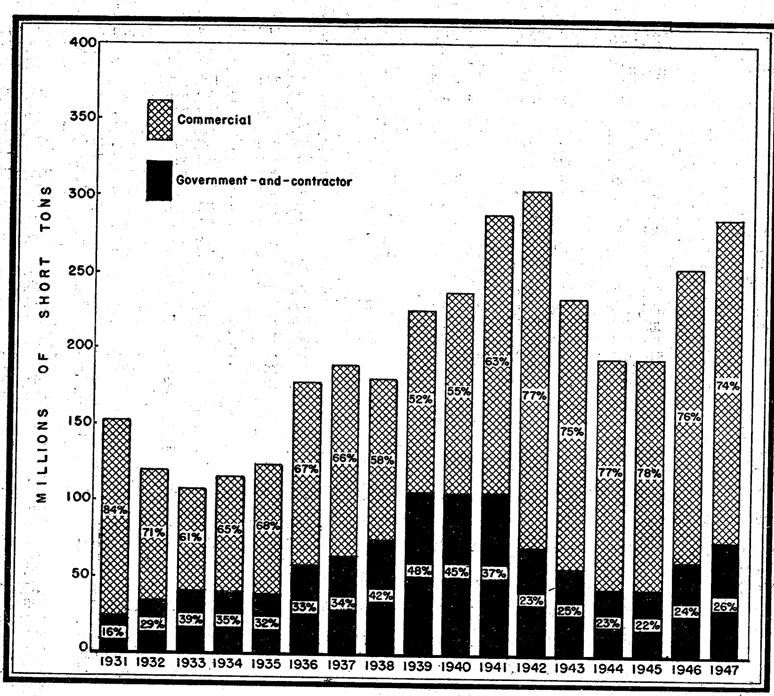

FIGURE 2.—Sand and gravel sold or used in the United States by commercial and Government-and-contractor producers, 1931–47.

Sand and gravel sold or used by Government-and-contractor producers in the United States, 1943–47, by uses

Year	Sand				Gravel				Total Government-and-contractor sand and gravel	
	Building		Paving		Building		Paving			
	Short tons	Value (dollars)	Short tons	Value (dollars)	Short tons	Value (dollars)	Short tons	Value (dollars)	Short tons	Value (dollars)
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
1946	894,000	313,000	4,752,000	1,629,000	2,752,000	1,416,000	53,641,000	19,932,000	62,039,000	23,290,000
1947	1,551,000	717,000	6,049,000	2,316,000	2,208,000	1,541,000	65,289,000	29,923,000	75,097,000	34,497,000

Sand and gravel sold or used by Government-and-contractor producers in the United States, 1944–47, by type of producer

Type of producer	1944 Short tons	1944 Average value per ton	1945 Short tons	1945 Average value per ton	1946 Short tons	1946 Average value per ton	1947 Short tons	1947 Average value per ton
Construction and maintenance crews	27,889,000	$0.29	29,353,000	$0.31	37,614,000	$0.32	38,662,000	$0.35
Contractors	16,261,000	.50	14,033,000	.67	24,425,000	.46	36,435,000	.58
	44,150,000	.37	43,386,000	.42	62,039,000	.38	75,097,000	.46
States	18,775,000	.40	15,944,000	.44	30,812,000	.40	37,017,000	.49
Counties	18,421,000	.27	19,126,000	.28	26,005,000	.31	26,958,000	.34
Municipalities	1,227,000	.37	1,155,000	.30	1,402,000	.41	1,573,000	.46
Other agencies	5,727,000	.59	7,161,000	.78	3,820,000	.63	9,549,000	.70
	44,150,000	.37	43,386,000	.42	62,039,000	.38	75,097,000	.46

DEGREE OF PREPARATION

Normally the bulk of sand and gravel shipped by commercial plants is prepared material, whereas most of the production of Government-and-contractor operations is largely unprepared material. The accompanying table shows this relationship in the past 2 years. Prepared sand and gravel, by both types of operations, accounted for 72 percent of the total production in 1947, compared to 73 percent in 1946. The percentage of prepared material remained the same in 1947 as in 1946 for commercial operations, but Government-and-contractor operators reported 1 percent more in their prepared class of material.

Sand and gravel (prepared or unprepared) sold or used by producers in the United States, 1946–47, by commercial and Government-and-contractor operations

	1946 Quantity Short tons	1946 Quantity Percent	1946 Average value per ton	1947 Quantity Short tons	1947 Quantity Percent	1947 Average value per ton
Commercial operations:						
Prepared	174,195,542	91	$0.80	192,619,538	91	$0.89
Unprepared	17,897,024	9	.50	19,942,879	9	.51
	192,092,566	100	.77	212,562,417	100	.86
Government-and-contractor operations:						
Prepared	11,483,000	19	.70	14,689,000	20	.89
Unprepared	50,556,000	81	.30	60,408,000	80	.36
	62,039,000	100	.38	75,097,000	100	.46
Grand total	254,131,000		.67	287,659,000		.75

SIZE OF PLANTS

The average plant output of commercial operators, excepting railroad plants, reached 92,000 short tons in 1947, an increase of approximately 5 percent over the 88,000 short tons reported in 1946. As in 1946, plants producing 100,000 to 200,000 tons accounted for approximately one-fifth of the total production. Plants producing over 500,000 short tons increased from 48 to 58 and supplied 24 percent of the total tonnage. Plants in the less-than-25,000-ton group showed the greatest expansion in numbers—from 838 to 869. Three groups—400,000 to 500,000, 600,000 to 700,000, and 800,000 to 900,000 tons—had fewer plants in operation in 1947 than in 1946. Details of output, by size groups, are shown in the accompanying table.

Comparison of number and production of commercial sand and gravel plants in the United States, 1946–47, by size groups [1]

Size group, in short tons	1946				1947			
	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	838	39.5	7,601,000	4.0	869	38.9	8,366,000	4.1
25,000 to less than 50,000	365	17.2	13,254,000	7.1	388	17.4	14,098,000	6.8
50,000 to less than 100,000	398	18.8	28,196,000	15.1	404	18.1	28,729,000	14.0
100,000 to less than 200,000	277	13.1	39,424,000	21.1	298	13.3	41,655,000	20.2
200,000 to less than 300,000	115	5.4	27,675,000	14.8	136	6.1	33,165,000	16.1
300,000 to less than 400,000	52	2.4	18,019,000	9.6	56	2.5	19,395,000	9.4
400,000 to less than 500,000	28	1.3	12,451,000	6.6	27	1.2	12,065,000	5.9
500,000 to less than 600,000	16	.8	8,620,000	4.6	25	1.1	13,614,000	6.6
600,000 to less than 700,000	9	.4	5,927,000	3.2	3	.1	1,934,000	.9
700,000 to less than 800,000	2	.1	1,468,000	.8	7	.3	5,139,000	2.5
800,000 to less than 900,000	7	.3	6,119,000	3.3	3	.1	2,517,000	1.2
900,000 to less than 1,000,000	2	.1	1,907,000	1.0	5	.2	4,690,000	2.3
1,000,000 and over	12	.6	16,469,000	8.8	15	.7	20,547,000	10.0
	2,121	100.0	187,130,000	100.0	2,236	100.0	205,914,000	100.0

[1] Plants operated by or for States, counties, municipalities, and other Government agencies are not included; also not included are approximately 133 railroad plants with an output of 4,962,000 tons of sand and gravel in 1946 and 163 plants with an output of 6,648,000 tons in 1947.

[2] Includes a few companies operating more than 1 plant but not submitting separate returns for individual plants.

METHOD OF TRANSPORTATION

More sand and gravel was moved by trucks than by other methods of transportation in 1947. Truck transportation handled 53 percent of the total commercial shipments compared with 51 percent in 1946. Rail shipments accounted for 38 percent in 1947 against 40 percent in 1946. The quantity of sand and gravel carried by waterways remained fairly constant and amounted to 9 percent. As indicated in the accompanying table, the percentage moved by truck transportation becomes even greater when Government-and-contractor production is added. The continued increase in truck transportation in 1947 might be attributed in part to the shortage of freight cars.

Sand and gravel sold or used by commercial producers in the United States, 1946–47, by methods of transportation [1]

Method of transportation	1946		1947	
	Short tons	Percent of total reported	Short tons	Percent of total reported
Truck	91,741,944	51.1	107,380,870	53.1
Rail	71,615,794	39.9	75,941,543	37.5
Waterway	16,231,812	9.0	19,003,120	9.4
Total reported	179,589,550	100.0	202,325,533	100.0
Percent of total commercial production covered		93.5		95.2

[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 approximately as follows—1946: truck 64 percent, rail 29 percent, and waterway 7 percent; 1947: truck 66 percent, rail 27 percent, and waterway 7 percent.

CONSUMPTION TRENDS

Sand and Gravel for Construction.—The demand for sand and gravel by the construction industry in 1947, as measured by shipments from commercial plants, continued to show strong upward trends. Building sand reached a peak of 52,475,831 short tons, a figure 4,237,882 tons more than in 1946, and considerably greater than the record output in 1942. Paving sand likewise showed an increase over 1946 of 4,026,705 short tons. In fact the only type of material to show a decrease in production for 1947 compared with 1946 was engine sand. Most indications point to the probability that continued building and highway construction will keep the demand for sand and gravel at a high level for some time.

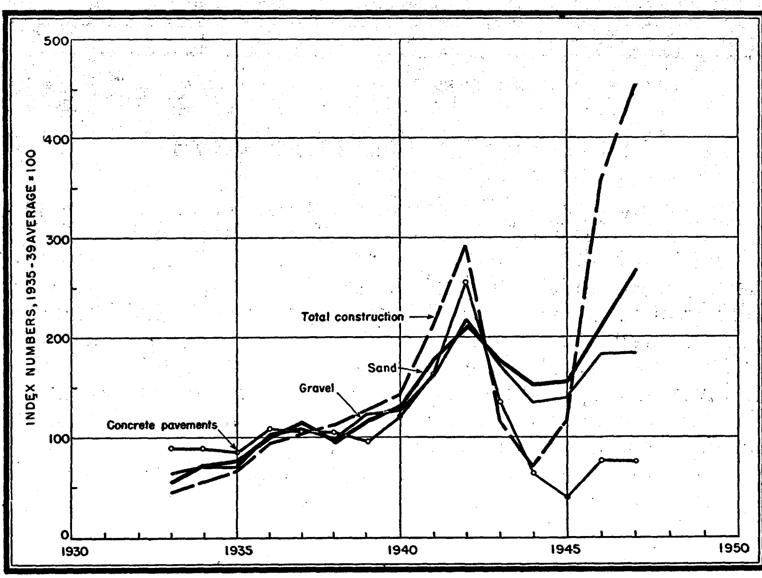

FIGURE 3.—Value of sand and gravel production, compared with total construction (contract awards, value) and concrete pavements (contract awards, thousands of square yards), in the United States, 1933–47. Data on construction and concrete pavements are from the Bureau of Foreign and Domestic Commerce.

Industrial Sands.—The output of the industrial sands in 1947, with the exception of engine sand, continued to increase. The greatest difference in the tonnage produced for 1947, was exhibited by molding sand, although fire or furnace sand showed the largest percentage increase. As industrial production is expected to be maintained at a fairly high level for some time, the future market prospects are encouraging.

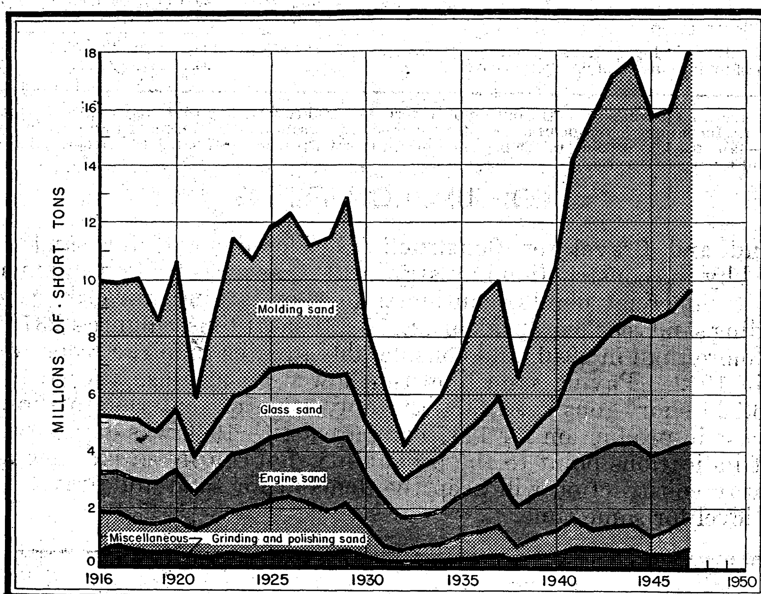

FIGURE 4.—Production of industrial sands in the United States, 1916–47.

EMPLOYMENT AND PRODUCTIVITY

The total number of men employed in the commercial sand and gravel industry averaged more than 25,000, compared with 22,000 in 1946, and reached the highest number since the peak year 1942. As the following table indicates, the average number of days worked was higher in 1947 than in 1946; but the average production per man per shift showed a slight decrease, although higher than at any time in the 1941–45 period. The accompanying table, showing a detailed break-down of employment and production, by regions, of all commercial plants (except those operated by railroads) indicates that the California-Nevada region employed the greatest number of men. The highest production per man per hour and shift was reported from the North Dakota-South Dakota-Minnesota region.

Employment in the commercial sand and gravel industry and average output per man in the United States, 1943–47, by regions [1]

	Employment: Average number of men	Employment: Time employed: Average number of days	Employment: Time employed: Total man-shifts	Employment: Time employed: Man-hours: Average per man per day	Employment: Time employed: Man-hours: Total	Production (short tons): Commercial sand and gravel	Production (short tons): Average per man: Per shift	Production (short tons): Average per man: Per hour	Percent of commercial industry represented
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
1946									
Maine, N. H., Vt., R. I., Mass., and Conn.	720	210	151,286	8.7	1,313,342	6,580,168	43.5	5.0	91.5
N. Y.	960	229	220,027	8.4	1,851,017	7,605,437	34.6	4.1	68.9
Pa., N. J., and Del.	1,982	257	510,145	8.7	4,427,853	14,134,677	27.7	3.2	90.8
W. Va., Va., Md., and D. C.	1,245	293	364,450	9.3	3,379,318	8,021,096	22.0	2.4	75.7
S. C., Ga., Ala., Fla., and Miss.	847	270	228,700	9.1	2,083,409	6,653,672	29.1	3.2	88.7
N. C., Ky., and Tenn.	972	254	246,837	9.6	2,365,931	6,238,963	25.3	2.6	83.8
Ark., La., and Tex.	1,500	255	382,307	9.4	3,594,527	10,578,609	27.7	2.9	68.3
Ohio	1,426	247	352,076	8.4	2,971,247	11,812,498	33.6	4.0	93.0
Ill. and Ind.	1,870	241	450,718	8.7	3,908,023	19,971,150	44.3	5.1	84.8
Mich. and Wisc.	1,622	188	304,395	9.1	2,781,918	15,211,650	50.0	5.5	82.2
N. Dak., S. Dak., and Minn.	508	163	82,712	9.1	751,628	4,266,764	51.6	5.7	69.7
Nebr. and Iowa	597	184	110,084	9.7	1,068,010	6,228,509	56.6	5.8	77.1
Kans., Mo., and Okla.	874	264	230,431	8.6	1,987,666	7,628,024	33.1	3.8	82.8
Wyo., Colo., N. Mex., Utah, and Ariz.	411	199	81,867	8.2	667,597	3,169,885	38.7	4.7	80.5
Calif. and Nev.	1,878	265	497,686	8.5	4,206,796	22,788,924	45.8	5.4	94.2
Mont., Wash., Oreg., and Idaho	988	197	194,655	8.4	1,643,302	8,313,178	42.7	5.1	75.9
Total United States	18,400	240	4,408,376	8.8	39,001,584	159,203,204	36.1	4.1	82.9
1947									
Maine, N. H., Vt., R. I., Mass., and Conn.	765	197	150,517	8.6	1,289,749	6,198,548	41.2	4.8	80.2
N. Y.	1,079	227	245,043	8.4	2,066,772	9,482,905	38.7	4.6	76.4
Pa., N. J., and Del.	2,318	276	640,643	8.5	5,450,121	16,247,643	25.4	3.0	97.6
W. Va., Va., Md., and D. C.	1,574	279	439,776	9.0	3,945,140	10,061,790	22.9	2.6	88.7
S. C., Ga., Ala., Fla., and Miss.	1,068	275	293,945	9.1	2,661,071	7,736,670	26.3	2.9	92.1
N. C., Ky., and Tenn.	919	258	236,918	9.5	2,243,670	5,742,810	24.2	2.6	79.0
Ark., La., and Tex.	1,790	268	479,581	9.3	4,462,114	14,122,938	29.4	3.2	76.8
Ohio	1,665	257	428,483	8.4	3,588,959	14,137,502	33.0	3.9	95.2
Ill. and Ind.	2,039	251	512,553	8.6	4,416,505	22,156,695	43.2	5.0	90.6
Mich. and Wisc.	1,856	200	371,863	9.0	3,346,382	18,476,607	49.7	5.5	88.8
N. Dak., S. Dak., and Minn.	539	166	89,326	9.1	812,288	4,652,126	52.1	5.7	60.1
Nebr. and Iowa	409	209	85,296	9.2	787,989	3,585,440	42.0	4.6	50.5
Kans., Mo., and Okla.	940	251	235,643	8.8	2,062,929	8,301,281	35.2	4.0	88.1
Wyo., Colo., N. Mex., Utah, and Ariz.	585	204	119,593	8.3	997,805	3,893,002	32.6	3.9	78.2
Calif. and Nev.	2,451	259	635,112	8.1	5,163,405	25,384,143	40.0	4.9	88.0
Mont., Wash., Oreg., and Idaho	1,247	204	253,872	8.2	2,081,281	9,484,422	37.4	4.6	77.9
Total United States	21,244	246	5,218,164	8.7	45,376,180	179,664,522	34.4	4.0	84.5

[1] Excludes plants operated by or directly for States, counties, municipalities, and other Government agencies.

PRICES

The average value for all shipments of sand and gravel in 1947 increased 12 percent over the previous year's figure. For commercial plants the average value increased 12 percent, and the change for Government-and-contractor operations amounted to a 21-percent increase. These increases reflect the continued rise in labor and other production costs. Higher prices were general in building and paving sands—increases for 1947 were 10 and 7 cents per ton, respectively, over the 1946 figures. Gravel for building and paving purposes likewise showed increases in the order of 10 cents per ton. Government-and-contractor sand and gravel also exhibited higher prices for 1947.

FOREIGN TRADE

Imports of sand and gravel in 1947 amounted to 482,529 short tons, representing an increase of 37 percent in quantity and 73 percent in value over 1946 figures. Belgium supplied virtually all of the glass sand, while Canada furnished 293,568 short tons of "other sand," with the United Kingdom, Belgium, and France supplying the balance. The gravel imported amounted to 177,244 short tons and came from Canada and Mexico.

Sand and gravel imported for consumption in the United States, 1943–47, by classes

[U. S. Department of Commerce]

Year	Sand				Gravel		Total	
	Glass sand [1]		Other sand [2]					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
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	80,861	43,976	281,141	170,226
1946	5,006	9,102	262,485	194,830	83,860	25,847	351,351	229,779
1947	7,804	12,532	297,481	283,884	177,244	100,665	482,529	397,081

[1] Classification reads "Sand containing 95 percent or more 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.

TECHNOLOGIC DEVELOPMENTS

As in 1946, the sand and gravel industry kept in tune with the times by using better methods of aggregate recovery and by improved production equipment. Some experimental work was done with a jig designed to separate aggregates on the basis of their specific gravities.[1] Modernization of equipment at a Pennsylvania plant not only tripled the output but increased the ratio of recovery of gravel to sand.[2] The utilization of sand and gravel products in granular bases and in bituminous mixes[3] for highway construction, and studies in durability of aggregates highlighted the annual meeting in California of the leading trade association of the industry.

[1] Rock Products, vol. 50, No. 6, June 1947, pp. 92–93.
[2] Pit & Quarry, vol. 39, No. 8, February 1947, pp. 69–72.
[3] Pit & Quarry, vol. 39, No. 10, April 1947, pp. 59–67.

Secondary Metals—Nonferrous

By A. J. McDERMID [1]

GENERAL SUMMARY

RECOVERY of all nonferrous metals from purchased scrap increased in 1947; and, except for magnesium and aluminum, which remained unchanged, unit values of the salvaged metal were higher. The increase in aluminum recovery was due to the temporary activities of private contractors melting aircraft scrap at army airfields. The increase in copper is to be credited to the refineries whose increased production of refined copper from scrap was a feature of the scrap-metal industry during the entire year. More lead was recovered from scrap in 1947 than ever before. There were substantial gains in recovery of secondary magnesium, tin, and antimony, and smaller increases in zinc and nickel.

Salient statistics of nonferrous secondary metals recovered in the United States, 1946–47

Metal	From new scrap		From old scrap		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1946						
Aluminum	187,538	$53,035,746	90,535	$25,603,298	278,073	$78,639,044
Antimony	3,010	1,042,062	16,105	5,575,551	19,115	6,617,613
Copper	397,093	114,362,784	406,453	117,058,464	803,546	231,421,248
Lead	48,244	8,104,992	344,543	57,883,224	392,787	65,988,216
Magnesium	3,907	1,601,870	1,210	496,100	5,117	2,097,970
Nickel	5,583	3,927,082	2,665	1,874,561	8,248	5,801,643
Tin	10,119	11,045,900	17,552	19,159,763	27,671	30,205,663
Zinc	223,459	39,775,702	77,223	13,745,694	300,682	53,521,396
	----------	232,896,138	----------	241,396,655	----------	474,292,793
1947						
Aluminum	180,990	51,147,774	163,847	46,303,162	344,837	97,450,936
Antimony	3,794	2,538,186	19,190	12,838,110	22,984	15,376,296
Copper	458,365	191,596,570	503,376	210,411,168	961,741	402,007,738
Lead	67,392	19,274,112	444,578	127,149,308	511,970	146,423,420
Magnesium	4,907	2,011,870	4,596	1,884,360	9,503	3,896,230
Nickel	6,734	5,073,395	2,807	2,114,794	9,541	7,188,189
Tin	11,055	17,232,534	18,999	29,615,641	30,054	46,848,175
Zinc	235,814	50,464,196	74,979	16,045,506	310,793	66,509,702
	----------	339,338,637	----------	446,362,049	----------	785,700,686

[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.

Although total recovery of secondary copper and aluminum increased in 1947, production of the established brass and aluminum ingot makers declined, owing to a slump in demand for both kinds of ingot in the first 7 months of the year. However, output at the army airfields effected an increase in over-all aluminum-ingot production. Secondary lead smelters experienced a decline in activity for 4 months, begun in May and ended in August, owing in part to plant shut-downs for repairs and employees' vacations. Secondary zinc plants, on the other hand, operated more steadily than the others, owing to the fact that their output is marketed to a wide variety of consumers such as manufacturers of pigments, rubber, galvanized products, and paper, whereas the ingot makers rely almost exclusively on the foundries for a market and were therefore confronted with periods of low demand for their products.

As in previous years, high-purity lead was reclaimed in the operations at many secondary lead smelters, and high-grade zinc was produced as easily from scrap as from ore. However, secondary aluminum of sufficient purity to compete with primary metal continued unobtainable from alloy scrap, and the commercial problem of recovering refined copper from brass scrap without sacrificing the zinc content remained unsolved, although important research in this field was being conducted. The solution of these problems would widen the market for scrap of both metals considerably.

The value of metals recovered in 1947 from both new and old scrap was $785,700,686 compared with $474,292,793 in 1946. The large increase was due not so much to the increased total quantity recovered as to the much higher prices, in most instances, that followed removal of price controls. The value of metals recovered from old scrap in 1947—$446,362,049—gained for the fifth successive year. The new-scrap recovery value was also substantial, totaling $339,338,637 compared with $232,896,138 in 1946.

These figures for the values of secondary metals recovered are calculated on the basis of replacement of primary metals by secondary; that is, if the plants involved had not been able to use scrap in their operations, they would have had to use primary metals amounting in value to the figures quoted above. However, it is difficult to state the value of secondary metal in terms of money. Metal recovered from old scrap is considered an addition to the pool of metal in use; the recovery from new scrap is not, and presumably is of less value to the national economy.

Secondary metals recovered as unalloyed metal, in alloys, and in chemical compounds in the United States, 1943–47, in short tons

Metal	1943	1944	1945	1946	1947
Aluminum	313, 961	325, 645	298, 387	278, 073	344, 837
Antimony	15, 483	15, 886	17, 148	19, 115	22, 984
Copper	1, 086, 047	950, 942	1, 006, 516	803, 546	961, 741
Lead	342, 094	331, 416	363, 039	392, 787	511, 970
Magnesium	11, 404	14, 185	9, 247	5, 117	9, 503
Nickel	6, 917	4, 321	6, 483	8, 248	9, 541
Tin	37, 820	32, 589	35, 133	27, 671	30, 054
Zinc	368, 488	345, 469	360, 444	300, 682	310, 793

SCOPE OF REPORT

Plants covered in nonferrous secondary metal surveys for 1947 included all known consumers of purchased nonferrous scrap metals. The scrap-metal dealers survey, which had been started in 1943, was terminated at the end of the first quarter of 1947. Reports on the consumption of copper materials were received from 114 plants classed as smelters (including 72 brass ingot makers and 19 primary producers) as well as 23 smelters that used copper scrap in other than copper alloys. Plants classed under the general heading of manufacturers and foundries on this survey totaled 2,645, including 54 brass and wire mills and 2,591 plants classed as chemical plants, miscellaneous manufacturers, and foundries. The copper materials reports received from all these plants contained data on refined copper, brass and bronze ingot, and copper-base scrap consumed and on the metals recovered from the scrap.

The large consumers of lead, zinc, and aluminum scrap were canvassed on a monthly basis by the Bureau of Mines in three separate surveys, and information regarding use of all nonferrous scrap (except copper scrap) was received on a single annual form from about 1,200 foundries, aluminum rolling mills, and miscellaneous manufacturers. In all, 383 plants were represented in the group classed as remelters, smelters, and refiners.

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 the metal and has no relation to the type of product recovered, either as to quality, degree of purity, or physical characteristics.

"Home scrap" means process scrap generated and used in the same plant. Data thereon are not included in this report.

"Purchased scrap" means all scrap that entered any plant in any form, whether old or new, and includes scrap treated for customers on a toll basis or conversion agreement and interplant transfers of scrap. Scrap consisting of worn-out or obsolete articles or equipment, salvaged and remelted for use in the same plant, is included in this category, although it is not actually purchased scrap. It represents, however, a definite recovery of secondary metal that should be recorded. Scrap salvaged by railroads from line operations and remelted 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.

"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 clippings, turnings, borings, skimmings, slags, drosses, and defective castings. However, if new scrap is consumed in the plant where it is generated, it is classed as home scrap and not recorded. If new scrap is shipped or sold to another plant, it becomes purchased scrap, and its consumption is recorded.

"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. However, 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.

"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

A record-breaking total of 344,837 short tons of secondary aluminum, valued at $97,450,936, was recovered in the United States in 1947, an increase of 24 percent over the 278,073 tons valued at $78,639,044 reclaimed in 1946. The previous record year was 1944, when 325,645 tons were recovered. Values were calculated on the basis of the average market price of primary pig, which was 14.14 cents a pound in 1946 and 14.13 cents a pound in 1947.

Secondary aluminum [1] recovered in the United States, 1946–47, in short tons

Secondary aluminum recovered			Recoverable aluminum-alloy content of scrap		
Form of recovery	1946	1947	Kind of scrap processed	1946	1947
As metal	2,075	5,105	New scrap:		
Aluminum alloys	274,068	338,200	Aluminum-base [2]	187,172	180,782
In brass and bronze	597	307	Copper-base	115	67
In zinc-base alloys	504	624	Zinc-base	52	93
In magnesium alloys	266	222	Magnesium-base	199	48
In chemical compounds	563	379			
				187,538	180,990
	278,073	344,837	Old scrap:		
			Aluminum-base [3]	90,005	163,110
			Copper-base	169	84
			Zinc-base	336	346
			Magnesium-base	25	307
				90,535	163,847
				278,073	344,837

[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 174,737 tons in 1946 and 166,269 tons in 1947.
[3] Recoverable aluminum content of old aluminum-base scrap was 82,941 tons in 1946 and 150,219 tons in 1947.

Although the total recoverable aluminum-alloy content of all scrap treated increased, the recovery from new scrap declined from 187,538 tons in 1946 to 180,990 tons in 1947. Recovery from old scrap increased from 90,535 tons to 163,847, owing largely to increased production from aircraft scrap. In ordinary peacetime years the preponderance of aluminum scrap is new or process scrap, of which the most important items are borings, turnings, and clippings whereas the biggest old scrap item is old castings. During World War II aircraft scrap came into prominence and strongly influenced secondary aluminum operations, beginning in 1944; it was the largest aluminum scrap item consumed in 1945, 1946, and 1947. Recovery of aluminum from magnesium-base scrap, though very small—355 tons in 1947—compared with that from aluminum-base scrap, was 58 percent greater than in 1946. The aluminum recovered from zinc-base scrap is obtained chiefly from zinc die-cast scrap which contains up to 5 percent aluminum. All but 1 or 2 percent of the total secondary aluminum recorded is in the form of aluminum alloys. Relatively little aluminum is recovered in unalloyed form from alloy scrap because of the difficulty in extracting aluminum from alloys. The 5,105 tons of aluminum recovered as metal in 1947 resulted from remelting relatively pure clippings.

Production of secondary aluminum and aluminum-alloy products in the United States, 1945–47, gross weight in short tons

	1945	1946	1947
Secondary aluminum ingot:[1]			
Pure aluminum (98.5 percent)	2,066	2,075	5,052
Silicon (max. Cu, 1 percent)	10,618	15,700	12,370
Silicon (Cu, 1 to 2.5 percent)	14,635	7,268	5,108
No. 12 aluminum	22,674	38,286	27,605
Other aluminum-copper (max. Si, 2.5 percent) alloys	26,360	23,714	[2] 89,642
Copper-silicon (each over 2.5 percent) alloys	50,983	67,540	72,286
Aluminum-copper- or aluminum-silicon-nickel alloys	18,208	2,603	2,101
Deoxidizing and other destructive uses	44,175	31,011	28,965
Aluminum hardeners	3,964	2,242	2,695
Al-Mg and Al-Zn alloys	4,743	17,135	3,833
Miscellaneous			10,258
	198,426	207,574	259,915
Secondary aluminum at primary producers[3]	108,705	73,388	84,074
Aluminum powder	[4] 79		[4] 53
Aluminum-alloy castings (except by primary producers)	2,555	4,444	7,645
Aluminum in chemicals	846	[5] 563	379

[1] Gross weight of alloys, including copper, silicon, and other added elements; total secondary ingot contained 6,816 tons of primary aluminum in 1945, 1,025 tons in 1946, and 1,525 tons in 1947.
[2] Of the total, 79,538 tons produced at naval air stations and plants of contractors melting down army planes.
[3] Combined with primary aluminum for the production of wrought products and castings.
[4] Does not include production measured as ingot for graining, powder, atomizing, or chemical purposes.
[5] Corrected figure.

Production of secondary aluminum ingot by aluminum ingot makers, naval air stations, and contractors melting down obsolete army planes totaled 259,915 tons, or 52,341 tons more than in 1946. Production by ingot makers alone declined, however. The trend of monthly production by aluminum ingot makers was similar to that of the brass ingot makers. Owing to falling demand, output declined steadily for the first 7 months of the year, being 21,375 tons in January and 11,461 tons in July. Production increased generally thereafter, reaching 16,326 tons in October and 15,245 tons in December. Output of "Other aluminum-copper" alloys, to which most production from aircraft scrap is assigned, increased from 23,714 tons in 1946 to 89,642 tons in 1947. Of the latter quantity, 66,395 tons were produced at plants of private contractors who will cease operations when their supply of scrap, purchased at five army airfields in 1946, is exhausted. The total quantity of aluminum that could be recovered from the scrap at these airfields was estimated at 112,000 tons before the contractors took possession. Some was later sold to dealers, so it is probable that recorded recovery from this source for 1948 will be substantially less than for 1947. Production of ingot used for deoxidizing and other destructive uses decreased for the third successive year, and output of No. 12 ingot declined from 38,286 tons in 1946 to 27,605 tons in 1947.

Secondary aluminum recovered from scrap at primary plants totaled 84,074 tons in 1947, 10,686 tons more than in 1946 but 24,631 tons less than in 1945. These figures represent the secondary metal content of the total production and do not refer to a separate secondary product. Scrap is melted at primary plants with virgin metal and other alloying ingredients, such as copper, and constitutes only a small percentage of the total raw material consumed. Generally scrap alone cannot be remelted into ingot for use in wrought products, but, since the proportion of scrap to refined aluminum in melts at primary plants is small, the resulting ingot can be produced with a composition suitable for either wrought products or castings. The procedure is such that no method has yet been found for determining the proportions of the secondary recovery to be assigned to castings and to wrought products. The ingot makers, who use mostly scrap, cannot in general produce ingot suitable for wrought products but must sell their ingot to the foundries to be made into castings. Some research was being done by aluminum scrap remelters toward producing a type of secondary ingot suitable for rolling into wrought products but results of such research are unavailable.

Total consumption of aluminum-base scrap was 411,070 tons in 1947 compared with 344,472 tons in 1946. Excluding aircraft scrap consumption, the totals for the 2 years were in closer relationship, being 261,929 tons and 239,527 tons, repsectively. Except for aircraft scrap the ingot makers consumed less scrap in 1947 than in 1946. Rolling mills and primary producers consumed a greater quantity and wider variety of scrap in 1947. Although use of airplane scrap (the only old scrap item consumed in 1946) dropped from 49,611 tons to 13,346 tons, rolling mills and primary producers also consumed 16,474 tons of old castings and forgings in addition to smaller quantities of four other old-scrap items. Probably the rolling mills also used considerable quantities of ingot from naval air stations and army air fields, but the Bureau of Mines maintains no records of such operations. Plants reporting on the monthly aluminum scrap survey in 1947 comprised 64 aluminum ingot makers, including naval air stations at Alameda and San Diego, Calif.; Miami and Jacksonville, Fla.; Corpus Christi, Tex.; and Norfolk, Va.

Consumption of purchased aluminum scrap in the United States in 1947, 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	11,299	393	14,721	10	500	10	26,933
Castings and forgings	21,088	17,935	2,003	16,474	2,341	2,510	62,351
Alloy sheet	42,185	5,361	38,123	361	47	38	86,115
Scrap sheet and sheet utensil		3,664		1,709	2,034	747	8,154
Borings and turnings	30,245		1,252		294		31,791
Die castings					61	13	74
Aircraft scrap		135,795		13,346			149,141
Miscellaneous aluminum and dross	28,600	15,522	1,468	542	379		46,511
	133,417	178,670	57,567	32,442	5,656	3,318	411,070

Stocks of aluminum scrap in the hands of consumers declined from 52,386 tons at the end of 1946 to 44,139 tons at the end of 1947. The figures exclude stocks held by army air-field contractors, data for which are unavailable but which are thought to contain approximately 40,000 tons of recoverable aluminum. Aircraft-scrap inventories at nine storage depots maintained by the War Assets Administration were disposed of by the end of March 1947. At the end of March (the last month for which the scrap-metal dealer survey was conducted), dealers held 48,856 tons of aluminum scrap, of which 29,756 tons were aircraft scrap. Dealers' shipments of aluminum scrap to consumers in January 1947 totaled 15,960 tons and exceeded monthly levels in 1946. In March, however, shipments dropped to 10,665 tons, a lower total than for any month of 1946.

Consumers' stocks of purchased aluminum-base scrap in the United States at end of year, 1946–47, gross weight in short tons

Scrap item	On hand—	
	Dec. 31, 1946	Dec. 31, 1947
Castings and forgings	8,011	11,296
Sheet, turnings, clippings, etc	25,145	21,054
Aircraft scrap	11,662	6,331
Miscellaneous aluminum and dross	7,568	5,458
	52,386	44,139

The dealers' buying price for cast aluminum scrap in New York dropped gradually from a monthly average price of 7.75 cents a pound in January to 4.40 cents in July—the month when aluminum-alloy-ingot production was lowest—increased sharply to 6.00 cents in August and rose to 6.70 cents in December. The average price for the year was 6.39 cents. The price for new aluminum clippings averaged 9.87 cents in January, experienced fluctuations paralleling those for cast scrap, and averaged 8.63 cents for the year—0.69 cent more than the average for 1946. The price for high-grade secondary aluminum ingot averaged 16.62 cents a pound in January, the highest level in 1947, after which it declined to 13.62 cents in July then rose to 15.81 cents in December. The average for the year was 14.92 cents. The price of primary aluminum remained at 15 cents a pound throughout the year.

SECONDARY ANTIMONY

Secondary antimony recovered from lead- and tin-base scrap totaled 22,984 short tons valued at $15,376,296, a gain of 20 percent over the 19,115 tons valued at $6,617,613 reclaimed in 1946. The value was computed at 33.45 cents a pound in 1947 and at 17.31 cents a pound in 1946, the average selling price for primary antimony in New York.

Secondary antimony recovered in the United States, 1946–47, in short tons

Secondary antimony recovered			Recoverable antimony content of scrap		
Form of recovery	1946	1947	Kind of scrap processed	1946	1947
In antimonial lead	12,054	16,638	New scrap: Lead-base	3,010	3,794
In other lead alloys	6,850	6,168			
In tin-base alloys	211	178		3,010	3,794
	19,115	22,984	Old scrap:		
			Lead-base	15,925	19,035
			Tin-base	180	155
				16,105	19,190
				19,115	22,984

The principal source of antimony recovered from scrap was, as in the past, old battery plates. The quantity of battery plates treated increased 27 percent—from 323,614 tons in 1946 to 411,088 tons in 1947. Antimony reclaimed from this source totaled 12,950 tons, also a 27-percent gain over the 10,193 tons in 1946. This did not include antimony recovered from dross generated in smelting battery lead plates, which was not separately recorded. The other important scrap sources of antimony in 1947 were type-metal scrap and dross, from which 4,798 tons of antimony were salvaged, and mixed common babbitt, from which 2,085 tons were recovered. Recovery of antimony in lead-base alloys other than antimonial lead and in tin-base alloys declined. Remelters, smelters, and refiners recovered 94 percent of the antimony reclaimed and the remaining 6 percent was recovered by bearing manufacturers and foundries. Products in which antimony was recovered are included in the lead- and tin-products table.

As was the case in 1946, a larger quantity of antimonial-lead scrap was used to produce soft lead, the resulting high-antimony drosses being used in other products. As far as could be determined, all antimony recovered from scrap remained in the alloyed state, none being recovered as unalloyed metal or in chemical compounds. The greater share of this work was done by secondary smelters and refiners, even though the quantity of soft lead recovered at primary plants during the year almost doubled. Of the 16,647 tons of primary antimony consumed in 1947, 10,092 tons emerged chiefly in lead and tin alloys, the remainder being used in nonmetallic products. As so much of the total consumption of antimony, both primary and secondary, was used in alloys, it is evident that the secondary metal was competitive with the primary except where unalloyed antimony was needed. Along with the general increase in recovery by secondary smelters, primary smelters raised their recovery of lead in antimonial lead from secondary sources by 66 percent.

Antimony, antimony-bearing scrap, and antimony-bearing secondary alloys remained under allocation and inventory and use control under WPB General Preference Order M–112 throughout 1947. Some modification of the order was effected by the Office of Materials Distribution in an amendment on September 5 which authorized control of receipts alone in place of both shipments and receipts, and which also relieved the applicant from naming his supplier.

Price control on antimony had been revoked in November 1946, and antimony was selling for 28.25 cents a pound in December. In 1947, five price increases raised it from 29.58 to 34.53 cents a pound.

SECONDARY COPPER AND BRASS

The recovery of secondary copper from scrap totaled 961,741 short tons valued at $402,007,738 in 1947, an increase of 20 percent in quantity over the 803,546 short tons valued at $231,421,248 recovered in 1946. Value was computed at 14.4 cents a pound in 1946 and 20.9 cents a pound in 1947, the average prices of deliveries of refined copper at New York in the 2 years, exclusive of bonus payments under the Premium Price Plan.

Of the total recovered in 1947, 503,376 tons were from old scrap. Reclamation of metal from old scrap may be considered an addition to the Nation's pool of copper in use. The total amount of copper supplied by the Nation in 1947, including the 1,159,970 tons produced by refineries from domestic and foreign primary materials, may therefore be considered to be 1,663,346 tons. New scrap, from which the balance of the 961,741 tons of secondary recovery came, is process or byproduct material, and recovery from it is not recorded unless it has been purchased or transferred from the plant of origin. However, recovery from worn-out equipment is counted, whether or not the scrap was purchased. An example of such material is worn-out railroad-car bearings, which are remade in railroad foundries or converted by bearing companies on a toll basis. Recovery of copper from both old and new scrap was greater in 1947 than in 1946; but the increase in recovery from old scrap was 96,923 tons, whereas the increase from new scrap was 61,272 tons.

All but 1 or 2 percent of all the secondary copper recovered comes from brass and copper scrap, and nearly as high a percentage of the recovered metal is returned to industry as brass or unalloyed copper. The rest is recovered in chemical compounds and in aluminum-base or other alloys. In 1947 the quantity of unalloyed copper recovered from scrap was 121 percent greater than in 1946, but the quantity of copper recovered in brass and bronze was 2 percent less. The increase was caused by increased production of secondary refined copper. The continued record peacetime demand for refined metal was the strongest factor in the copper market and had marked influence on the secondary copper and brass industry in 1947. During 1947, 275,415 tons of refined copper of electrolytic grade were produced from scrap, a gain of 147 percent over the 111,613 tons produced from this source in 1946.

The figures for recoverable copper content of scrap in the following table were obtained by multiplying the weights of each of the numerous types of scrap consumed—such as No. 1 copper wire, monel clippings, and zinc die castings—by appropriate percentages which consider melting loss and copper content. The entries for secondary copper recovered, in the left side of the table, are compiled, in the case of most items, from individual company reports. Inasmuch as the copper recovered in brass ingot is not shown on the brass-ingot schedules, however, the quantity for this class must be calculated in the same manner as those for recoverable copper contents, that is, by means of recovery factors and scrap consumption. The quantity of copper recoverable from scrap is obviously the same as the quantity recovered; but, as the two figures are calculated by different methods, the results are slightly different. In tables of the type under discussion an adjustment is made in one of the larger items to make the two totals equal.

Secondary copper recovered in the United States, 1946–47, in short tons

Secondary copper recovered: Form of recovery	1946	1947
As unalloyed copper:		
At primary plants	105,572	269,085
At other plants	31,337	34,007
	136,909	303,092
In brass and bronze	630,588	619,576
In alloy iron and steel	1,932	2,830
In aluminum alloys	14,434	16,962
In other alloys	491	443
In chemical compounds	19,192	18,838
	666,637	658,649
	803,546	961,741

Recoverable copper content of scrap: Kind of scrap processed	1946	1947
New scrap:		
Copper-base	388,291	449,900
Aluminum-base	8,123	7,426
Nickel-base	678	1,037
Zinc-base	1	2
	397,093	458,365
Old scrap:		
Copper-base	401,791	495,789
Aluminum-base	3,664	6,686
Nickel-base	789	789
Lead-base	104	21
Tin-base	104	90
Zinc-base	1	1
	406,453	503,376
	803,546	961,741

Output of brass ingot, continuing the declining trend from the 518,261 tons gross weight produced in 1944, decreased to 284,868 tons in 1947. The ingot makers sell their product to the foundries; therefore, their prosperity depends upon the demand for brass and bronze castings. This demand fluctuated in 1947, but the price for refined copper remained firm, stabilizing the activities of refineries. The principal scrap items the ingot makers consume are composition, yellow brass, and unalloyed copper. Composition scrap has too much lead in it to be attractive to the brass mills and too much tin for the primary producers. The ingot makers have to compete with the latter group for the unalloyed scrap and with the former for yellow brass that is segregated and comes from wrought-brass or rod-brass products. Brass mills are not interested in unsegregated or casting scrap. Lack of orders from the foundries caused operations of brass-ingot makers to slacken continuously during the first 7 months of 1947, after which there was some improvement; production in December was 25,631 tons, compared with 16,393 tons in July. In all of 1946 the trend had been irregularly upward. In addition to using most of the output of the brass-ingot makers in 1947, the foundries recovered 110,624 tons of secondary copper from scrap in brass and bronze castings.

Analysis and production of secondary copper and copper-alloy products in the United States, 1946–47

Item produced from scrap	Approximate analysis (percent)						Gross weight produced (short tons)	
	Cu	Sn	Pb	Zn	Ni	Al	1946	1947
Refined copper (electrolytic grade)	100	----	----	----	----	----	111,613	275,415
Casting copper	99	----	----	----	----	----	4,839	3,919
Copper sheet, rod, tubing, etc	99	----	----	----	----	----	17,171	20,346
Copper powder	98	----	----	----	----	----	2,982	2,991
Copper castings	98	----	----	----	----	----	304	421
Total unalloyed copper products	----	----	----	----	----	----	136,909	303,092
Brass and bronze ingots:								
Tin bronze	88	10	----	2	----	----	20,290	19,391
Leaded-tin bronze	88	6	1.5	4.5	----	----	21,703	16,253
Leaded red brass	85	5	5	5	----	----	145,999	113,508
Leaded semired brass	81	3	7	9	----	----	54,788	46,522
High-leaded-tin bronze	80	10	10	----	----	----	28,651	22,215
Do	84	6	8	2	----	----	10,393	8,074
Do	75	5	20	----	----	----	6,674	8,109
Leaded yellow brass	66	1	3	30	----	----	24,209	20,912
Manganese bronze	62	----	----	27	----	5	9,802	13,017
Aluminum bronze	89	----	----	----	----	10	2,328	1,674
Nickel silver	58	2	7	18	14	----	4,923	4,800
Do	65	4	3	5	22	----		
Low brass	80	----	----	20	----	----	2,304	1,960
Silicon bronze	92	----	----	4	----	----	2,719	2,141
Conductor bronze	94	2	2	2	----	----	867	831
Hardeners and special alloys	81	----	----	----	----	----	10,591	5,461
Total copper-alloy ingots							346,241	284,868
Brass mill billets made by ingot makers							4,241	3,329
Brass and bronze sheet, rod, tubing, etc							[1] 389,587	[1] 383,789
Brass and bronze castings							[2] 129,102	[2] 139,880
Brass powder							803	1,425
Copper in chemical products (content)							19,192	19,838

[1] Gross weight of secondary brass and bronze in commercial shapes. Incudes 266,859 tons of copper, 1,749 tons of nickel, 3,786 tons of lead, 381 tons of tin, 116,743 tons of zinc, and 69 tons of aluminum in 1946; and 269,408 tons of copper; 2,702 tons of nickel, 3,483 tons of lead, 276 tons of tin, 107,795 tons of zinc, and 125 tons of aluminum in 1947.

[2] Gross weight of secondary metal in brass and bronze castings. Includes 99,959 tons of copper, 112 tons of nickel, 15,415 tons of lead, 6,459 tons of tin, 7,022 tons of zinc, and 135 tons of aluminum in 1946; and 110,624 tons of copper, 95 tons of nickel, 14,228 tons of lead, 5,676 tons of tin, 9,216 tons of zinc, and 41 tons of aluminum in 1947.

The brass mills produced 383,789 tons of brass and bronze sheet, rod, and tubing from scrap in 1947 compared with 389,587 tons in 1946, and 20,346 tons compared with 17,171 tons of copper products from unalloyed copper scrap. With the wire mills, brass mills are the chief consumers of refined copper and are large users of refined zinc; they also rely on wrought- and rod-brass scrap as auxiliary sources of raw material. Scrap used by brass mills must be cleaner and more carefully segregated than that used by ingot makers. Some types of rod brass made by brass mills may contain as much as 3 percent lead, but the presence of the heavy metal in sheet brass weakens it and causes soft spots. In addition to consuming 391,187 tons of copper-base scrap, the brass mills used 648,759 tons of refined copper in 1947. Two-thirds of the scrap was new yellow-brass clippings from fabricating plants.

Wire mills do not use scrap but in 1947 consumed 768,889 tons of refined copper, of which 748,654 tons were wire bars. Their increase of 264,650 tons in consumption of wire bars over the 484,004 tons used in 1946 is evidence of the greatly increased activity in the communication industries.

The relation of the fabricators of wrought-brass products to the brass mills is the same as that of the brass foundries to the ingot makers. In the latter part of April there were indications that orders from fabricators for sheet brass and rod brass were beginning to decrease. In a letter addressed to company employees, Herman W. Steinkraus, president of Bridgeport Brass Co., assigned this decline to high prices of copper and zinc, causing manufacturers to use aluminum and steel instead of brass.[2] Brass-mill production from scrap declined from 116,000 tons in the first quarter to 104,000 in the second and 69,000 in the third but increased to 94,000 tons in the last 3 months of 1947.

Copper-base scrap consumption by all consumers totaled 1,473,896 tons in 1947, or 304,756 tons more than in 1946. The chief factor in the rise was the increased use of unalloyed and low-grade scrap by the primary producers. The brass mills also increased their consumption of unalloyed scrap but their treatment of new yellow-brass clippings declined 8 percent. The foundries increased their consumption of copper-base scrap 8 percent. The total amounts used by the brass mills and ingot makers, however, declined.

Consumption of purchased copper scrap in the United States in 1947, 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	56,893	40,039	12,606	986	2,521	18,072	131,117
No. 2 wire, mixed heavy, and light	60,104	103,035	21,942	2,559	2,985	7,580	198,205
Composition or red brass	41,610	52,402			19,349	24,578	137,939
Railroad-car boxes		309				59,554	59,863
Yellow brass	16,503	45,816	261,816	1,833	4,922	12,584	343,474
Cartridge cases	46	6,133	660	53,727		99	60,665
Auto radiators (unsweated)		28,696					28,696
Electrotype shells		2,023					2,023
Bronze	4,764	23,657	856	20	2,191	12,582	44,070
Nickel silver	798	2,517	13,691	286	81	9	17,382
Low brass	2,539	467	19,971	225	361	1,615	25,178
Aluminum bronze	112	505	9		49	135	810
Low-grade scrap and residues	118,848	303,791			198	1,637	424,474
	302,217	609,390	331,551	59,636	32,657	138,445	1,473,896

[2] American Metal Market, vol. 54, No. 83, Apr. 30, 1947, p. 2.

The primary producers treat principally blister copper produced from ore and concentrates. They also, however, consume copper bearing residues, refinery brass, unalloyed copper scrap, and blister produced from scrap. They consumed a total of 543,132 tons of copper-base scrap in 1947 compared with 368,475 tons used by the secondary smelters. Much of the scrap used by primary refiners was low-grade material. The furnace heats in a primary plant are so high that usually only the copper is recovered except where zinc and other metal can be extracted from the flue dust. In both 1946 and 1947 primary producers consumed large quantities of battlefield shell cases on foreign account in addition to their normal use of domestic scrap. Of the 275,415 tons of refined copper produced from scrap in 1947, 269,085 tons came from primary plants.

The primary plants are usually integrated with mines, brass and wire mills, and manufacturers of finished copper products and the organizations are so large that their operations are not seriously affected by minor market and business fluctuations. During 1947 their influence was exerted to keep the price of copper from soaring to a point where its competitive position with other metals would be weakened when supply and demand became equalized.

Data on transactions of scrap-metal dealers are available for the first quarter of 1947 only, because the dealer survey begun on a monthly basis in 1942 was discontinued March 31, 1947. Dealers shipped copper and brass scrap to consumers in the first 3 months of the year at an average of 58,389 tons a month compared with an average of 42,208 tons for 1946, but the 1947 average was probably not maintained after the first quarter of the year. Dealer transactions were probably larger in 1947 than in 1946 because scrap consumption—particularly old scrap consumption—increased. A large proportion of the new scrap used is segregated process scrap returned to consumers by generators without passing through the hands of dealers, but much of the old scrap used is first sorted and cleaned or concentrated by the dealers before being passed on to consumers.

On June 25 the War Department announced that it had limited quantities of copper-base scrap for sale and, in compliance with amendment 2 to WAA Regulation 17, would be guided by recommendations of the Office of Materials Distribution, United States Department of Commerce, as to the buyers and quantities. These recommendations had the effect of channeling cartridge brass and gilding metal material to brass mills, wire mills, smelters, and refiners.

Consumers' stocks of copper-base alloy scrap and low-grade scrap increased in 1947, but their unalloyed scrap inventories decreased. Most of the unalloyed stocks were held by the secondary smelters and most of the low-grade by the refiners, but the brass mills were the chief repositories of the alloy scrap.

Consumers' stocks of purchased copper-base scrap in the United States at end of year, 1946–47, gross weight in short tons

Scrap item	On hand—	
	Dec. 31, 1946	Dec. 31, 1947
Unalloyed copper	23,034	15,830
Copper-base alloy	62,622	72,780
Low-grade scrap and residues	38,813	66,936
	124,469	155,546

There were substantial increases in the prices of nonferrous metals following removal of price ceilings on November 10, 1946; and these increases were reflected in higher prices for copper and brass scrap, as well as for brass ingot and other products made from the scrap, in 1947 as compared with 1946. Dealers' buying prices for No. 1 Heavy copper scrap opened in 1947 at 15.75 cents a pound, increased to 16.75 cents in April, dipped to 15.34 cents in July, and ended the year at 16.73 cents, the average for the 12 months being 16.16 cents. The price of composition scrap—the type most used by ingot makers—at the beginning of the year was 14.25 cents, it remained above 14 cents through April, then declined, the low point for the year being reached at 11.01 cents in October. The price at the end of 1947 was 12.25 cents and the average for the year 12.67 cents, or 2.56 cents higher than the average for 1946.

Other restrictions on transactions in copper and brass scrap, which had remained in effect after price ceilings were lifted, were removed at the end of the first quarter of 1947, including amended Direction 22 to Priorities Regulation 13, which provided for the allocation of cartridge brass ingot, fired cartridge cases, and gilding metal forms from Army, Navy, and Maritime Commission sources by CPA, instead of having the material declared surplus to the WAA and distributed by that agency. Another order rescinded at this time was Direction 11 to PR 32, which placed certain restrictions on receipts of copper-base scrap by dealers.

Brass and copper scrap imported into and exported from the United States, 1943–47, in short tons

	1943	1944	1945	1946	1947
Imports:[1]					
Brass scrap	9,102	6,226	7,727	24,008	112,393
Scrap copper	3,002	1,055	1,348	1,030	5,957
Exports:					
Brass scrap	6	38	421	1,184	3,157
Scrap copper	(2)	99	133	909	969

[1] Data include scrap copper imported for consumption but exclude material entering the country under bond.
[2] Less than 1 ton.

SECONDARY LEAD

Operations in the secondary lead industry in 1947 reached the highest level ever recorded, with recovery of 511,970 short tons of lead valued at $146,423,420 compared with 392,787 tons valued at $65,988,216, reclaimed in 1946, a quantitative gain of 30 percent. Values were computed at 14.3 cents a pound in 1947 and 8.4 cents a pound in 1946, the average selling prices of all grades of primary lead exclusive of premium price payments. For the third successive year recovery of lead from scrap exceeded the production of refined primary lead from domestic ores and base bullion and for the second successive year exceeded domestic mine production.

Secondary lead recovered in the United States, 1946–47, in short tons

Secondary lead recovered			Recoverable lead content of scrap		
Form of recovery	1946	1947	Kind of scrap processed	1946	1947
As metal:			New scrap:		
At primary plants	8,013	15,662	Lead-base	40,625	60,277
At other plants	65,691	95,843	Copper-base	7,619	7,115
	73,704	111,505		48,244	67,392
In antimonial lead [1]	193,684	265,935	Old scrap:		
In other lead alloys	94,653	103,799	Battery-lead plates	215,657	273,952
In copper-base alloys	30,101	30,137	All other lead-base	111,787	151,111
In tin-base alloys	645	594	Copper-base	17,074	19,494
			Tin-base	25	21
	319,083	400,465		344,543	444,578
	392,787	511,970		392,787	511,970

[1] Includes 33,850 tons of lead recovered in antimonial lead from secondary sources at primary plants in 1946 and 56,456 tons in 1947.

Production of soft lead from scrap increased from 76,150 tons in 1946 to 112,664 tons in 1947, a gain of 48 percent. The secondary lead content of antimonial lead produced increased 37 percent, from 193,684 to 265,935 tons. Secondary lead recovered in solder increased substantially for the second year, advancing from 24,918 tons in 1946 to 35,881 tons in 1947. Production of type metals, however, declined, the secondary content decreasing from 36,725 to 33,330 tons. Total production of the secondary lead industry increased considerably; but the increase came entirely from greater use of scrap, for reporting companies revealed a 23-percent decrease in the use of primary metal, continuing for the third successive year a declining use of primary metals in secondary lead products.

Shipments [1] of secondary lead, tin, and lead- and tin-alloy products in the United States in 1947, gross weight in short tons

	Gross weight of product [2]	Secondary metal content			
		Lead	Tin	Antimony	Copper
Refined pig lead	107,017	107,017			
Remelt lead	4,634	3,977			
Lead foil	1,013	511			
	112,664	111,505			
Refined pig tin	3,167		3,167		
Remelt tin	147		122		
Tin foil					
	3,314		3,289		
Lead and tin alloys:					
Antimonial lead	293,811	265,935	334	16,638	27
Common babbitt	39,535	30,374	1,511	2,390	29
Genuine babbitt	2,825	206	613	119	55
Other tin babbitts	1,541	388	235	59	14
Solder	68,025	35,881	6,315	357	6
Type metals	41,280	33,330	2,009	3,313	3
Miscellaneous lead-tin alloys	7,114	4,003	189	58	
	454,131	370,117	11,206	22,934	134
Composition foil	453	211	63	50	
Tin content of chemical products	545		545		
	571,107	481,833	15,103	22,984	134

[1] 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 products and secondary metal content represents added primary metals or impurity content.

As in previous years, antimonial lead was the principal product of secondary lead smelters, comprising 51 percent of the total output in 1947. This was to be expected because battery lead plates, which contain an average of 4.5 percent recoverable antimony, constituted 61 percent of the scrap consumed by secondary plants during the year. However, refined lead can be produced at secondary plants as practicably as at primary smelters. When refined lead is produced from antimonial lead scrap, the process is called softening. The antimony rises to the top of the melt and is removed as a high-antimony lead dross which can be used to provide the antimony content of products such as type metals and babbitt, as well as battery lead plates.

As it is possible to produce refined lead at secondary as well as primary plants, the two types of plants are competitors in the same market, and any change in the scale of operations of one group is apt to be reflected in the activities of the other. Production at secondary lead smelters decreased steadily for 4 months in 1947 beginning in May and ending in August. Plant shut-downs for repairs and vacations occurred at this time, but business conditions also contributed to the decrease. Several authorities expressed the opinion that supply and demand for lead had reached a state of equilibrium. Nevertheless, output of secondary lead products reached the highest level of the year in the last quarter. Secondary recovery of lead could drop back from the high 1947 rate to a more normal figure in 1948 or

1949; but, in view of the limited national ore reserves and the prospective large supply of battery-lead scrap, a large decrease seemed unlikely.

Of the total secondary lead recovered, 485,361 short tons were reclaimed from lead- and tin-base scrap, whereas the remaining 26,609 tons were contained in secondary brass and bronze and reclaimed by remelting copper-base scrap. In all, 3,528 tons of lead in lead-base scrap were added to brass and bronze to bring the total recovery of secondary lead in this type of product to 30,137 tons.

Consumption of purchased lead scrap in the United States in 1947, 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		70,185	233	1,884	72,302
Hard lead		20,255		794	21,049
Cable lead		20,362		38	20,400
Battery-lead plates		411,037		51	411,088
Mixed common babbitt		9,955	331	13,935	24,221
Solder and tinny lead		9,292	1,476	197	10,965
Type metals		17,705		441	18,146
Dross and residues	93,092		19		93,111
	93,092	558,791	2,059	17,340	671,282

The quantity of lead-base scrap consumed in 1947 totaled 671,282 tons, an increase of 32 percent over 1946 and the highest quantity ever reported processed. Treatment of battery-lead plates rose 87,474 tons over the preceding year, cable lead 6,378 tons, soft lead 28,285 tons, common babbitt 5,069 tons, solder and tinny lead 2,311 tons, and drosses and residues 33,980 tons. Treatment of all grades of scrap was high through the first 6 months of the year, slumped slightly in the summer months, and attained the highest level of the year in the last quarter.

The year was comparatively free of labor-management difficulties; but despite this, and the high rate of secondary production, constantly increasing demand for lead in industrial uses could not be entirely met. Inventories of lead held by the Office of Metals Reserve were too low to be of great help, but they were reduced during the year from 45,493 tons at the end of 1946 to 4,996 tons on December 31, 1947.

Percentage metals circulated in pig form among remelters, smelters, and refiners in 1947 totaled 62,670 short tons, consisting of 5,412 tons of solder, 5,100 tons of lead-base babbitt, 17,569 tons of soft lead, 32,245 tons of antimonial lead, 2,058 tons of type metals, 205 tons of cable lead, 18 tons of tinny lead, 61 tons of remelt tin, and 2 tons of pewter.

The high rate of consumption throughout most of the year, together with insufficient supplies, forced smelters' stocks of lead scrap downward during the last 10 months. Stocks rose from 94,929 tons on January 1, to 101,277 tons on February 28 and thereafter declined consistently each month to a total of 56,929 tons on December 31. The reduction was evident in drosses and residues as well as in battery-lead plates and solid metal scrap. Smelters' stocks of secondary pig, bar, and ingot also dropped during the year, from 27,782 to 22,591 tons.

Lead scrap consumed is predominantly old scrap, the new scrap consisting largely of dross and residues which makes up only 10 to 15 percent of the total used. This percentage increases when the smelters increase their softening operations. Such plant-scrap items as lead clippings, borings, and turnings are virtually nonexistent.

In 1947, 86 percent of the lead scrap used was old scrap and, of the old scrap, battery-lead plates made up 71 percent. With the number of old batteries entering the lead scrap market depending to a great extent on the number of automobiles in use, a good supply of battery-lead plate scrap seemed assured for an indefinite period.

Consumers' stocks of purchased lead-base scrap in the United States at end of year, 1946–47, gross weight in short tons

Scrap item	On hand—	
	Dec. 31, 1946	Dec. 31, 1947
Unalloyed lead	4,043	2,878
Lead-base alloy	57,679	33,388
Drosses and residues	33,207	20,663
	94,929	56,929

After price controls on lead were lifted in November 1946, the price increased to 10.50 cents a pound and toward the end of the year increased again to 12.55 cents a pound, the highest price on record. However, on January 7, 1947, the quotation was established at 13 cents; near the end of February another increase raised the price to 14.00 cents; and on March 3 the price advanced again, this time to 15.00 cents. A closer relationship in the demand-supply situation with a lower price for lead in the last quarter was freely predicted during the summer but did not materialize, and the 15-cent price continued throughout the remainder of the year. With each price rise for primary metal, scrap and secondary prices were adjusted accordingly. Scrap-metal dealers' prices for heavy-lead scrap at New York averaged 11.44 cents a pound in the first month of 1947, rose to 12.50 cents in April, then declined to a low of 10.84 cents in July and increased to 12.00 cents in December, the average price for the year being 11.72 cents. The prices paid by dealers for old battery-lead plates followed a parallel course to those for heavy-lead scrap, opening the year at 6.00 cents a pound, rising to 7.75 cents in April, falling to 6.00 cents in July, and closing in December at 7.00 cents.

Smelter and dealer inventory control of scrap lead remained under Civilian Production Administration surveillance through March 1947, at which time all control was revoked and an entirely free market reestablished. In January, CPA lifted restrictions on the sale of WAA surplus battery lead scrap, antimonial lead, and solder. Formerly such surplus material had been sold to smelters and refiners only, because under CPA restrictions most of it needed reprocessing.

Imports of lead scrap increased from 3,959 tons (revised, lead content) to 18,155 tons (lead content) in 1947.

SECONDARY MAGNESIUM

Secondary magnesium (including alloying ingredients) recovered from scrap in 1947 totaled 9,503 short tons valued at $3,896,230 compared with 5,117 short tons in 1946 valued at $2,097,970. Values were calculated for both years at 20.50 cents a pound—the price of magnesium since January 1943. Primary production in 1947 was 12,344 tons; but only 7,008 tons of this was consumed, the rest being stocked for lack of a market, whereas a high percentage of the magnesium recovered from scrap was consumed in castings or otherwise.

The percentage of secondary magnesium reclaimed from old scrap increased from 24 percent of the total in 1946 to 48 percent of the total in 1947, because more of the magnesium scrap castings consumed were old—71 percent compared with 26 percent in 1946. The increased recovery of secondary magnesium from old aluminum-base scrap was caused by the increase in aircraft-scrap consumption from 104,945 tons in 1946 to 149,141 tons in 1947. This scrap contained about 1 percent of recoverable magnesium. It was used by secondary smelters to make aluminum ingot, which accounts for the increase in secondary magnesium recovered in aluminum alloys from 1,218 tons in 1946 to 1,883 tons in 1947. The increased recovery of magnesium from new scrap in 1947, although not as great as from old scrap, was substantial and amounted to 1,000 tons or 26 percent.

Secondary magnesium recovered in the United States, 1946–47, in short tons

Secondary magnesium recovered		
Form of recovery	1946	1947
Magnesium-alloy ingot [1] (gross weight)	2,506	5,138
Magnesium-alloy castings (gross weight)	1,145	1,377
Magnesium-alloy shapes	136	85
In aluminum alloys	1,218	1,883
In zinc alloys	4	3
In other alloys	2	
Chemical and incendiary uses	106	199
Cathodic protection		818
	5,117	9,503

Recoverable magnesium-alloy content of scrap		
Kind of scrap processed	1946	1947
New scrap: Magnesium-base	3,907	4,907
	3,907	4,907
Old scrap:		
Magnesium-base	632	3,622
Aluminum-base	578	974
	1,210	4,596
	5,117	9,503

[1] Figures include secondary magnesium incorporated in primary magnesium ingot.

Secondary smelters produced 3,933 tons of secondary magnesium alloy ingot in 1947 compared with 2,063 tons in 1946 and disposed of all of it except 178 tons, the net increase in their inventories. The remaining 1,205 tons of the 5,138 tons of secondary magnesium recovered in magnesium-alloy ingot was incorporated in primary magnesium ingot.

A growing use for magnesium is to protect other metals against galvanic corrosion. For example, a magnesium bar, placed near a pipe line and connected to it by a copper wire, acts as an anode, being preferentially corroded by the circulating ground water. Engineers of the Dow Chemical Co.[3] explain the theory of cathodic protection in

[3] Cathodic Protection of Pipelines: Chemical and Engineering News, vol. 23, No. 11, June 10, 1945, pp. 984, 1051.

this way: Corrosion of metal surfaces in the presence of moisture is chiefly electrolytic. This corrosive attack may be greatly reduced or prevented by using an expendable and replaceable anode which, connected to the pipe, reduces the rate of solution of its anodic areas. A variation of this use is the installation of magnesium anodes in steel hot-water tanks; the magnesium dissolves before the steel and can be replaced when necessary. Of the secondary magnesium recovered in 1947, 818 tons was used for these purposes, whereas in previous years the quantity thus reported was insufficient to warrant a separate item in the recovery table.

Consumption of cast magnesium scrap was 113 percent higher in 1947 than in 1946 and that of solid wrought scrap 148 percent higher. In contrast, the quantity of borings, grindings, drosses, etc., treated decreased 40 percent. Borings, grindings, and other magnesium fines are not popular types of scrap because of the fire hazard involved in storing them.

Stocks and consumption of magnesium scrap in the United States in 1947, gross weight in short tons

Scrap item	On hand—		Consumption during 1947
	Dec. 31, 1946	Dec. 31, 1947	
Cast scrap	3,350	3,659	5,545
Solid wrought scrap	1,598	638	3,131
Borings, grindings, drosses, etc	292	300	744
	5,240	4,597	9,420

Dealers' buying prices for magnesium scrap were not normally listed in the trade journals in 1947, but considerable quantities of segregated cast scrap were purchased at 10 to 12 cents a pound by one large user and of unsegregated solids at 6 cents a pound by another. The price of remelt magnesium ingot, which had risen during 1946 from 15.75 cents to 18 to 18.50 cents a pound (carload lots), remained at 18 to 18.50 cents throughout 1947. The lower prices in the first part of 1946 were caused by the presence in the market of large quantities of contract termination scrap and ingot, and stocks of magnesium in various forms held by several Government agencies. Consumption of the light metal for military purposes had been sharply curtailed; and civilian use had not taken its place, as had been the case with aluminum. Much of the surplus scrap-magnesium stocks were still in the hands of Government agencies in 1947. The army in particular had a large supply of magnesium incendiary bomb bodies which were rendered obsolete with the ending of the war and which needed processing to make them safe for storage. By the end of 1947 these and other Government stocks of magnesium scrap were being transferred to the national strategic stock pile.

Although magnesium was consumed in much smaller quantities in 1947 than any of the four major nonferrous metals, it has qualities that may make it more of a competitor in future. Reserves of magnesium in sea water, which is the only raw material from which the primary metal is at present being extracted, are unlimited. Magnesium is lighter than any other common metal. Disadvantages are its strong chemical reactivity and comparatively weak physical characteristics. The future of the metal appears to lie in the possibilities of finding suitable alloying ingredients and metallurgical treatment that will provide strength and resistance to chemical action.

SECONDARY NICKEL

The recovery of secondary nickel from nonferrous scrap in 1947 totaled 9,541 short tons, valued at $7,188,189, an increase of 16 percent over the 8,248 tons valued at $5,801,643 recovered in 1946. The total value was calculated at 37.67 cents a pound in 1947 and 35.17 cents in 1946, the average spot-delivery prices for electrolytic nickel in the two years. The increased recovery in 1947 was due to increased secondary nickel content in brass mill products, in monel metal ingot and brass ingot, and in secondary nickel recovered as a constituent of iron and steel castings and of sheet steel (including stainless steel). Only the nickel recovered from nonferrous scrap was recorded. The nickel contained in the steel or iron scrap consumed was not measured.

Secondary nickel (nonferrous) recovered in the United States, 1946–47, in short tons

Secondary nickel recovered		
Form of recovery	1946	1947
As metal	299	121
In nickel-base alloys	906	2,000
In copper-base alloys	3,039	3,262
In aluminum-base alloys	916	537
In lead-base alloys	12	13
In cast iron and steel [1]	1,225	1,843
In chemical compounds	1,851	1,765
	8,248	9,541

Recoverable nickel content of scrap		
Kind of scrap processed	1946	1947
New scrap:		
Nickel-base	3,190	3,750
Copper-base	1,727	2,447
Aluminum-base	666	537
	5,583	6,734
Old scrap:		
Nickel-base	1,911	1,949
Copper-base	496	433
Aluminum-base	250	418
Lead-base	8	7
	2,665	2,807
	8,248	9,541

[1] Includes only nonferrous nickel scrap added to cast iron and steel.

The production of secondary monel metal pig, shot, and castings—which more than doubled in 1946—again showed a substantial gain in 1947 when 1,922 tons were produced compared with 1,191 in 1946. Output of copper-nickel pig and shot declined from 350 tons averaging 51 percent nickel in 1946 to 279 tons in 1947, but the nickel content in the latter year was 55 percent. Recovery of nickel from scrap in all nickel-base alloys, mostly monel metal, increased from 906 tons in 1946 to 2,000 tons in 1947 and in iron and steel from 1,225 tons in 1946 to 1,843 tons in 1947. Recovery in copper-base alloys increased moderately. Recovery of secondary nickel in the other items listed in the table except lead-base alloys, and including chemical compounds, aluminum-base alloys, and unalloyed nickel, decreased, but the total decrease in all these items together was only 642 tons.

Consumption of nickel scrap totaled 27,001 tons in 1947 compared with 23,192 tons in 1946, and all items except residues participated in the general increase. The largest item—nickel silver—had the biggest increase, 3,592 tons or 26 percent. This scrap contains about 64 percent copper, 19 percent zinc, and 17 percent nickel. Containing more copper than anything else, it is copper-base scrap, and is shown in the nickel-scrap consumption table only because it is such an important source of secondary nickel. It also appears in the copper-scrap consumption table and to that extent the copper- and nickel-scrap figures are duplicated. However, there is no duplication in the recovery tables.

Consumption of purchased nickel scrap in the United States in 1947, 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	239	68	1,159	255	1,721
Monel metal	501	1,859	2,412	440	5,212
Nickel silver	798	2,517	13,772	295	17,382
Miscellaneous nickel alloys	36			1	37
Nickel residues	222		2,033	394	2,649
	1,796	4,444	19,376	1,385	27,001

The United States has no nickel mines and only a few hundred tons of primary production annually, as a byproduct of copper refining. The chief domestic source of nickel is the secondary metal, but most of the nickel used in this country comes from foreign sources. The spot-delivery price of Grade F nickel ingots and shot in 10,000-pound lots at New York remained at 37.67 cents a pound throughout 1947, but prices of scrap had trended downward. Dealers' buying prices in New York were quoted at 20.50 cents a pound for nickel sheet and clips and 15 cents a pound for monel clips for the first 5 months of the year. In June they declined to 19 and 14 cents, respectively, and decreased again on September 1 to 17 and 12.50 cents, where they remained for the rest of the year.

No imports of nickel-bearing scrap were reported in 1946 or 1947, but exports in 1947 totaled 8,424 short tons compared with 5,597 tons in 1946 and 2,287 tons in 1945.

Consumers' stocks of purchased nonferrous nickel scrap [1] in the United States at end of year, 1946–47, gross weight in short tons

Scrap item	On hand—	
	Dec. 31, 1946	Dec. 31, 1947
Unalloyed nickel	225	488
Nonferrous nickel alloys	3,055	3,233
Nickel residues	1,911	2,032
	5,191	5,753

[1] Includes nickel-silver scrap.

SECONDARY TIN

Recovery of secondary tin from scrap in 1947 gained 9 percent to total 30,054 short tons valued at $46,848,175 compared with 27,671 tons valued at $30,205,663 in 1946. Values were computed at an average price of 52 cents in 1946 and 77.94 cents in 1947.

Detinning plants produced 3,046 short tons of pig tin from old tin cans and new tin-plate clippings and 98 tons from tin-base scrap. Recovery as metal at secondary smelters was 145 tons, making a total recovery of 3,289 tons of unalloyed tin from scrap, a 12-percent gain over 1946. Recovery in lead-base alloys and in tin babbitt decreased, but recovery in solder gained 27 percent and also increased in chemical compounds and in brass and bronze. Shipments of secondary tin and lead-tin alloys are presented in a table in the Lead section of this chapter.

Secondary tin recovered in the United States, 1946–47, in short tons

Secondary tin recovered			Recoverable tin content of scrap		
Form of recovery	1946	1947	Kind of scrap processed	1946	1947
As metal:			New scrap:		
At detinning plants	2,779	3,144	Tin plate	2,884	3,313
At other plants	159	145	Tin-base	1,580	2,356
			Lead-base	2,280	2,122
	2,938	3,289	Copper-base	3,375	3,264
In solder	4,975	6,315		10,119	11,055
In tin babbitt	981	848			
In chemical compounds	404	545	Old scrap:		
In lead-base alloys	4,146	4,106	Tin cans	260	134
In brass and bronze	14,227	14,951	Tin-base	3,101	2,887
			Lead-base	4,239	5,318
	24,733	26,765	Copper-base	9,952	10,660
	27,671	30,054		17,552	18,999
				27,671	30,054

Consumption of tin-base scrap increased 19 percent over 1946, but the increase came almost entirely from greater use of residues and drosses. Slightly more block-tin pipe and pewter scrap were consumed, but use of high-tin babbitt dropped 17 percent. From lead-bearing scrap, two companies produced 64 tons of tin in chemical residues which were later reduced to pig tin at detinning plants.

Consumption of purchased tin scrap in the United States in 1947, 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		847	6	101	954
Tin scruff and dross	3,256				3,256
No. 1 pewter		128		1	129
High-tin babbitt		2,138		61	2,199
Residues	882		1		883
	4,138	3,113	7	163	7,421

The supply of tin in 1947 was not considered to allow uncontrolled use; consequently, War Production Board General Preference Order M-43, which restricted uses of tin and provided for allocation, was continued, as was Government import purchase of nearly all tin entered from abroad. Secondary tin and tin-bearing alloys had been brought under the order in 1946 and remained so throughout 1947. On August 5 the Office of Material Distribution amended the order, removing restrictions on the tin content of solder for specified refrigeration and motor uses and permitting production and unlimited use of tin tetrachloride from low-grade drosses and scrap metal.

Consumers' stocks of purchased tin-base scrap in the United States at end of year, 1946-47, gross weight in short tons

Scrap item	On hand	
	Dec. 31, 1946	Dec. 31, 1947
Unalloyed tin	86	145
Tin-base alloys	299	445
Drosses and residues	1,414	467
	1,799	1,057

Smelters' stocks of tin-base scrap dropped 41 percent in 1947, entirely in drosses and residues. Unalloyed tin and tin-base alloy inventories gained 69 and 49 percent, respectively. Price rises for primary tin directly affected the price of scrap block-tin pipe and tin-bearing alloys. Dealers' buying price on block-tin-pipe scrap was 61 cents during the first 3 months, advanced to 66.91 in April, rose again to 67.50 cents the following month, and remained there until December, when it increased to 70.23 cents a pound, each rise following an increase in the price of primary tin.

Detinning Plants.—Seven detinning plants reported operations in 1947: Johnson & Jennings Co., Cleveland, Ohio; Metal & Thermit Corp., South San Francisco, Calif., East Chicago, Ind., and Carteret, N. J.; Standard Metal Refining Co., Baltimore, Md.; and the Vulcan Detinning Co., Sewaren, N. J., and Neville Island, Pittsburgh, Pa.

The recovery of secondary tin at detinning plants, as metal and in chemical compounds, gained 10 percent in 1947 over that in 1946. Thus, the declining trend in detinner operations that had been evident since 1942 despite the wartime salvage program of old tin cans, was arrested by the increasing quantity of new tin-plate clippings available for treatment. Recovery of tin from new clippings and old tin-coated containers totaled 3,447 short tons in 1947, compared with 3,144 tons in 1946 and 3,981 tons in 1945. Of the 3,447 short tons of tin recovered, 3,046 tons were reclaimed as metal in the form of pigs and anodes, and 401 tons in the form of tin compounds.

All of the gain was in tin recovered from new clippings, which increased from 2,884 tons in 1946 to 3,313 tons in 1947, or 15 percent. Tin recovered from old cans dropped from 260 tons in 1946 to 134 tons in 1947, a loss of 48 percent. A total of 320,907 long tons of clean tinplate clippings was made available to detinners last year, compared with 249,813 tons in 1946; but the quantity of old cans treated declined to only 16,741 tons in 1947, compared with 28,434 tons in the preceding year and a peak use of 175,870 tons in 1943.

Secondary tin recovered at detinning plants in the United States, 1946–47

	1946	1947
Scrap treated:		
Clean tin plate .... long tons..	249,813	320,907
Old tin-coated containers .... do....	28,434	16,741
	278,247	337,648
Tin recovered from new tin-plate clippings .... short tons..	2,884	3,313
Tin recovered from old tin-coated containers .... do....	260	134
	3,144	3,447
Tin recovered as metal .... short tons..	[1] 2,772	[1] 3,046
Tin recovered in compounds .... do....	372	401
	[2] 3,144	[2] 3,447
Weight of tin compounds produced .... short tons..	757	780
Average quantity of tin recovered per long ton of clean tin-plate scrap used, pounds..	23.09	20 65
Average quantity of tin recovered per long ton of old tin-coated containers used .... pounds..	18.33	16.02
Average delivered cost of clean tin-plate scrap .... per long ton..	$14,37	$29.43
Average delivered cost of old tin-coated containers .... do....	$13.98	$22.37

[1] Includes a small tonnage of pig tin of less than standard purity and, consequently, subject to further refining or alloying.
[2] Recovery from tin-plate clippings and old containers only. In addition, detinners recovered 30 tons of tin as metal and 8 tons of tin in compounds from tin-base scrap and residues in 1946, and 98 tons of tin as metal and 80 tons of tin in compounds from these sources in 1947.

The average quantity of tin recovered per long ton of clean tin-plate scrap used declined from 23.09 pounds in 1946 to 20.65 pounds in 1947; the 1947 figure indicates clearly the growing proportion of electrolytic tinplate being produced, with the consequent thinner average coating of tin on new clippings. The average quantity of tin recovered per long ton of old tin-coated containers used declined further to 16.02 pounds in 1947, compared with 18.33 pounds in the preceding year.

In addition to the tin from tin-plate clippings and old cans, detinners recovered 98 short tons of tin as metal and 80 short tons of tin in compounds from the treatment of white-metal scrap and chemical residues in 1947. The recovery from comparable operations in 1946 was 30 short tons of tin as metal and 8 tons of tin in compounds.

Imports of tin-plate scrap increased from 24,530 long tons in 1946 to 30,797 tons in 1947. Exports of terne-plate scrap, circles, waste-waste, and clippings more than doubled from 11,451 to 26,558 tons in 1947.

SECONDARY ZINC

Secondary zinc recovered in 1947 from purchased scrap and residues totaled 310,793 short tons, with a value of $66,509,702, calculated at 10.7 cents a pound—the average selling price for the year of all grades of refined zinc, not including bonuses paid by the Office of Metals Reserve under the Premium Price Plan. This total was 3 percent higher than in 1946, when 300,682 tons with a value of $53,521.396 at 8.9 cents a pound were recovered.

Secondary zinc recovered in the United States, 1946–47, in short tons

Secondary zinc recovered

Form of recovery	1946	1947
As metal:		
By distillation:		
Slab zinc	44,139	58,987
Zinc dust	25,638	27,770
By remelting	11,659	10,356
	81,436	97,113
In zinc-base alloys	9,953	10,383
In brass and bronze	163,374	146,866
In aluminum-base alloys	890	906
In chemical products:		
Zinc oxide (lead free)	11,084	18,402
Zinc sulfate	3,573	4,249
Zinc chloride	12,267	13,959
Lithopone	17,017	17,888
Miscellaneous	1,088	1,027
	219,246	213,680
	300,682	310,793

Recoverable zinc content of scrap

Kind of scrap processed	1946	1947
New scrap:		
Zinc-base	115,245	134,092
Copper-base	107,548	101,185
Aluminum-base	666	537
	223,459	235,814
Old scrap:		
Zinc-base	27,690	29,262
Copper-base	49,336	45,356
Aluminum-base	197	361
	77,223	74,979
	300,682	310,793

It may be said of secondary aluminum, copper, and lead that each is recovered chiefly from scrap, of which it is the chief constituent. A large proportion of secondary zinc, however, is reclaimed from brass scrap; in years when munition manufacture is large or when battlefield scrap is plentiful over 50 percent comes from that source. By 1947 scrap resulting from military activity had been largely consumed, so that recovery of zinc from copper-base scrap, for the first time since before the war, fell below that from zinc-base scrap.

It is also true that more zinc is recovered from both new copper-base scrap and new zinc-base scrap than from old. More zinc is reclaimed from the former because new brass scrap is apt to be segregated and goes to the brass mills which recover both its zinc and copper, whereas old brass scrap is apt to be unsegregated and a large part of it is sold as refinery brass to copper refiners who do not recover the zinc. A large percentage of zinc scrap is residue scrap which is classed as new whether resulting from consumption of primary metal or scrap. Thus the recovery of zinc from new scrap is greater than that from old.

Recovery of zinc in redistilled slab increased from 44,139 tons in 1946 to 58,987 tons in 1947, and recovery from scrap in lead-free zinc oxide was 18,402 tons or 66 percent more than in 1946. Most lead-free zinc oxide is made from ore, only 10 percent having been produced from scrap in 1946 and 12 percent in 1947. The fact that more scrap was used for this purpose in 1947 indicates that enough ore was not available. Secondary zinc reclaimed in brass and bronze declined from 163,374 tons in 1946 to 146,866 tons in 1947.

The production of secondary zinc and zinc-alloy products increased from 138,195 tons in 1946 to 165,252 tons in 1947 owing to increased output of the three major items: Redistilled slab, zinc dust, and zinc in chemical products. The 55,525 tons of zinc recovered from scrap in chemical products was only 3,462 tons less than that reclaimed in redistilled slab, the biggest item, and was three times as large as the recovery of secondary copper in chemicals.

Production of secondary zinc and zinc-alloy products in the United States, 1943–47, gross weight in short tons

Products	1943	1944	1945	1946	1947
Redistilled slab zinc	48,215	49,037	49,242	44,516	59,542
Zinc dust	22,788	23,307	23,892	26,002	28,334
Remelt spelter [1]	7,406	7,741	8,090	8,212	7,443
Remelt die-cast slab	2,641	3,760	4,727	7,829	8,595
Zinc-die and die-casting alloys	2,617	1,786	2,281	3,002	2,698
Galvanizing stock	591	594	701	876	774
Rolled zinc	909	1,737	3,054	2,729	2,341
Secondary zinc in chemical products	31,610	36,738	41,866	45,029	55,525

[1] Contains small tonnages of zinc anodes.

Zinc scrap was consumed by 22 distillers in 1947. Of these 11 made only redistilled slab, 6 made only zinc dust, and the other 5 made both slab and dust. Production of heavy zinc chemicals was carried on in 32 plants. In addition to the distillers and chemical plants, 78 secondary smelters, die casters, galvanizers, and miscellaneous remelters were covered by the monthly zinc-scrap survey, and these 132 plants accounted for over 95 percent of the total recovery of secondary zinc from zinc-base scrap by all plants, including those reporting only on an annual basis.

Zinc-base scrap consumption totaled 243,521 tons in 1947—36,645 tons more than in 1946. Monthly consumption was steadier than was the case with copper and aluminum scrap and reached record heights for 3 months in succession, the highest being 21,537 tons in May. There was no sustained decline in use of zinc scrap as there was of aluminum and copper scrap in the first half of the year. Consumption of the unalloyed metallic zinc scrap items and of die-cast and die-casting scrap (alloys of zinc with aluminum and copper) was about the same as in 1946, but consumption of the residue types of scrap increased substantially, use of skimmings, dross, and flue dust and residues totaling 86,168 tons, 57,453 tons, and 55,474 tons, respectively, in 1947, and 75,974 tons, 50,547 tons, and 37,578 tons in 1946.

Consumption of purchased zinc scrap in the United States in 1947, 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	4,556		4,228		8,784
Sheet and strip		5,688		44	5,732
Engravers' plates		1,849		186	2,035
Skimmings and ashes	53,620		32,548		86,168
Dross	57,376		77		57,453
Die castings		20,852	427	309	21,588
Rod and die scrap		6,287			6,287
Flue dust and residues	28,837		26,637		55,474
	144,389	34,676	63,917	539	243,521

Zinc-base byproduct residues are new scrap, but they are not what is known as run-around scrap like clippings, borings, and turnings. They cannot, in general, be treated in the plant where they are generated. Dross, a byproduct of galvanizing, is sold to producers of zinc dust or redistilled slab. Skimmings are also generated by galvanizers and by remelters. They are consumed by distillers or at zinc chemical plants. Chemical residues are chiefly zinc carbonate and oxide fines resulting from production of sodium hydrosulfite from zinc dust. They are sometimes processed into high-grade zinc oxide at the plant of generation and sometimes shipped to other chemical plants or to smelters. Zinc flue dust is generated mainly by brass-ingot makers. It is mixed with ore and distilled or it can be used by chemical plants. Zinc residues, other than dross, are readily soluble and if stored outside they soon become leached and lose their value. Most of them are low-grade to begin with and in slack times are not easily marketable. The high 1947 total consumption of zinc scrap, especially of the residue types, suggests a scarcity of higher-grade zinc scrap. The availability of zinc dross—the highest-grade residue item—and to a great extent the skimmings, depends on the quantity of zinc consumed in galvanizing.

Consumers' stocks of purchased zinc-base scrap in the United States at end of year, 1946–47, gross weight in short tons

Scrap item	On hand—	
	Dec. 31, 1946	Dec. 31, 1947
Metallic zinc scrap	9,740	3,459
Dross	6,138	8,013
Skimmings and residues	18,723	23,805
	34,601	35,277

Dealers' buying prices for new zinc clippings averaged 7.16 cents a pound during 1947 compared with 6.03 cents in 1946 and 5.83 cents in 1945. In the first 4 months of 1947 the price was 7.75 cents; it decreased to 6.75 cents in September and ended the year at 6.85 cents. The price for old zinc followed the same trend as that for clippings in 1947, averaging 5.37 cents a pound for the year compared with 4.70 cents in 1946 and 4.37 cents in 1945.

Imports of old zinc scrap into the United States totaled 714 tons in 1947 compared with 1,286 tons in 1946. Imported drosses and residues totaled 4,315 tons in 1947, an increase of 1,464 tons over the 2,851 tons imported in 1946. Large quantities of fume from a primary smelter in Canada were imported by one company for the manufacture of zinc sulfate and lithopone; the zinc reclaimed from this material was not counted as secondary zinc but as recovered from material other than scrap.

Slag—Iron Blast-Furnace[1]

By G. RICHARDS GWINN

GENERAL SUMMARY

THE iron blast-furnace-slag industry in 1947 again had a prosperous year as demands by the construction industry continued strong. As stocks of processed slag are relatively small and constant from year to year, production virtually equals sales. Thus these terms are used interchangeably in this report. As shown in the accompanying salient statistics table, sales in 1947 of all types of slag, with the exception of unscreened air-cooled material, increased over those reported in 1946.

PRODUCTION

The output of slag from iron blast furnaces in 1947—the first year in which production statistics on this material were collected by the Bureau of Mines—reached 32,284,000 short tons.

The quantity of slag processed for commercial use in 1947, as reported by the National Slag Association, reached a record high of 19,581,679 short tons valued at $19,525,482, a figure 17 percent above the 16,706,792 tons valued at $14,869,839 in 1946. The 1947 output of processed slag came from 38 companies operating 58 slag plants. Two new companies started operations in 1947—the Houston Slag Materials Co., offices at 902 Scanlon Building, Houston, Tex., and operations at the Sheffield Steel of Texas furnace in Houston, and the Lebanon Building Block Aggregate Inc., 15th and Willow Streets, Lebanon, Pa., which processes slag from an old slag bank.

The accompanying table shows details on processed slag by States in 1947.

Screened, air-cooled, iron blast-furnace slag processed in the United States, 1946–47, by States

[National Slag Association]

	1946			1947		
	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total	
Alabama	3,462,614	24	$2,887,268	4,344,427	26	$3,953,629
Ohio	3,849,789	27	3,928,964	4,501,587	27	4,945,385
Pennsylvania	2,188,061	15	2,320,032	2,521,783	15	3,087,209
Other States [1]	4,832,432	34	4,114,429	5,344,380	32	5,058,797
	14,332,896	100	13,250,693	16,712,177	100	17,045,020

[1] California, Colorado, Illinois, Kentucky, Maryland, Massachusetts (in 1947 only), Michigan, New York, Texas, and West Virginia.

[1] Iron blast-furnace slag was discussed in the Sand and Gravel chapter of preceding editions of Minerals Yearbook.

Iron blast-furnace slag sold or used by processors in the United States, 1943–47, by types

[National Slag Association]

	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
1943	13,736,642	$11,714,225	$0.85	1,364,779	$540,465	$0.40	1,329,215	$319,421	$0.24	76,971	$112,817	$1.47
1944	10,730,613	9,260,257	.86	776,302	303,460	.39	733,255	133,308	.18	165,822	232,508	1.40
1945	11,427,689	9,841,813	.86	406,775	140,527	.35	567,297	132,581	.23	234,107	335,931	1.43
1946	14,332,896	13,250,693	.92	596,957	211,078	.35	1,003,789	(1)	(1)	773,150	1,321,685	1.71
1947	16,712,177	17,045,020	1.02	447,908	257,683	.58	1,290,958	(1)	(1)	1,130,636	2,127,692	1.88

[1] Complete data not available.

PREPARATION

Processed blast-furnace slag is sold as screened or unscreened air-cooled slag, granulated slag, and lightweight slag. Slag produced in blast furnaces and permitted to air-cool either in the pit or a modified bank is the material for the manufacture of all slag products.

Air-cooled slag is processed similarly to other crushed mineral aggregate, with two exceptions. Air-cooled slag is processed while hot, which necessitates special protection for the equipment used, and iron is recovered by magnetic methods while the slag is being treated. Granulated slag is prepared by pouring the molten material into a pit in which sufficient water is present to quench and thus granulate the slag. Slag utilized in making lightweight aggregate is processed in the molten state by the machine or pit process.

TRANSPORTATION

Shipments of iron blast-furnace slag in the United States, 1946–47, by methods of transportation

[National Slag Association]

Method of transportation	1946		1947	
	Short tons	Percent of total	Short tons	Percent of total
Rail	9,408,089	61	11,217,642	59
Truck	5,909,293	38	7,640,384	40
Waterway	221,257	1	283,697	1
Total shipments	15,538,639	100	19,141,723	100
Percent of total processed slag		93		98

CONSUMPTION

Air-cooled iron blast-furnace slag sold or used by processors in the United States in 1947, by uses

[National Slag Association]

Use	Screened		Unscreened	
	Short tons	Value	Short tons	Value
Aggregate in:				
Portland-cement concrete construction	1,605,568	$1,613,972		
Bituminous construction, (all types)	4,304,081	4,999,487	63	$31
Other highway construction uses	4,781,439	5,144,262	168,852	96,776
Manufacture of concrete block	695,067	675,206		
Railroad ballast	4,040,212	3,122,933	39,261	25,017
Mineral wool	635,386	757,557	307	154
Roofing:				
Built-up	205,217	284,692		
Granules	28,619	97,304		
Sewage trickling filter mediums	20,010	22,889		
Agricultural slag	50,939	61,225		
Other uses	345,639	265,493	239,425	135,705
	16,712,177	17,045,020	447,908	257,683

Granulated and lightweight iron blast-furnace slag sold or used by processors in the United States in 1947, by uses

[National Slag Association]

Use	Granulated		Lightweight	
	Short tons	Value	Short tons	Value
Road fill, etc.	325,193	$62,737		
Agricultural slag	26,302	25,295		
Cement manufacture	916,976	(1)		
Aggregate for manufacturing concrete block	16,334	5,182	[2] 1,130,636	[2] $2,127,692
Other uses	6,153	1,873		
	1,290,958	(1)	1,130,636	2,127,692

[1] Data not available.
[2] Includes a small amount used for concrete other than block.

PRICES

Average value per short ton of iron blast-furnace slag sold or used by processors in the United States in 1947, by uses

[National Slag Association]

Use [1]	Air-cooled		Granulated	Lightweight
	Screened	Unscreened		
Aggregate in:				
Portland-cement concrete construction	$1.01			
Bituminous construction, all types	1.16	$0.49		
Other highway construction uses	1.08	.57		
Manufacture of concrete block	.97		$0.32	$1.88
Railroad ballast	.77	.64		
Mineral wool	1.19	.50		
Roofing:				
Built-up	1.39			
Granules	3.40			
Sewage trickling filter mediums	1.14			
Agricultural slag	1.20		.96	
Road fill, etc.			.19	
Other uses	.77	.57	.30	
Average for all uses [1]	1.02	.58	(2)	1.88

[1] Value of slag used in cement manufacture not available.
[2] Data not available.

RECOVERY OF IRON

Iron recovered in processing slag reached 212,575 short tons in 1947, an increase of 18 percent over the 180,432 tons recovered in 1946. Iron is recovered by hand picking and by magnetic methods within the slag-processing plants. With the continued strong demand for pig iron, the recovery of this material continues to be an important function performed for the iron and steel industry.

EMPLOYMENT

In all, 2,216 plant and yard employees were reported by the slag industry in 1947 compared to 2,023 in 1946. The number of man-hours expended in 1947 reached 5,212,930, an increase of 14 percent over the 4,571,175 hours reported in 1946. A calculation based on the total man-hours and tonnage of all types of slag shows that an average of 3.76 tons of slag were processed per man-hour in 1947.

Slate

By LAWRENCE G. HOUK AND M. G. DOWNEY

GENERAL SUMMARY

DOMESTIC production of slate in 1947 increased 15 percent in quantity and 32 percent in value over 1946. Dimension slate rose 17 percent in quantity and 48 percent in value, and granules and flour 15 percent in tonnage and 22 percent in value.

Roofing-slate sales increased 16 percent in volume and 56 percent in value. The average value per square in 1946 was $13.51, compared with $18.14 in 1947. In Pennsylvania, roofing-slate sales increased 7 percent in quantity and 42 percent in value. Pennsylvania accounted for 64 percent of the total value of roofing slate sold in the United States, Vermont and Maine 27 percent, Virginia 8 percent, and New York and Georgia 1 percent.

Salient statistics of the slate industry in the United States, 1946–47

	1946			1947				
	Quantity			Quantity			Percent of change 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* 146,790	56,240	$1,982,928	*Squares* 170,590	64,350	$3,094,780	+16	+56
Mill stock:	*Sq. ft.*			*Sq. ft.*				
Electrical slate	389,210	2,760	366,039	486,870	3,650	486,687	+25	+33
Structural and sanitary slate	448,520	3,530	222,675	523,360	4,090	308,874	+17	+39
Grave vaults and covers	145,910	1,330	58,671	40,560	370	23,006	−72	−61
Blackboards and bulletin boards	808,710	2,090	240,520	786,130	2,040	373,421	−3	+55
Billiard-table tops	292,740	2,180	135,217	424,940	3,160	243,856	+45	+80
School slates	[1] 286,730	260	9,462	[1] 273,160	240	8,991	−5	−5
Total mill stock	2,371,820	12,150	1,032,584	2,535,020	13,550	1,444,835	+7	+40
Flagstones, etc.[2]	4,322,220	27,860	403,990	5,208,820	34,610	537,705	+21	+33
Total slate as dimension stone		96,250	3,419,502		112,510	5,077,320	+17	+48
Granules and flour		663,520	5,424,604		763,500	6,608,234	+15	+22
Grand total domestic production		759,770	8,844,106		876,010	11,685,554	+15	+32

[1] Square feet approximate. Number of pieces: 1946, 535,950; 1947, 510,340.
[2] Includes slate used for walkways, stepping stones, and miscellaneous uses.

Sales of mill stock increased 7 percent in volume and 40 percent in value compared with 1946. In this category, electrical slate gained 25 percent in quantity and 33 percent in value, whereas structural and sanitary slate increased 17 percent in volume and 39 percent in value. Slate used for billiard-table tops increased 45 percent in quantity and 80 percent in value. On the other hand, grave vaults and covers declined 72 percent, school slates 5 percent, and blackboards and bulletin boards 3 percent in volume.

Sales of slate for flagstones, walkways, and stepping stones and for miscellaneous uses increased 21 percent in quantity and 33 percent in value.

Sales of granules and flour, used principally in the manufacture of roofing materials, rose to a new high in 1947. Figures on output of all types of granules, including slate, are given in the chapter on Stone.

SALES

Dimension Slate.—Dimension slate includes all slate products with the exception of flour and granules.

Dimension slate sold by producers in the United States, 1943–47

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
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
1946	146,790	56,240	1,982,928	12,150	1,032,584	27,860	403,990	96,250	3,419,502
1947	170,590	64,350	3,094,780	13,550	1,444,835	34,610	537,705	112,510	5,077,320

[1] Includes flagstones, walkways, stepping stones, and miscellaneous slate.

Figure 1 compares sales of roofing slate and mill stock with new dwelling units and new nonresidential building from 1925 to 1947. Roofing slate is primarily used in dwelling construction and tends to follow the trend of activity in erection of new dwelling units. From 1929 to 1938, sales of roofing slate roughly paralleled the number of new dwelling units erected. However, since 1938 roofing slate has failed to register the demand normally expected for the number of dwelling units erected. Prepared roofing materials have cut deeply into the market formerly held by slate. Shipment of 87.4 million squares of asphalt roofing material, compared with 170,590 squares of roofing slate sold or used in 1947, shows the dominance of the market by prepared roofing materials.

Figure 1 also compares mill-stock slate sales with the value of new nonresidential construction (except farm and public utility) from 1925 to 1947. As mill stock is most widely used in nonresidential construction, sales generally have closely followed construction activity in this field, but since 1944 mill stock has failed to gain its share of the increased nonresidential building market.

Figure 2 presents graphically the history of the slate industry from 1915 to 1947, showing the value of slate sold in the United States, by uses. The value of production reached a peak in 1925, dropped rapidly during the depression, recovered prior to the war, declined during the early war years, and since 1944 has been improving rapidly. The greatest part of the recovery has been due to the increased consumption of granules and flour.

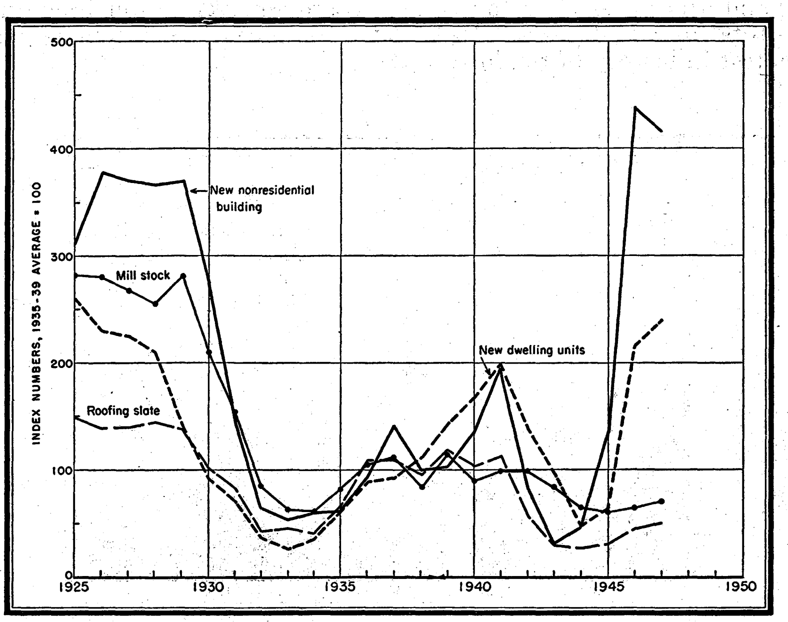

FIGURE 1.—Sales of roofing slate and mill stock compared with number of new dwelling units and value of new nonresidential construction, 1925–47. Data on number of new dwelling units (actual starts) in nonfarm areas from U. S. Department of Labor, Monthly Labor Review; on value of nonresidential construction activity from U. S. Department of Commerce, Survey of Current Business.

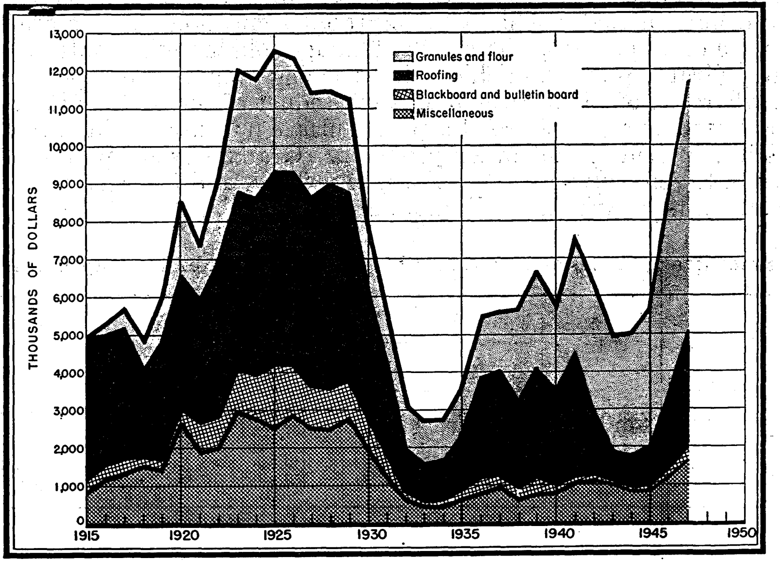

FIGURE 2.—Value of slate sold in the United States, 1915–47, by uses.

The history of slate sales, by uses, from 1915 to 1947 is shown in figure 3. Granules and flour have the dominant place in the industry from the standpoint of both tonnage and value of production. Roofing and other uses have contributed a progressively lower fraction of the total in recent years. In 1947 the tonnage of slate sold was the greatest in history of the industry.

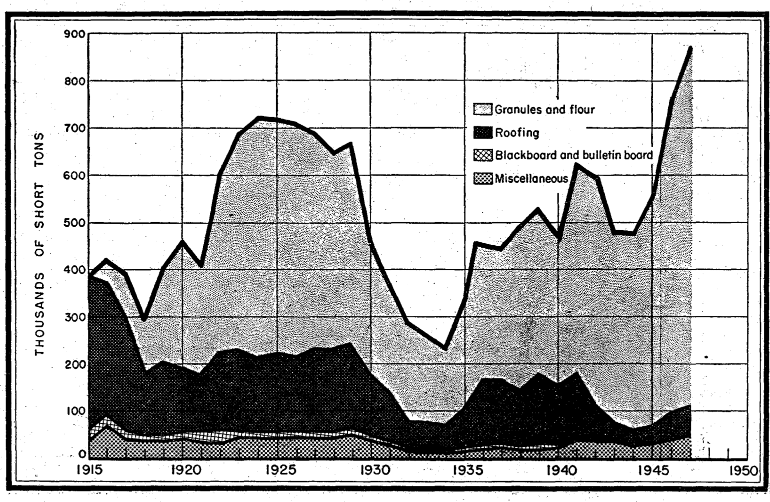

FIGURE 3.—Quantity of slate sold in the United States, 1915–47, by uses.

Granules and Flour.—Sales of granules and flour established a new record high in 1947. The value of granules and flour sold showed an increase of 22 percent, whereas the tonnage sold increased only 15 percent. Granules are used chiefly in surfacing prepared roofing materials, whereas flour is recovered as a byproduct of the granule industry and is used as a filler in road-asphalt surface mixtures, paints, roofing mastics, linoleum, and other products. Granules were produced in Vermont, Pennsylvania, New York, Maryland, and Georgia, with lesser amounts in Arkansas, Virginia, and California.

Crushed slate (granules and flour) sold by producers in the United States, 1943–47

Year	Granules		Flour		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	513,780	4,851,314	149,740	573,290	663,520	5,424,604
1947	593,560	5,911,151	169,940	697,083	763,500	6,608,234

REVIEW BY STATES AND DISTRICTS

There were 15 more slate quarries in operation in 1947 than in 1946. Geographically, 10 were in the Vermont-Maine area, 2 in New York, and 1 each in California, Georgia, and Pennsylvania.

Slate sold by producers in the United States in 1943–47 by States and uses

	Operators	Roofing		Mill stock		Other uses (value) [1]	Total value
		Squares (100 square feet)	Value	Square feet	Value		
1943	49	96,220	$841,750	2,644,140	$938,368	$3,090,119	$4,870,237
1944	44	89,090	802,179	2,041,210	715,689	3,486,327	5,004,195
1945	46	101,300	976,122	2,107,780	742,345	3,940,446	5,658,913
1946	61	146,790	1,982,928	2,371,820	1,032,584	5,828,594	8,844,106
1947							
Arkansas	1					(2)	(2)
California	2					(2)	(2)
Georgia	2	(3)	(3)			(2)	(2)
Maryland	1					(2)	(2)
New York	15	860	17,905			1,557,347	1,575,252
Pennsylvania	21	121,480	1,988,255	2,153,200	1,005,478	1,324,463	4,318,196
Vermont and Maine	29	36,720	824,699	381,820	439,357	2,622,782	3,886,838
Virginia	5	[3] 11,530	[3] 263,921			(2)	(2)
Undistributed						1,641,347	1,905,268
Total 1947	76	170,590	3,094,780	2,535,020	1,444,835	7,145,939	11,685,554

[1] Flagging and similar products, granules, and flour.
[2] Included with "Undistributed."
[3] Roofing slate in Georgia included with Virginia.

Maine.—Production in Maine is included with Vermont to maintain confidential the information of individual companies. The Maine quarries are near Monson and produce primarily electrical slate, with small output of roofing slate and minor amounts of vaults and covers. Since 1943 only one company has been active.

New York.—Roofing slate produced in New York in 1947 totaled 860 squares valued at $17,905. The value of other slate products (granules, flour, and flagging) in New York increased 34 percent over 1946.

Pennsylvania.—Lehigh and Northampton Counties in Pennsylvania are the most productive slate areas in the United States. Some slate is produced in York County in the Peach Bottom District between Delta, Pa., and Cardiff, Md.

The value of all slate products sold in Lehigh County showed a 72 percent increase over 1946. Roofing-slate production declined 7 percent, but the value of production increased 90 percent. Electrical slate from Lehigh County increased 7 percent in volume and 78 percent in value, blackboards and bulletin boards increased 16 percent in quantity and 46 percent in value, and school slates decreased 5 percent in quantity and value.

The total value of production in Northampton and York Counties in 1947 was 33 percent higher than in 1946, and the quantity of slate produced increased 12 percent. Sales of granules and flour increased 12 percent in quantity and 16 percent in value.

Slate sold by producers in Pennsylvania in 1947, by counties and uses

County	Operators	Roofing slate: Squares (100 square feet)	Roofing slate: Value	Mill stock: Electrical: Square feet	Electrical: Value	Structural and sanitary: Square feet	Structural and sanitary: Value	Vaults and covers: Square feet	Vaults and covers: Value
Lehigh	4	9,420	$155,620	39,700	$27,603	(1)	(1)	(1)	(1)
Northampton and York [2]	17	112,060	1,832,635	110,960	61,639	478,810	$267,828	39,500	$22,140
Total: 1947	21	121,480	1,988,255	150,660	89,242	478,810	267,828	39,500	22,140
1946	20	113,490	1,401,427	69,020	27,471	416,370	197,057	142,670	56,819

County	Mill stock—Continued: Blackboards and bulletin boards: Square feet	Blackboards and bulletin boards: Value	Billiard-table tops: Square feet	Billiard-table tops: Value	School slates: Square feet	School slates: Value	Other uses (value)	Total value
Lehigh	109,950	$33,753			273,160	$8,991	$538	$226,505
Northampton and York [2]	676,180	339,668	424,940	$243,856			1,323,925	4,091,691
Total: 1947	786,130	373,421	424,940	243,856	273,160	8,991	1,324,463	4,318,196
1946	808,710	240,520	287,150	130,716	286,730	9,462	1,134,273	3,197,745

[1] Small amount of slate for grave vaults and covers and for structural and sanitary uses produced in Lehigh County, included with Northampton and York Counties.
[2] York County produced granules and flour only.

Vermont.—The value of slate produced in Vermont and Maine was 35 percent higher than in 1946. The quantity of roofing slate increased 84 percent and the value of production 137 percent.

Virginia.—The number of squares of roofing slate produced in Virginia and Georgia decreased 13 percent in 1947, but the value of production increased 13 percent over 1946. Roofing slate of high quality in dark gray or slightly greenish with a lustrous surface has been produced in Virginia for many years. Substantial amounts of granules are produced, but sales cannot be shown separately because of the small number of operations.

Other Districts.—Slate products, principally granules and flour, were produced in Montgomery County, Ark., near Glenwood; near Placerville, Eldorado County, Calif.; and near Fair Mount, in Bartow County, Ga.

PRICES

The average price of roofing slate, f. o. b. quarry or mill, as reported to the Bureau of Mines, increased by $4.63 per square to $18.14 per square in 1947. In New York it was $20.82, in Pennsylvania $16.37, in Vermont and Maine $22.46, and in Virginia about $23.

The average value of mill stock rose to 57 cents per square foot, a gain of 13 cents over 1946. The average value of electrical slate increased 6 cents, structural and sanitary 9 cents, grave vaults and covers 17 cents, blackboards and bulletin boards 18 cents, and billiard-table tops 11 cents per square foot over 1946. The average sales value of granules rose 52 cents to $9.96, and slate flour 27 cents to $4.10 per ton.

Price History.—Figure 4 shows that the average value of roofing slate and mill stock generally moved with wholesale prices of building materials from 1915 to 1947. The price of slate in 1915 to 1920, compared with its base period (1935–39) was relatively less than the price of building materials. From 1921 to 1936 the situation was reversed. Since 1933 the price variations have been almost in unison.

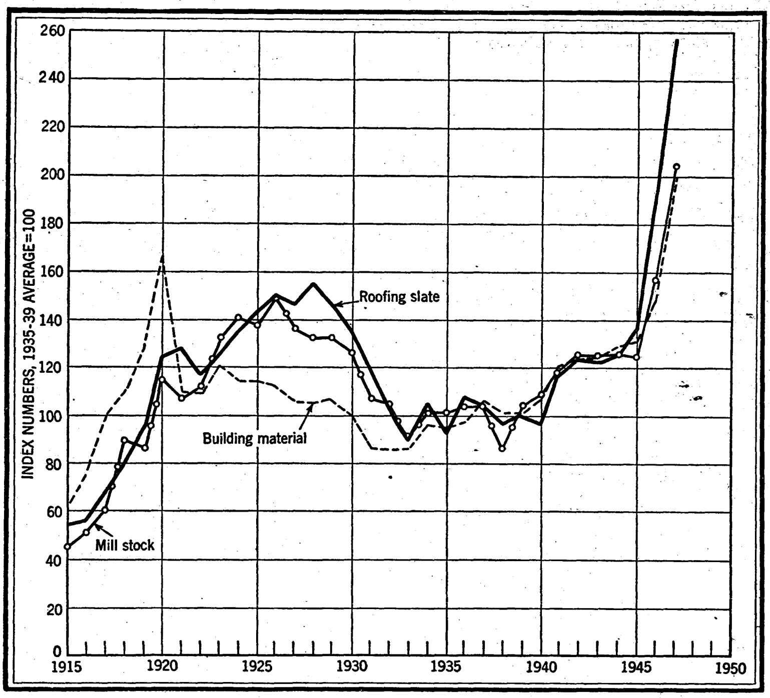

FIGURE 4.—Average value of slate compared with wholesale prices of building materials in general, 1915–47. Wholesale prices from U. S. Department of Labor.

FOREIGN TRADE[1]

Imports.—Imports of slate have been small in recent years, amounting to only $616 in 1946. However, in 1947 the value increased to $5,747. Material valued at $5,688 came from Italy, $39 from China, $16 from Canada, and $4 from the United Kingdom.

Exports.—The following table gives the value of exports of slate products for the latest 5-year period as reported to the Bureau of Mines by shippers. The value of exports was $605,144, a 19-percent increase above 1946.

[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.

Slate exported from the United States, 1943–47, by uses [1]

Use	1943	1944	1945	1946	1947
Roofing	(2)	$5,398	$3,465	$7,103	$13,748
School slates [3]	$18,939	24,008	4,751	21,701	30,436
Electrical	3,461	3,782	2,490	5,117	3,164
Blackboards	5,861	14,674	20,211	40,294	47,899
Billiard tables	87,834	75,797	161,439	47,605	43,161
Structural [4]	(2)	180,697	2,316	386,642	466,736
Slate granules and flour	(2)		219,933		
Undistributed	150,346				
	266,441	304,356	414,605	508,462	605,144

[1] Figures collected by the Bureau of Mines from shippers of products named.
[2] Included with "Undistributed."
[3] Includes slate used for pencils and educational toys.
[4] Includes slate for floors and walkways

Stone

By D. G. RUNNER AND NAN C. JENSEN

GENERAL SUMMARY

SALES of crushed and dimension stone combined (207,554,790 short tons) were 16 percent greater in 1947 than in 1946 and 6 percent greater than the previous all-time high record for 1942. The total value ($289,344,482) increased 23 percent over that reported for 1946. The output of crushed and broken stone was 16 percent greater than in 1946 and the value 23 percent greater. Dimension-stone production increased 3 percent in quantity and 24 percent in value over the 1946 figures. In common with the upward trend of prices, the average values of nearly all classes of dimension stone (except stone for rough construction) showed increases over 1946 data. In the crushed- and broken-stone industry, riprap and stone for calcium carbide works decreased in average values, while all other uses followed the general upward trend.

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 therefore included with sales in the statistics. 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. This chapter follows the general plan introduced in 1938 whereby crushed stone and dimension stone are considered separately, except in the introductory tables. The following tables show the total sales of stone by kinds, uses, and States.

Stone sold or used by producers in the United States, 1943–47, by kinds

Year	Granite		Basalt and related rocks (trap rock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	11, 119, 490	29, 492, 076	16, 400, 120	20, 683, 202	205, 260	7, 919, 979	134, 717, 410	155, 649, 197
1947	12, 443, 320	34, 123, 460	19, 616, 020	25, 755, 314	227, 880	10, 252, 522	150, 408, 820	186, 548, 286

Year	Sandstone		Other stone [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	4, 253, 860	11, 407, 302	12, 156, 220	9, 187, 730	178, 852, 360	234, 339, 486
1947	6, 809, 080	16, 586, 504	18, 049, 670	16, 078, 396	207, 554, 790	289, 344, 482

[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 principal group.

Stone sold or used by producers in the United States, 1946–47, by uses

Use	1946		1947	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rough construction [1] ....short tons	208, 170	$1, 578, 668	200, 420	$1, 996, 445
Cut stone, slabs, and mill blocks [1] ....cubic feet	6, 654, 340	12, 189, 205	7, 203, 530	16, 614, 261
Approximate equivalent in short tons	499, 050		538, 870	
Rubble ....short tons	293, 430	649, 604	268, 890	715, 296
Monumental stone ....cubic feet	3, 677, 920	17, 434, 556	3, 778, 060	19, 814, 723
Approximate equivalent in short tons	300, 070		312, 150	
Paving blocks ....number	578, 750	50, 346	683, 950	56, 118
Approximate equivalent in short tons	5, 270		4, 830	
Curbing ....cubic feet	374, 900	544, 477	634, 860	1, 109, 897
Approximate equivalent in short tons	30, 460		51, 860	
Flagging ....cubic feet	475, 620	525, 364	520, 490	585, 782
Approximate equivalent in short tons	38, 130		41, 440	
Total dimension stone (quantities approximate, in short tons)	1, 374, 580	32, 972, 220	1, 418, 460	40, 892, 522
Crushed and broken stone:				
Riprap ....short tons	3, 847, 550	5, 010, 207	5, 732, 740	6, 513, 792
Crushed stone ....do	107, 267, 250	110, 892, 504	123, 427, 850	139, 320, 324
Furnace flux (limestone) ....do	25, 157, 760	20, 791, 833	32, 570, 270	28, 687, 950
Refractory stone [2] ....do	2, 088, 080	4, 157, 179	2, 704, 220	5, 536, 738
Agricultural (limestone) ....do	22, 781, 750	32, 482, 907	22, 605, 500	35, 075, 883
Other uses ....do	16, 335, 390	28, 032, 636	19, 095, 750	33, 317, 273
Total crushed and broken stone ....do	177, 477, 780	201, 367, 266	206, 136, 330	248, 451, 960
Grand total (quantities, approximate, in short tons)	178, 852, 360	234, 339, 486	207, 554, 790	289, 344, 482

[1] To avoid disclosure of individual outputs, dimension stone for refractory use is included with building stone. Rough construction and sawed building stone includes—1946: 11,280 short tons of stone for refractory use valued at $305,879; 1947: 36,690 tons, $905,943.
[2] Ganister (sandstone), mica schist, soapstone, and dolomite.

Stone sold or used by noncommercial producers in the United States, 1946–47, by uses

[Included in total production]

Use	1946		1947	
	Short tons	Value	Short tons	Value
Building stone	34,240	$174,029	10,120	$24,499
Rubble	38,540	48,776	24,980	31,668
Flagging	2	20		
Riprap	769,620	908,940	1,032,240	1,148,361
Crushed stone	6,479,220	7,940,772	11,899,150	12,941,922
Agricultural (limestone)	479,710	630,282	422,420	599,008
Other uses	112,630	162,299	817,170	674,063
	7,913,962	9,865,118	14,206,080	15,419,521

Stone sold or used by producers in the United States, 1946–47, by States

State	1946		1947	
	Short tons	Value	Short tons	Value
Alabama	1,874,330	$3,385,892	2,795,240	$4,624,892
Alaska	(1)	(1)	(1)	(1)
Arizona	[2] 191,430	[2] 269,279	353,880	219,891
Arkansas	995,720	1,135,856	[2] 210,100	[2] 448,650
California	[2] 8,950,320	[2] 8,452,083	[2] 12,757,790	[2] 13,012,556
Colorado	612,000	818,606	1,069,250	1,406,989
Connecticut	1,324,160	1,878,793	[2] 1,362,840	[2] 1,929,548
Delaware	23,070	57,662	(1)	(1)
Florida	[2] 2,863,070	[2] 3,212,135	3,534,010	4,511,894
Georgia	2,417,340	8,538,435	2,960,520	9,977,938
Hawaii	763,920	1,195,265	[2] 786,010	[2] 1,470,703
Idaho	548,870	568,159	[2] 1,044,780	[2] 991,599
Illinois	15,635,470	16,891,933	[2] 15,545,130	[2] 18,160,506
Indiana	5,767,430	9,950,338	[2] 5,589,550	[2] 11,254,020
Iowa	5,162,540	6,646,273	5,586,460	7,385,436
Kansas	3,653,640	3,908,588	4,792,850	4,867,789
Kentucky	[2] 4,745,560	[2] 5,205,820	[2] 4,990,170	[2] 5,875,574
Louisiana	(1)	(1)	892,110	827,184
Maine	[2] 147,680	[2] 927,588	[2] 158,150	[2] 1,557,978
Maryland	[2] 1,715,120	[2] 2,622,618	[2] 1,552,610	[2] 2,416,393
Massachusetts	[2] 1,976,180	[2] 4,135,238	[2] 2,565,960	[2] 5,644,821
Michigan	15,432,320	9,971,003	18,600,370	12,601,288
Minnesota	[2] 1,286,800	3,700,535	[2] 1,372,220	[2] 3,854,473
Mississippi	(1)	(1)	(1)	(1)
Missouri	7,258,990	8,996,440	[2] 8,438,320	[2] 11,195,993
Montana	441,480	440,046	632,620	574,726
Nebraska	263,930	612,120	219,780	537,824
Nevada	[2] 87,810	[2] 122,940	1,691,700	1,068,840
New Hampshire	68,530	385,828	109,230	399,879
New Jersey	3,419,210	5,239,342	3,857,710	6,136,857
New Mexico	(1)	(1)	477,970	251,080
New York	9,939,440	12,086,748	11,197,990	14,992,064
North Carolina	4,505,880	6,835,448	5,018,060	7,561,167
Ohio	[2] 16,991,440	[2] 19,069,169	[2] 18,710,890	[2] 23,633,433
Oklahoma	3,413,430	2,624,579	2,610,770	2,679,855
Oregon	[2] 1,472,700	[2] 2,008,374	3,002,000	4,425,847
Pennsylvania	18,883,740	25,872,596	[2] 22,352,810	[2] 31,938,877
Puerto Rico	155,860	290,722	104,470	194,746
Rhode Island	[2] 4,860	[2] 274,130	[2] 32,090	[2] 400,602
South Carolina	1,979,270	2,990,678	2,207,840	3,921,465
South Dakota	379,880	2,385,543	885,650	3,554,096
Tennessee	5,156,490	7,625,086	6,796,630	10,617,502
Texas	3,285,220	3,611,118	3,786,040	4,277,404
Utah	404,370	591,940	[2] 178,680	[2] 368,255
Vermont	230,400	6,740,160	392,420	7,652,139
Virginia	7,873,020	9,754,482	8,359,420	12,377,061
Washington	[2] 3,149,900	[2] 3,232,805	3,865,110	4,550,275
West Virginia	[2] 4,131,540	[2] 4,464,048	4,888,860	6,033,930
Wisconsin	6,193,400	11,473,119	[2] 5,897,960	[2] 11,669,611
Wyoming	1,204,570	1,203,636	1,393,070	1,497,034
Undistributed	1,870,030	1,936,290	1,926,700	3,793,798
	178,852,360	234,339,486	207,554,790	289,344,482

[1] Included with "Undistributed."
[2] To avoid disclosing confidential information, certain State totals are incomplete, the figures not included being combined with "Undistributed." The class of stone omitted from such State totals is noted in the State tables in the Statistical Summary chapter of this volume.

DIMENSION STONE

Dimension stone and crushed stone are so diverse in character that they are considered in separate sections of this chapter. The term "dimension stone" is applied to blocks or slabs of natural stone, most of which are cut to definite shapes and sizes. The principal uses of dimension stone are for construction of masonry walls and for memorials. Crushed and broken stone, on the other hand, consists of irregular fragments or grains, sized mainly by mechanical screening or air separation. The chief uses of crushed and broken stone are as concrete aggregate, railroad ballast, furnace flux, and numerous industrial applications that have little or no relationship to masonry construction.

Dimension-stone producers may be divided into three main groups upon the basis of plant operation. The first group includes operators who quarry stone and sell it as rough blocks or slabs; a second group quarries stone and also manufactures it into finished products; while a third group buys sawed slabs or rough blocks of stone and manufactures them into finished products but does not operate quarries as such. The Bureau of Mines statistical canvass covers the first and second groups; but inasmuch as the third group comprises manufacturers rather than quarrymen, it is canvassed only by the Bureau of the Census. 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 1947 increased 4 percent in quantity and 26 percent in value compared with 1946. These over-all figures include slate, but detailed statistics of this branch of the industry are given in the Slate chapter of this volume.

The accompanying table presents salient statistics for 1946 and 1947.

Dimension stone sold or used by producers in the United States, 1946–47, by kinds and uses

Kind and use	1946	1947 Total	1947 Percent of change
Granite:			
Building stone:			
Rough construction ... short tons	69,750	73,060	+5
Value	$380,338	$322,004	−15
Average per ton	$5.45	$4.41	−19
Cut stone, slabs, and mill blocks ... cubic feet	538,810	509,830	−5
Value	$2,127,124	$2,863,506	+35
Average per cubic foot	$3.95	$5.62	+42
Rubble ... short tons	130,820	86,910	−34
Value	$263,054	$214,221	−19
Monumental stone ... cubic feet	3,194,740	3,268,650	+2
Value	$13,433,094	$14,854,098	+11
Average per cubic foot	$4.20	$4.54	+8
Paving blocks ... number	578,750	683,950	+18
Value	$50,346	$56,118	+11
Curbing ... cubic feet	314,540	553,910	+76
Value	$458,312	$970,840	+112
Total:			
Quantity ... approximate short tons	535,230	521,630	−3
Value	$16,712,268	$19,280,787	+15
Basalt and related rocks (trap rock):			
Building stone:			
Rough construction ... short tons	20,470	23,020	+12
Value	$53,237	$59,332	+11
Average per ton	$2.60	$2.58	−1
Rubble ... short tons	29,460	15,820	−46
Value	$17,232	$11,492	−33

Dimension stone sold or used by producers in the United States, 1946–47, by kinds and uses—Continued

Kind and use	1946	1947 Total	1947 Percent of change
Basalt and related rocks—Continued			
Total:			
Quantity short tons	49,930	38,840	−22
Value	$70,469	$70,824	+1
Marble:			
Building stone (cut stone, slabs, and mill blocks) cubic feet	422,880	501,590	+19
Value	$3,079,553	$4,276,453	+39
Average per cubic foot	$7.28	$8.53	+17
Monumental stone cubic feet	483,180	509,410	+5
Value	$4,001,462	$4,960,625	+24
Average per cubic foot	$8.28	$9.74	+18
Total:			
Quantity approximate short tons	77,010	85,920	+12
Value	$7,081,015	$9,237,078	+30
Limestone:			
Building stone:			
Rough construction short tons	57,670	45,790	−21
Value	$147,420	$112,868	−23
Average per ton	$2.56	$2.46	−4
Cut stone, slabs, and mill blocks cubic feet	4,678,050	4,839,130	+3
Value	$5,516,423	$6,793,365	+23
Average per cubic foot	$1.18	$1.40	+19
Rubble short tons	95,020	129,900	+37
Value	$170,832	$247,833	+45
Flagging cubic feet	90,240	145,620	+61
Value	$44,229	$67,425	+52
Total:			
Quantity approximate short tons	504,070	542,630	+8
Value	$5,878,904	$7,221,491	+23
Sandstone:			
Building stone:			
Rough construction short tons	24,880	25,800	+4
Value	$134,644	$118,561	−12
Average per ton	$5.41	$4.60	−15
Cut stone, slabs, and mill blocks cubic feet	1,014,600	1,352,980	+33
Value	$1,466,105	$2,680,937	+83
Average per cubic foot	$1.45	$1.98	+37
Rubble short tons	27,940	27,640	−1
Value	$176,994	$208,239	+18
Curbing cubic feet	60,360	80,950	+34
Value	$86,165	$139,057	+61
Flagging cubic feet	363,620	368,400	+1
Value	$463,170	$509,166	+10
Total:			
Quantity approximate short tons	160,900	187,530	+17
Value	$2,327,078	$3,655,960	+57
Miscellaneous stone:[1]			
Building stone cubic feet	416,470	386,180	−7
Value	$863,029	$1,383,680	+60
Average per cubic foot	$2.07	$3.58	+73
Rubble short tons	10,190	8,620	−15
Value	$21,492	$33,511	+56
Flagging cubic feet	21,760	6,470	−70
Value	$17,965	$9,191	−49
Total:			
Quantity approximate short tons	47,440	41,910	−12
Value	$902,486	$1,426,382	+58
Total dimension stone, excluding slate:			
Quantity approximate short tons	1,374,580	1,418,460	+3
Value	$32,972,220	$40,892,522	+24
Slate as dimension stone[2] approximate short tons	96,250	112,510	+17
Value	$3,419,502	$5,077,320	+48
Total dimension stone, including slate:			
Quantity approximate short tons	1,470,830	1,530,970	+4
Value	$36,391,722	$45,969,842	+26

[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 Slate chapter of this volume.

BUILDING STONE

The greatest use of dimension stone is for building purposes. During the war the total output declined to a new low in 1944. Since that time, however, the production has been upward, and the total 1947 output increased 5 percent in quantity and 35 percent in value over the 1946 figures. The following table gives the quantity and value of the major types of building stone used in 1947.

Building stone sold or used by producers in the United States in 1947, by kinds

Kind	Rough			
	Construction		Architectural	
	Cubic feet	Value	Cubic feet	Value
Granite	877,170	$322,004	115,790	$136,883
Basalt	273,290	59,332		
Marble			175,720	532,622
Limestone	554,990	112,868	2,572,620	2,078,620
Sandstone	326,270	118,561	134,720	154,949
Miscellaneous	[1] 386,180	[1] 1,383,680		
	[1] 2,417,900	[1] 1,996,445	2,998,850	2,903,074

Kind	Finished				Total	
	Sawed		Cut			
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
Granite [2]	208,210	$945,123	185,830	$1,781,500	1,387,000	$3,185,510
Basalt					273,290	59,332
Marble	136,090	975,061	189,780	2,768,770	501,590	4,276,453
Limestone	1,572,810	1,824,400	693,700	2,890,345	5,394,120	6,906,233
Sandstone	1,072,960	1,866,675	145,300	659,313	1,679,250	2,799,498
Miscellaneous	(1)	(1)			386,180	1,383,680
	[1] 2,990,070	[1] 5,611,259	1,214,610	8,099,928	9,621,430	18,610,706

[1] Sawed miscellaneous stone included with construction stone.
[2] Sawed stone corresponds to dressed stone for construction work (walls, foundations, bridges) and cut stone to architectural stone for high-class buildings.

GRANITE

Sales of granite in the form of blocks and slabs decreased 3 percent in quantity but increased 15 percent in value in 1947 compared with 1946. Stone for rough construction increased 5 percent, while cut stone decreased 5 percent in quantity compared with 1946. Monumental stone in 1947 increased 2 percent in quantity and 11 percent in value. Considerable gains in quantity and value were recorded for paving blocks and curbing. The former increased 18 percent in quantity and 11 percent in value, while curbing output increased 76 percent in quantity and 112 percent in value over 1946 figures. However, decreases of 34 percent in quantity and 19 percent in value were recorded for rubble. With the exception of stone for rough construction, dressed monumental, and paving blocks, unit prices increased over those in 1946, the gain in one instance was 42 percent, registered for rough architectural and dressed stone. Details by States are indicated in the following table:

Granite (dimension stone) sold or used by producers in the United States in 1947, by States and uses

State	Active plants	Building								Monumental				Paving blocks		Curbing		Total	
		Rough				Dressed		Rubble		Rough		Dressed							
		Construction		Architectural															
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Cubic feet	Value	Cubic feet	Value	Number	Value	Cubic feet	Value	Short tons (approximate)	Value
California	15	(1)	(1)	4,770	$21,447	-------	-------	(1)	(1)	32,670	$117,989	18,630	$161,492	-------	-------	(1)	(1)	6,420	$305,303
Colorado	4	-------	-------	(1)	(1)	-------	-------	-------	-------	(1)	(1)	-------	-------	-------	-------	-------	-------	390	19,046
Connecticut	5	(1)	(1)	390	782	(1)	(1)	1,710	$5,739	3,670	18,534	(1)	(1)	-------	-------	(1)	(1)	5,900	143,008
Georgia	15	(1)	(1)	-------	-------	(1)	(1)	(1)	(1)	722,810	1,501,746	152,480	1,175,778	(1)	(1)	(1)	(1)	103,810	2,884,772
Maine	10	(1)	(1)	41,900	43,831	86,950	$775,302	2,820	15,547	37,670	67,727	17,010	160,424	(1)	(1)	(1)	(1)	23,420	1,145,541
Maryland	5	(1)	(1)	-------	-------	-------	-------	(1)	(1)	-------	-------	-------	-------	-------	-------	-------	-------	67,940	246,744
Massachusetts	6	(1)	(1)	25,310	40,722	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	61,870	1,979,507
Minnesota	19	-------	-------	(1)	(1)	(1)	(1)	(1)	(1)	119,540	272,083	192,030	1,296,840	-------	-------	-------	-------	30,430	1,863,996
Missouri	1	-------	-------	-------	-------	-------	-------	880	5,280	54,320	140,937	-------	-------	-------	-------	-------	-------	5,420	146,217
Montana	2	-------	-------	-------	-------	-------	-------	-------	-------	(1)	(1)	(1)	(1)	-------	-------	-------	-------	80	6,780
New Hampshire	3	240	$1,148	-------	-------	(1)	(1)	-------	-------	7,070	26,564	(1)	(1)	-------	-------	2,100	$3,145	2,740	296,660
New York	3	(1)	(1)	-------	-------	4,050	30,000	1,560	4,800	-------	-------	-------	-------	(1)	(1)	3,000	4,500	5,970	72,941
North Carolina	7	500	2,400	(1)	(1)	(1)	(1)	(1)	(1)	28,420	81,597	(1)	(1)	252,070	$8,541	(1)	(1)	17,550	622,797
Oklahoma	6	-------	-------	(1)	(1)	-------	-------	(1)	(1)	(1)	(1)	43,990	489,230	-------	-------	(1)	(1)	4,930	514,345
Oregon	1	-------	-------	-------	-------	450	6,705	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	40	6,705
Pennsylvania	8	25,150	66,415	(1)	(1)	-------	-------	(1)	(1)	16,360	35,382	12,640	145,490	27,490	1,814	(1)	(1)	34,070	274,409
Rhode Island	2	-------	-------	-------	-------	-------	-------	-------	-------	50,800	310,051	-------	-------	-------	-------	-------	-------	4,140	310,051
South Carolina	3	150	520	-------	-------	-------	-------	(1)	(1)	(1)	(1)	-------	-------	-------	-------	(1)	(1)	30,000	1,065,495
South Dakota	7	-------	-------	-------	-------	(1)	(1)	-------	-------	(1)	(1)	199,800	2,142,158	-------	-------	-------	-------	20,570	2,337,030
Texas	2	-------	-------	-------	-------	-------	-------	-------	-------	(1)	(1)	-------	-------	-------	-------	-------	-------	(1)	(1)
Vermont	6	-------	-------	(1)	(1)	-------	-------	-------	-------	(1)	(1)	-------	-------	-------	-------	-------	-------	78,200	3,586,798
Virginia	2	-------	-------	-------	-------	(1)	(1)	(1)	(1)	-------	-------	(1)	(1)	-------	-------	-------	-------	(1)	(1)
Washington	4	-------	-------	-------	-------	(1)	(1)	(1)	(1)	-------	-------	6,030	27,706	-------	-------	-------	-------	6,750	36,646
Wisconsin	8	-------	-------	-------	-------	(1)	(1)	(1)	(1)	(1)	(1)	84,880	1,213,303	(1)	(1)	-------	-------	9,950	1,346,265
Undistributed	-------	47,020	251,521	43,420	30,101	302,590	1,914,616	79,940	182,855	1,417,910	4,962,768	49,920	506,299	404,390	45,763	548,810	963,195	1,040	69,731
	144	73,060	322,004	115,790	136,883	394,040	2,726,623	86,910	214,221	2,491,240	7,535,378	777,410	7,318,720	683,950	56,118	553,910	970,840	521,630	19,280,787
Average unit value	-------	-------	$4.41	-------	$1.18	-------	$6.92	-------	$2.46	-------	$3.02	-------	$9.41	-------	$0.08	-------	$1.75	-------	$36.96
Short tons (approximate)	-------	(2)	-------	9,620	-------	32,600	-------	-------	-------	204,530	-------	64,320	-------	4,830	-------	45,760	-------	-------	-------

[1] Included with "Undistributed."
[2] 877,170 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, 1943–47 [1]

Year	Cubic feet	Value	Year	Cubic feet	Value
1943	635,350	$2,267,777	1946	990,156	$3,461,801
1944	733,500	2,553,681	1947	937,403	3,534,798
1945	713,050	2,308,506			

[1] Barre granite is sold also for construction and crushed stone.

Estimated output of monumental granite in the Barre district, Vermont, 1945–47 [1]

	1945	1946	1947
Total quarry output, rough stock .... cubic feet	716,089	982,692	927,046
Shipped out of Barre district in rough .... do	143,217	196,538	185,409
Manufactured in Barre district .... do	572,872	786,154	741,637
Light stock consumed in district .... do	477,393	524,103	494,424
Dark stock consumed in district .... do	238,696	262,051	247,213
Number of cutters in district	1,318	1,500	1,748
Average daily wage	$10.50	$11.00	$12.50
Average number of days worked	250	250	186
Total pay roll for year	$3,459,750	$4,125,000	$4,064,100
Estimated overhead	1,729,875	2,062,500	2,032,050
Estimated value of light stock	1,862,833	2,718,781	2,688,430
Estimated value of dark stock	1,109,936	1,621,442	1,606,878
Estimated polishing cost	1,441,128	2,236,418	1,865,681
Estimated sawing cost	1,127,839	1,750,240	1,460,098
Total value of granite	10,731,361	14,514,381	13,717,237

[1] Through cooperation 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)

Because of their dark color, basalt and related rocks are not used extensively as building stone. Sales in 1947 for rough construction were greater than in 1946, but sales of rubble—a crude form of building stone—declined greatly. Basalt and associated rocks are used to some extent for memorials, but such stones are classed in the 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 1947, by States and uses

State	Active plants	Building stone				Total	
		Rough construction		Rubble		Short tons	Value
		Short tons	Value	Short tons	Value		
Colorado	1			(1)	(1)	(1)	(1)
Connecticut	1	(1)	(1)			(1)	(1)
Hawaii	2	(1)	(1)	(1)	(1)	(1)	(1)
Idaho	1			8,000	$8,640	8,000	$8,640
Oregon	1	3,310	$15,928			3,310	15,928
Pennsylvania	1	(1)	(1)			(1)	(1)
Undistributed		19,710	43,404	7,820	2,852	27,530	46,256
	7	[2] 23,020	59,332	15,820	11,492	38,840	70,824
Average unit value			$2.58		$0.73		$1.82

[1] Included with "Undistributed."
[2] 273,290 cubic feet (approximate).

MARBLE

In 1947 total sales of marble increased 12 percent in quantity and 30 percent in value compared with 1946. As in 1946, the marble industry is still benefiting from construction activity, as evidenced by the gain of 19 percent in quantity and 39 percent in value of building stone. Monumental stone in 1947 also increased in sales over 1946, with the gain in value amounting to 24 percent. The unit price increased 18 percent over that for 1946.

Marble (dimension stone) sold by producers in the United States, 1946–47, by uses

Use	1946		1947	
	Cubic feet	Value	Cubic feet	Value
Building stone:				
Rough:				
Exterior	9,170	$31,653	34,040	$147,483
Interior	[1] 98,330	[1] 245,470	141,680	385,139
Finished:				
Exterior	87,670	535,100	48,820	542,888
Interior	227,710	2,267,330	277,050	3,200,943
Total exterior	96,840	566,753	82,860	690,371
Total interior	326,040	2,512,800	418,730	3,586,082
Total building stone	422,880	3,079,553	501,590	4,276,453
Monumental stone:				
Rough	----------	----------	509,410	4,960,625
Finished	483,180	4,001,462		
Total monumental stone	483,180	4,001,462	509,410	4,960,625
Total building and monumental	906,060	7,081,015	1,011,000	9,237,078
Approximate short tons	77,010	----------	85,920	----------

[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 1947, by States and uses

State	Active plants	Building		Monumental		Total		
		Cubic feet	Value	Cubic feet	Value	Quantity: Cubic feet	Quantity: Short tons (approximate)	Value
Alabama	2	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Arkansas	1	8,800	$11,400	--------	----------	8,800	750	$11,400
Colorado	1	7,280	21,846	--------	----------	7,280	620	21,846
Georgia	1	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Maryland	1	7,940	67,718	--------	----------	7,940	670	67,718
Minnesota	1	1,010	34,760	--------	----------	1,010	70	34,760
Missouri	3	40,810	366,049	2,980	$24,357	43,790	3,720	390,406
North Carolina	1	--------	----------	2,920	32,666	2,920	250	32,666
Tennessee	5	268,320	1,959,254	15,920	217,344	284,240	24,160	2,176,598
Vermont	6	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed	--------	167,430	1,815,426	487,590	4,686,258	655,020	55,680	6,501,684
	22	501,590	4,276,453	509,410	4,960,625	1,011,000	85,920	9,237,078
Average unit value	--------	--------	$8.53	--------	$9.74	--------	----------	[2] $9.14
Short tons (approximate)	--------	42,620	----------	43,300	----------	--------	----------	----------

[1] Included with "Undistributed."
[2] Average value per cubic foot.

LIMESTONE

Limestone blocks cut to definite shapes and sizes are used almost exclusively for building purposes. Under normal conditions limestone is used extensively, particularly for interiors and exteriors of public buildings of all kinds, such as post offices, museums, churches, schools, and courthouses, as well as for commercial buildings. During the war, activity of the building-limestone industry was greatly curtailed. In 1947, as in 1946, this industry was steadily climbing in production. Less rough construction stone was reported than in 1946, but all other classes showed substantial gains in tonnage and value.

Production of cut stone increased 3 percent in quantity, 23 percent in total value, and 19 percent in unit value. Rubble output was 37 percent over that in 1946, while flagging rose to 61 percent above the previous year's figures. The total quantity of limestone sold or used increased 8 percent in quantity and 23 percent in value over 1946 figures. Details are shown in the accompanying table.

The area in the United States most productive of dimension limestone is in the vicinity of Bedford and Bloomington, Ind. This area supplied 82 percent of the rough architectural and finished (sawed and cut) limestone sold in 1947. The following tables show production in the Bedford-Bloomington, Ind., and Carthage, Mo., areas over a 5-year period.

Limestone sold by producers in the Indiana oolitic limestone district, 1943–47, by classes

Year	Construction					
	Rough block		Sawed and semifinished		Cut	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
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
1946	1,930,710	1,143,664	1,340,930	1,411,831	453,010	1,460,305
1947	2,082,330	1,492,620	1,398,440	1,563,008	470,620	1,834,447

Year	Construction—Continued			Other uses		Total	
	Total						
	Cubic feet	Short tons (approximate)	Value	Short tons	Value	Short tons (approximate)	Value
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	24,880	23,850	176,880	2,053,566
1946	3,724,650	270,040	4,015,800	77,550	45,144	347,590	4,060,944
1947	3,951,390	286,480	4,890,075	90,440	306,784	376,920	5,196,859

Cut stone is included with sawed and semifinished stone.

Limestone (dimension stone) sold or used by producers in the United States in 1947, by States and uses

State	Active plants	Building								Flagging		Total	
		Rough				Finished (cut and sawed)		Rubble					
		Construction		Architectural									
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Cubic feet	Value	Short tons (approximate)	Value
Alabama	3	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	---	---	(1)	(1)
California	6	640	$1,720	---	---	2,190	$3,500	650	$3,216	3,250	$3,800	1,730	$12,236
Colorado	1	---	---	---	---	---	---	(1)	(1)	---	---	(1)	(1)
Connecticut	1	160	372	---	---	---	---	---	---	---	---	160	372
Illinois	9	1,540	2,800	---	---	---	---	3,400	7,063	9,610	2,652	5,760	12,515
Indiana	19	(1)	(1)	2,082,330	$1,492,620	1,869,060	3,397,455	17,880	20,183	(1)	(1)	305,760	4,911,698
Iowa	2	---	---	---	---	---	---	(1)	(1)	(1)	(1)	1,560	6,095
Kansas	12	2,580	2,019	11,890	5,351	96,020	210,429	5,220	19,758	710	475	17,030	238,032
Kentucky	2	(1)	(1)	---	---	---	---	(1)	(1)	---	---	(1)	(1)
Michigan	2	(1)	(1)	---	---	270	1,150	140	710	8,350	4,970	(1)	(1)
Minnesota	5	(1)	(1)	(1)	(1)	(1)	(1)	3,480	11,033	(1)	(1)	12,420	340,572
Missouri	17	---	---	(1)	(1)	(1)	(1)	74,700	128,240	8,350	5,901	77,730	289,531
New York	3	(1)	(1)	---	---	---	---	(1)	(1)	(1)	(1)	6,240	13,665
Ohio	4	(1)	(1)	---	---	---	---	(1)	(1)	(1)	(1)	5,300	8,468
Oklahoma	1	(1)	(1)	---	---	---	---	(1)	(1)	---	---	(1)	(1)
Pennsylvania	9	20,960	55,529	---	---	---	---	(1)	(1)	(1)	(1)	22,410	58,230
Puerto Rico	1	---	---	---	---	---	---	(1)	(1)	---	---	(1)	(1)
South Dakota	1	---	---	---	---	---	---	---	---	(1)	(1)	(1)	(1)
Tennessee	2	(1)	(1)	---	---	---	---	(1)	(1)	---	---	(1)	(1)
Texas	5	(1)	(1)	209,720	209,547	138,070	389,962	(1)	(1)	1,720	1,555	25,590	601,576
Vermont	1	---	---	---	---	---	---	(1)	(1)	---	---	(1)	(1)
Virginia	1	(1)	(1)	---	---	---	---	---	---	---	---	(1)	(1)
West Virginia	1	(1)	(1)	---	---	---	---	---	---	---	---	(1)	(1)
Wisconsin	14	7,910	20,572	201,760	302,958	30,240	61,566	11,770	34,911	92,780	41,188	45,660	461,195
Undistributed	---	12,000	29,856	66,920	68,144	130,660	650,683	12,660	22,719	20,850	6,884	15,280	267,306
	122	45,790	112,868	2,572,620	2,078,620	2,266,510	4,714,745	129,900	247,833	145,620	67,425	542,630	7,221,491
Average unit value	---	---	$2.46	---	$0.81	---	$2.08	---	$1.91	---	$0.46	---	$13.31
Short tons (approximate)	---	(2)	---	188,600	---	166,570	---	---	---	11,770	---	---	---

[1] Included with "Undistributed."

[2] 554,990 cubic feet (approximate).

Purchased Indiana limestone sold by mills in the Indiana oolitic limestone district, 1943–47, by classes

Year	Sawed and semifinished		Cut		Total	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1943	(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
1946	42,360	44,200	590,320	1,972,265	632,680	2,016,465
1947	68,020	72,594	994,510	3,583,166	1,062,530	3,655,760

[1] A small quantity of sawed and semifinished stone included with cut stone.

Limestone and marble sold by producers in the Carthage district, Jasper County, Mo., 1943–47, 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
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	223,160	444,518	226,820	720,717
1946	49,190	289,866	10,610	41,718	59,800	5,080	331,584	265,260	550,998	270,340	882,582
1947	58,220	487,799	2,980	24,357	61,200	5,200	512,156	300,680	513,273	305,880	1,025,429

SANDSTONE

The total output of sandstone in 1947 increased 17 percent in quantity and 57 percent in value over the 1946 figures. Stone for rough construction increased 4 percent in tonnage but decreased 12 percent in value compared with 1946. In 1947 cut stone, slabs, and mill blocks increased 33 percent in quantity and 83 percent in value over the preceding year's figures. Curbing stone showed greater increases in quantity and value than did flagging.

As in previous years, Ohio was the principal producer. Its quarries produced 73 percent of the total value of output in 1947. Other producing States, in order of sales value, were New York, Tennessee, and Washington.

Sandstone (dimension stone) sold or used by producers in the United States in 1947, by States and uses

State	Active plants	Building								Rubble		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	Cubic feet	Value	Cubic feet	Value	Short tons (approximate)	Value
California	5	(1)	(1)	(1)	(1)					(1)	(1)			(1)	(1)	6,390	$43,500
Colorado	2	(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)			(1)	(1)	(1)	(1)
Illinois	1									(1)	(1)					(1)	(1)
Indiana	1			(1)	(1)											(1)	(1)
Kansas	3	(1)	(1)	6,410	$5,000	770	$1,200			(1)	(1)					1,190	9,513
Massachusetts	1			1,200	2,400	1,600	4,480	1,100	$5,600							310	12,480
Montana	1									(1)	(1)					(1)	(1)
New Jersey	1	(1)	(1)	(1)	(1)											(1)	(1)
New Mexico	1									(1)	(1)					(1)	(1)
New York [2]	10	440	$933	13,100	13,250	4,000	16,000	11,060	47,718	1,570	$5,720	20,910	$30,389	115,750	$160,875	15,820	274,885
Ohio	7			93,310	123,012	1,036,550	1,786,339	123,260	478,100			55,570	105,702	104,650	172,879	102,470	2,666,032
Pennsylvania [3]	16	11,790	34,362	15,370	6,569			410	838	7,430	28,501	4,470	2,966	43,540	57,147	24,420	130,383
Tennessee	2									(1)	(1)			(1)	(1)	(1)	(1)
Virginia	2	(1)	(1)											(1)	(1)	(1)	(1)
Washington	1					20,350	43,356	9,470	127,057							2,390	170,413
West Virginia	3									(1)	(1)					(1)	(1)
Wisconsin	5					(1)	(1)							(1)	(1)	900	16,520
Undistributed		13,570	83,266	5,330	4,718	9,690	15,300			18,640	174,018			104,460	118,265	33,640	332,234
	62	25,800	118,561	134,720	154,949	1,072,960	1,866,675	145,300	659,313	27,640	208,239	80,950	139,057	368,400	509,166	187,530	3,655,960
Average unit value			$4.60		$1.15		$1.74		$4.54		$7.53		$1.72		$1.38		$19.50
Short tons (approximate)		(4)		10,030		78,080		10,750				6,100		29,130			

[1] Included with "Undistributed."
[2] Includes 171,550 cubic feet of bluestone (approximately 14,500 tons) valued at $258,922 sold for construction, curbing, and flagging.
[3] Includes 103,130 cubic feet of bluestone (approximately 8,710 tons) valued at $67,246 sold for construction, curbing, and flagging.
[4] 326,270 cubic feet (approximate).

The accompanying table presents the sales of bluestone in 1943–47. 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. During the past several years the industry has declined somewhat due to inroads of concrete. However, as indicated in the table, production has been on the upgrade for the past 2 years.

Bluestone (dimension stone) sold or used in the United States, 1943–47 [1]

Year	Cubic feet	Value	Year	Cubic feet	Value
1943	99, 840	$92, 059	1946	273, 720	$274, 517
1944	156, 160	108, 732	1947	274, 680	326, 168
1945	109, 330	89, 448			

[1] New York and Pennsylvania were the only States that produced 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-colored volcanic rocks, soapstone, and greenstone. The quantity sold in 1947 decreased 12 percent, while the value increased 58 percent compared with 1946.

Miscellaneous varieties of stone (dimension stone) sold or used by producers in the United States in 1947, 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	6	(1)	(1)	(1)	(1)	(1)	(1)	410	$3, 103
Georgia	1			(1)	(1)			(1)	(1)
Maryland	4	(1)	(1)	7, 580	$31, 402	(1)	(1)	8, 930	38, 438
New Jersey	1	2, 300	$20, 000					2, 300	20, 000
New York	1	(1)	(1)					(1)	(1)
North Carolina	1	100	207					100	207
Pennsylvania	2	(1)	(1)	(1)	(1)	(1)	(1)	20, 530	70, 007
Virginia	2	(1)	(1)			(1)	(1)	(1)	(1)
Undistributed		30, 350	1, 363, 473	1, 040	2, 109	540	$9, 191	9, 640	1, 294, 627
	18	[2] 32,750	1, 383, 680	8, 620	33, 511	[3] 540	9, 191	41, 910	1, 426, 382
Average unit value			$42. 25		$3. 89		$17. 02		$34. 03

[1] Included with "Undistributed."
[2] Approximately 386,180 cubic feet.
[3] Approximately 6,470 cubic feet.

TRENDS IN USE OF DIMENSION STONE

The history of production of dimension stone by kinds, for a 32-year period, is indicated in figure 1. Dimension stone finds little use during war times, as illustrated by the low sales figures for 1918 and 1944. The trough of the 1931–36 period indicates that depressions also react strongly to the detriment of the dimension-stone industry. The sales figures started an upward climb in 1945 and indications are good for continued increases.

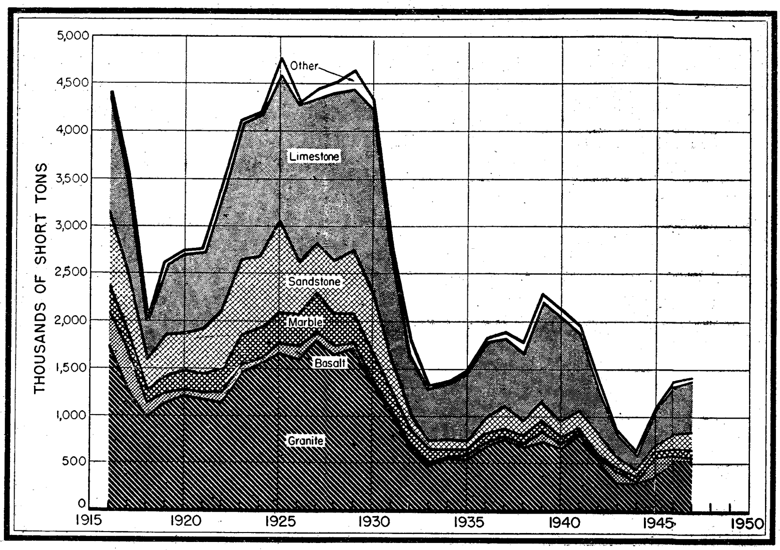

FIGURE 1.—Sales of dimension stone in the United States, by kinds, 1916–47.

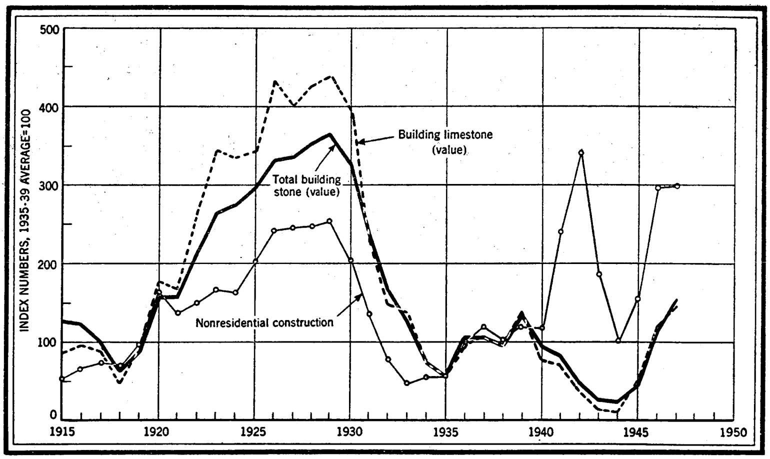

FIGURE 2.—Sales of all building stone and building limestone compared with nonresidential construction (public and private), 1915–47. Data on nonresidential building construction from Bureau of Foreign and Domestic Commerce.

Figure 2 traces for a 33-year period the history of production of all building stone and of the principal variety—limestone—in their relationship to nonresidential building, the class of construction that normally uses stone most extensively. During the war years, there was small demand for dimension stone for use in either residential or nonresidential construction. There is a backlog of potential public and private nonresidential building construction that has been delayed due to emphasis on the less-expensive type of residential construction. The dimension-stone industry should benefit from these building programs in the future.

TECHNOLOGIC DEVELOPMENTS

Two new developments of possible interest to dimension-stone producers are the use of coal cutters and a new system of thermic boring by means of the oxygen lance.[1] In England, the arc-shearing coal cutters have been used in underground limestone workings to remove large blocks of stone. One advantage of particular value is the small quantity of waste material produced in such an operation.

The oxygen lance, a tool already in use for cutting steel ingots, offers considerable promise in drilling rock, particularly those of high-silica content. Work on this method of drilling has been done in France, Belgium, and Great Britain. It is reported that the drilling is silent and the silicosis hazard considerably reduced.

CRUSHED AND BROKEN STONE

Over 200 million short tons of crushed and broken stone were produced in 1947, exclusive of that used for making cement and lime. Output increased 16 percent in quantity and 23 percent in value over the 1946 figures. The chief tonnage gains were in concrete and road metal, metallurgical uses, and riprap, in contrast with slight declines in the consumption of railroad ballast, stone for alkali works, and agricultural stone. The average value at the quarry increased 8 cents a ton.

The accompanying table of salient statistics shows the quantity sold and the value of output during 1946 and 1947, by uses. Detailed data on asphaltic stone and slate granules and flour are given in the Asphalt and Slate chapters of this volume.

[1] Mine & Quarry Engineering (London), vol. 14, No. 2, February 1948, pp. 37, 45.

Crushed and broken stone sold or used by producers in the United States, 1946–47, by principal uses

Use	1946			1947		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Concrete and road metal	90,358,900	$97,765,446	$1.08	107,077,590	$125,753,455	$1.17
Railroad ballast	16,908,350	13,127,058	.78	16,350,260	13,566,869	.83
Metallurgical	25,157,760	20,791,833	.83	32,570,270	28,687,950	.88
Alkali works	7,418,690	5,230,804	.71	7,074,270	5,295,318	.75
Riprap	3,847,550	5,010,207	1.30	5,732,740	6,513,792	1.14
Agricultural	22,781,750	32,482,907	1.43	22,605,500	35,075,883	1.55
Refractory (ganister, mica schist, dolomite, soapstone)	2,088,080	4,157,179	1.99	2,704,220	5,536,738	2.05
Asphalt filler	459,020	1,270,734	2.77	486,470	1,422,998	2.93
Calcium carbide works	411,660	437,231	1.06	846,860	846,293	1.00
Sugar factories	378,720	693,058	1.83	649,420	1,349,886	2.08
Glass factories	648,250	1,163,161	1.79	756,930	1,576,701	2.08
Paper mills	385,620	685,912	1.78	569,930	1,049,591	1.84
Other uses	6,633,430	18,551,736	2.80	8,711,870	21,776,486	2.50
	177,477,780	201,367,266	1.13	206,136,330	248,451,960	1.21
Portland and natural cement and cement rock [1]	43,877,000	(2)		49,530,000	(2)	
Lime [3]	11,985,000	(2)		13,558,000	(2)	
Total stone	233,340,000	(2)		269,224,000	(2)	
Asphaltic stone	777,467	2,861,591	3.68	1,004,740	3,756,074	3.74
Slate granules and flour	663,520	5,424,604	8.18	763,500	6,608,234	8.66

[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 1947.

Crushed stone for concrete and road metal and railroad ballast sold or used by producers in the United States, 1943–47

Year	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	90,358,900	97,765,446	16,908,350	13,127,058	107,267,250	110,892,504
1947	107,077,590	125,753,455	16,350,260	13,566,869	123,427,850	139,320,324

Crushed stone for concrete and road metal and railroad ballast sold or used by producers in the United States in 1947, by States

State	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	67,490	$115,899			67,490	$115,899
Alaska	(1)	(1)			(1)	(1)
Arizona	282,250	142,980	16,740	$17,628	298,990	160,608
Arkansas	369,130	454,631	293,330	234,329	662,460	688,960
California	8,142,610	7,107,805	412,200	206,053	8,554,810	7,313,858
Colorado	326,110	598,355			326,110	598,355
Connecticut	1,216,390	1,483,109	62,130	62,126	1,278,520	1,545,235
Delaware	(1)	(1)			(1)	(1)
Florida	3,105,650	3,852,287	(1)	(1)	[2] 3,105,650	[2] 3,852,287
Georgia	[2] 2,340,400	[2] 2,948,780	30,230	33,362	[2] 2,370,630	[2] 2,982,142
Hawaii	731,910	1,366,783	500	628	732,410	1,367,411
Idaho	[2] 815,340	[2] 815,485	(1)	(1)	949,700	938,322
Illinois	8,375,270	8,700,040	799,940	678,415	9,175,210	9,378,455
Indiana	3,017,710	3,268,061	282,970	295,098	3,300,680	3,563,159
Iowa	3,259,290	3,683,548	35,040	67,214	3,294,330	3,750,762
Kansas	2,287,860	2,621,095	1,521,450	479,000	3,809,310	3,100,095
Kentucky	3,726,350	4,538,656	420,800	332,122	4,147,150	4,870,778
Louisiana	180,720	115,793			180,720	115,793
Maine	137,350	272,211			137,350	272,211
Maryland	1,233,600	1,587,934	[2] 41,080	[2] 49,296	[2] 1,274,680	[2] 1,637,230
Massachusetts	1,941,840	2,202,985	199,640	218,218	2,141,480	2,421,203
Michigan	2,479,280	1,836,651	184,270	179,647	2,663,550	2,016,298
Minnesota	1,007,500	1,181,400	[2] 146,250	[2] 109,500	[2] 1,153,750	[2] 1,290,900
Missouri	3,856,440	4,682,820	1,086,380	431,825	4,942,820	5,114,645
Montana	16,180	16,600	433,960	322,917	450,140	339,517
Nebraska	(1)	(1)	(1)	(1)	33,260	59,094
Nevada	[2] 1,569,890	[2] 843,423			[2] 1,569,890	[2] 843,423
New Hampshire	61,850	77,360			61,850	77,360
New Jersey	3,217,700	4,623,956	[2] 460	[2] 556	[2] 3,218,160	[2] 4,624,512
New Mexico	[2] 101,380	[2] 18,835	301,500	196,700	[2] 402,880	[2] 215,535
New York	7,629,980	9,733,285	[2] 991,850	[2] 871,993	[2] 8,621,830	[2] 10,605,278
North Carolina	3,828,540	5,582,354	755,940	943,112	4,584,480	6,525,466
Ohio	[2] 7,506,830	[2] 8,000,664	1,170,340	1,157,135	[2] 8,677,170	[2] 9,157,799
Oklahoma	1,352,420	1,295,258	[2] 740,890	[2] 185,222	[2] 2,093,310	[2] 1,480,480
Oregon	2,418,900	3,881,809	126,670	121,220	2,545,570	4,003,029
Pennsylvania	8,337,650	10,874,725	759,530	934,019	9,097,180	11,808,744
Puerto Rico	[2] 84,490	[2] 166,326	[2] 3,200	[2] 2,926	97,430	183,952
Rhode Island	[2] 13,610	[2] 23,277			[2] 13,610	[2] 23,277
South Carolina	[2] 1,426,240	[2] 1,998,319	383,430	419,467	[2] 1,809,670	[2] 2,417,786
South Dakota	[2] 660,080	[2] 880,682			[2] 660,080	[2] 880,682
Tennessee	[2] 4,539,250	[2] 5,405,724	539,690	490,210	[2] 5,078,940	[2] 5,895.934
Texas	2,367,720	2,376,891	[2] 247,740	[2] 189,851	[2] 2,615,460	[2] 2,566,742
Utah	(1)	(1)			(1)	(1)
Vermont	[2] 88,680	[2] 126,958			[2] 88,680	[2] 126,958
Virginia	5,039,310	6,789,125	962,400	954,817	6,001,710	7,743,942
Washington	2,451,120	2,648,956	752,550	678,093	3,203,670	3,327,049
West Virginia	1,541,180	2,271,738	400,990	439,985	1,942,170	2,711,723
Wisconsin	3,327,680	3,382,759	161,740	139,445	3,489,420	3,522,204
Wyoming	[2] 28,700	[2] 25,556	[2] 247,650	[2] 224,987	1,106,540	1,121,809
Undistributed	567,720	1,131,567	1,836,780	1,899,753	1,396,950	1,963,423
	107,077,590	125,753,455	16,350,260	13,566,869	123,427,850	139,320,324

[1] Included with "Undistributed."
[2] To avoid disclosing confidential information, total is somewhat incomplete, the figures not included being combined with "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 before 1940, Government-sponsored enterprises produced 29 to 46 percent of the total output. They consisted chiefly of make-work organizations designed to meet the unemployment problem and, to a lesser extent, of State, county, and city highway boards or commissions. However, war conditions brought about a change in this situation. Unemployment ceased to be a problem. Highway construction, except for military roads, was virtually suspended, and even highway maintenance was widely curtailed. Consequently the output of stone by noncommerical agencies was very small. In 1946 noncommercial tonnage accounted for only 7 percent of the total. In 1947 the tonnage virtually doubled and rose to 11 percent of the total output.

Crushed stone for concrete and road metal sold or used by commercial and noncommercial operators in the United States, 1943–47

[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
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
1946	83,879,680	1.07	+41	93	6,479,220	1.23	+36	7	90,358,900	+41
1947	95,178,440	1.19	+13	89	11,899,150	1.09	+84	11	107,077,590	+19

GRANULES

Output of granules for roofing purposes has been canvassed completely since 1942. The following table shows total production for the past 5 years. Separate figures for slate granules are given in the Slate chapter of this volume.

Roofing granules [1] sold or used in the United States, 1943–47, by kinds

Year	Natural		Artificially colored		Brick		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	447,910	3,470,411	877,990	12,939,512	54,660	866,174	1,380,560	17,276,097
1947	504,980	4,166,810	1,133,870	17,905,899	56,570	998,434	1,695,420	23,071,143

[1] Manufactured from stone, slate, slag, and brick.

SIZE OF PLANTS

In 1946 the average crushed-stone plant produced about 107,000 tons; in 1947 this average increased to approximately 120,000 tons. During 1947, 37 percent of the plants reported less than 25,000 tons but contributed only 3 percent of the total output. On the other hand, the 26 plants that produced 900,000 tons or more contributed 25 percent of the total. The accompanying table shows additional details of the size pattern of the industry. Comparable statistics have been published in Minerals Yearbook for each year beginning with 1941.

Number and production of commercial crushed-stone [1] plants in 1946–47, by size of output

Size of output	1946				1947			
	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 total (short tons)
Less than 1,000 tons	65	29, 800	0. 02	29, 800	71	28, 490	0. 02	28, 490
1,000 to 25,000	602	6, 617, 380	3. 90	6, 647, 180	524	5, 673, 240	2. 96	5, 701, 730
25,000 to 50,000	251	8, 920, 110	5. 26	15, 567, 290	251	9, 250, 630	4. 82	14, 952, 360
50,000 to 75,000	159	9, 630, 090	5. 68	25, 197, 380	189	11, 406, 070	5. 95	26, 358, 430
75,000 to 100,000	109	9, 468, 710	5. 59	34, 666, 090	118	10, 171, 300	5. 30	36, 529, 730
100,000 to 200,000	173	23, 514, 570	13. 87	58, 180, 660	205	27, 466, 960	14. 32	63, 996, 690
200,000 to 300,000	96	23, 328, 280	13. 76	81, 508, 940	98	23, 837, 510	12. 43	87, 834, 200
300,000 to 400,000	47	16, 358, 320	9. 65	97, 867, 260	54	18, 823, 270	9. 81	106, 657, 470
400,000 to 500,000	24	10, 901, 680	6. 43	108, 768, 940	23	10, 309, 220	5. 37	116, 966, 690
500,000 to 600,000	11	6, 148, 290	3. 63	114, 917, 230	18	9, 726, 530	5. 07	126, 693, 220
600,000 to 700,000	11	7, 152, 140	4. 22	122, 069, 370	15	9, 707, 840	5. 06	136, 401, 060
700,000 to 800,000	5	3, 806, 600	2. 25	125, 875, 970	6	4, 570, 890	2. 38	140, 971, 950
800,000 to 900,000	4	3, 550, 500	2. 09	129, 426, 470	3	2, 591, 740	1. 35	143, 563, 690
900,000 tons and over	24	40, 081, 880	23. 65	169, 508, 350	26	48, 259, 700	25. 16	191, 823, 390
	1, 581	169, 508, 350	100. 00	169, 508, 350	1, 601	191, 823, 390	100. 00	191, 823, 390

[1] Exclusive of marble, which is primarily a dimension-stone industry.

METHODS OF TRANSPORTATION

As shown in the accompanying table, truck transportation is the principal method used in the crushed-stone industry, while rail is a close second. Waterways provide relatively minor but locally important facilities. In years prior to 1946 the table included only the transportation statistics of the commercial stone used for concrete and road metal.

Crushed stone sold or used in the United States in 1947, by methods of transportation

Method of transportation	Commercial operations		Commercial and noncommercial [1] operations	
	Short tons	Percent of total	Short tons	Percent of total
Truck	83, 726, 780	44	97, 897, 760	47
Rail	74, 359, 910	39	74, 359, 910	36
Waterway	22, 258, 940	11	22, 258, 940	11
Unspecified	11, 619, 720	6	11, 619, 720	6
	191, 965, 350	100	206, 136, 330	100

[1] Entire output of noncommercial operations assumed to be moved by truck.

GRANITE

Sales of crushed and broken granite increased 13 percent in quantity and 16 percent in value in 1947. The average sales value per ton increased 4 cents. Sales of riprap declined in quantity and value compared with 1946 figures. Crushed granite for concrete and road metal gained 17 percent in quantity and 27 percent in value, and the average value was 11 cents higher in 1947. Granite sold as railroad ballast advanced only 3 percent in quantity but 13 percent in value. The average sales value of such ballast increased 10 cents a ton. As indicated in the accompanying table, granite is produced in a great many States, but the majority of the output comes from the Southeastern States. North Carolina was the principal producer in 1947, followed by South Carolina, Georgia, California, and Virginia in that order.

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 most 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.

BASALT AND RELATED ROCKS (TRAP ROCK)

Basalt, gabbro, diorite, and other dark igneous rocks that are known commercially as trap rock are widely used in the construction industry. In 1947, Washington was the leading State, followed closely by New Jersey, then by Oregon, Massachuestts, California, Pennsylvania, Connecticut, and Idaho. Total sales of crushed and broken trap rock were 20 percent greater in quantity and 25 percent greater in value in 1947 than in 1946. The average value per ton increased from $1.26 to $1.31. See second table following for details.

Granite (crushed and broken stone) sold or used by producers in the United States in 1947, by States and uses

State	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
Alaska	----------	----------	----------	----------	----------	----------	(2)	(2)	(2)	(2)
California	134,320	$135,304	927,780	$744,437	(2)	(2)	(2)	(2)	1,558,350	$1,227,820
Colorado	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Connecticut	1,020	3,052	----------	----------	----------	----------	80	$458	1,100	3,510
Delaware	----------	----------	(2)	(2)	----------	----------	(2)	(2)	(2)	(2)
Georgia	4,200	5,250	1,691,480	2,178,020	30,230	$33,362	90,430	55,339	1,816,340	2,271,971
Maine	(2)	(2)	(2)	(2)	----------	----------	300	900	8,870	16,891
Maryland	(2)	(2)	52,660	86,988	(2)	(2)	----------	----------	101,160	202,988
Massachusetts	(2)	(2)	259,770	335,838	----------	----------	(2)	(2)	285,300	372,134
Minnesota	(2)	(2)	(2)	(2)	145,000	107,500	(2)	(2)	179,590	173,331
Missouri	1,850	2,354	----------	----------	----------	----------	----------	----------	1,850	2,354
Montana	(2)	(2)	(2)	(2)	----------	----------	----------	----------	(2)	(2)
New Hampshire	1,720	1,610	61,850	77,360	----------	----------	42,920	24,249	106,490	103,219
New Jersey	----------	----------	(2)	(2)	460	556	5,070	5,066	(2)	(2)
New York	(2)	(2)	(2)	(2)	----------	----------	----------	----------	(2)	(2)
North Carolina	7,840	12,142	2,145,140	3,276,526	724,210	908,212	404,180	362,694	3,281,370	4,559,574
Oklahoma	(2)	(2)	(2)	(2)	----------	----------	----------	----------	11,140	9,944
Oregon	----------	----------	----------	----------	----------	----------	1,710	23,125	1,710	23,125
Pennsylvania	----------	----------	60,000	75,000	----------	----------	----------	----------	60,000	75,000
Puerto Rico	----------	----------	13,200	13,200	----------	----------	----------	----------	13,200	13,200
Rhode Island	1,610	4,593	1,610	2,877	----------	----------	120	203	3,340	7,673
South Carolina	5,900	7,660	1,426,240	1,998,319	383,430	419,467	61,980	18,600	1,877,550	2,444,046
South Dakota	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Tennessee	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Vermont	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Virginia	----------	----------	921,980	1,346,079	379,580	399,899	----------	----------	1,301,560	1,745,978
Washington	(2)	(2)	(2)	(2)	----------	----------	9,040	44,568	92,440	110,625
Wisconsin	(2)	(2)	(2)	(2)	----------	----------	(2)	(2)	152,470	120,230
Wyoming	(2)	(2)	----------	----------	(2)	(2)	(2)	(2)	(2)	(2)
Undistributed	160,560	207,714	393,380	575,350	770,910	853,961	597,930	494,841	1,067,860	1,359,060
	319,020	379,679	7,955,090	10,709,994	2,433,820	2,722,957	1,213,760	1,030,043	11,921,690	14,842,673
Average unit value	----------	$1.19	----------	$1.35	----------	$1.12	----------	$0.85	----------	$1.25

[1] Includes stone used for concrete pipe, fill material, poultry grit, road base, stone sand, and unspecified uses.
[2] Included with "Undistributed."

Basalt and related rocks (trap rock) (crushed and broken stone) sold or used by producers in the United States in 1947, 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	----------	----------	250,000	$100,000	----------	----------	----------	----------	250,000	$100,000
California	292,810	$481,623	1,108,330	1,160,418	128,650	$94,395	----------	----------	1,529,790	1,736,436
Colorado	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Connecticut	7,770	8,033	1,215,530	1,480,995	62,130	62,126	----------	----------	1,285,430	1,551,154
Hawaii	1,890	3,400	731,910	1,366,783	500	628	38,610	$77,982	772,910	1,448,793
Idaho	(2)	(2)	815,340	815,485	(2)	(2)	----------	----------	1,036,780	982,959
Maine	----------	----------	1,430	3,060	----------	----------	----------	----------	1,430	3,060
Maryland	----------	----------	(2)	(2)	(2)	(2)	----------	----------	510,980	670,421
Massachusetts	12,590	8,587	1,499,420	1,638,500	199,640	218,218	36,840	95,778	1,748,490	1,961,083
Michigan	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Minnesota	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Montana	(2)	(2)	----------	----------	(2)	(2)	(2)	(2)	(2)	(2)
Nevada	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
New Jersey	(2)	(2)	2,959,430	4,308,326	(2)	(2)	----------	----------	3,354,370	4,820,495
New York	190	136	826,320	1,233,224	98,470	129,564	----------	----------	924,980	1,362,924
North Carolina	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Oregon	321,280	231,408	1,798,850	2,814,536	126,670	121,220	14,410	26,836	2,261,210	3,194,000
Pennsylvania	(2)	(2)	1,031,860	1,392,176	(2)	(2)	----------	----------	1,331,560	1,757,211
Puerto Rico	----------	----------	250	236	3,200	2,926	----------	----------	3,450	3,162
Rhode Island	----------	----------	12,000	20,400	----------	----------	----------	----------	12,000	20,400
Texas	(2)	(2)	(2)	(2)	(2)	(2)	----------	----------	(2)	(2)
Virginia	----------	----------	395,240	541,824	----------	----------	----------	----------	395,240	541,824
Washington	311,360	364,839	2,265,980	2,447,128	752,550	678,093	45,380	23,095	3,375,270	3,513,155
Wisconsin	----------	----------	(2)	(2)	----------	----------	(2)	(2)	(2)	(2)
Wyoming	(2)	(2)	----------	----------	----------	----------	----------	----------	(2)	(2)
Undistributed	421,050	430,228	701,020	1,069,054	916,850	1,047,808	171,430	1,185,422	783,290	2,017,413
	1,368,940	1,528,254	15,612,910	20,392,145	2,288,660	2,354,978	306,670	1,409,113	19,577,180	25,684,490
Average unit value	----------	$1.12	----------	$1.31	----------	$1.03	----------	$4.59	----------	$1.31

[1] Includes stone sold for fill material, roofing granules, and unspecified uses.
[2] Included with "Undistributed."

MARBLE

In the manufacture of marble blocks, large quantities of waste material accumulate, consisting either of defective blocks or cuttings and spalls from marble-dressing operations. This byproduct material is marketed for a great variety of uses listed in the footnote of the accompanying table. The average value varies considerably from State to State because in some States a large portion is marketed for high-priced products, such as terrazzo or marble flour, whereas in others a considerable amount must be sold for road stone, concrete aggregates, or other low-priced uses. Statistics on crushed and broken marble are shown in the accompanying table.

Marble (crushed and broken stone) sold by producers in the United States in 1947, by States [1]

State	Active plants	Short tons	Value
Alabama	2	(2)	(2)
Arkansas	1	150	$650
California	2	(2)	(2)
Georgia	1	(2)	(2)
Maryland	1	3,490	48,599
Missouri	1	2,370	14,190
New Jersey	1	1,500	11,000
New York	1	24,070	187,632
Tennessee	4	16,020	72,890
Texas	1	10,000	$118,000
Utah	1	5,920	69,322
Virginia	1	(2)	(2)
Washington	1	1,920	7,756
Undistributed		76,520	485,405
Total	18	141,960	1,015,444
Average unit value			7.15

[1] Includes stone used for agriculture, asphalt filler, cast stone, composition flooring, crushed stone, magnesia, mineral food, poultry grit, riprap, shingles, spalls, stucco, terrazzo, tile, whiting (excluding marble whiting made by companies that purchase their marble), and unspecified uses.
[2] Included with "Undistributed."

LIMESTONE

Sales of limestone were reported to the Bureau of Mines from 44 States and 2 Territories in 1947. Because of its wide distribution and relatively moderate production cost it is used more extensively than other types of stone in the United States. In 1947, limestone (excluding that used for making cement and lime) constituted 73 percent of the total crushed and broken stone produced in the United States. Sales of stone for fluxing increased 29 percent, while concrete and road-metal stone increased 12 percent. On the other hand, output of stone for riprap, railroad ballast, and agricultural uses declined slightly. The tonnages consumed in "Miscellaneous Uses," which as a group gained 12 percent, are shown in an accompanying table.

Limestone (crushed and broken stone) sold or used by producers in the United States in 1947, by States and uses

State	Riprap		Fluxing stone		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Agriculture		Miscellaneous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	20,350	$20,354	1,996,860	$1,981,956	67,490	$115,899	----------	----------	360,140	$396,706	258,810	$936,177	2,703,650	$3,451,092
Arizona	----------	----------	29,460	41,678	22,440	33,419	16,740	$17,628	----------	----------	----------	----------	68,640	92,725
Arkansas	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	115,470	256,917
California	(1)	(1)	95,170	206,000	317,080	400,447	----------	----------	(1)	(1)	575,260	1,860,048	991,040	2,476,898
Colorado	----------	----------	324,630	353,865	32,710	53,358	----------	----------	----------	----------	237,980	288,839	595,320	696,062
Connecticut	420	520	(1)	(1)	860	2,114	----------	----------	51,420	165,672	(1)	(1)	70,250	231,504
Florida	(1)	(1)	----------	----------	3,075,650	3,732,287	(1)	(1)	103,860	361,566	310,490	280,402	3,504,010	4,391,894
Georgia	----------	----------	----------	----------	648,920	770,760	----------	----------	231,090	422,253	117,240	347,734	997,250	1,540,747
Hawaii	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	13,100	21,910	13,100	21,910
Illinois	134,730	164,182	933,920	1,182,878	8,375,270	8,700,040	799,940	678,415	4,793,360	6,189,194	501,570	1,227,258	15,538,790	18,141,967
Indiana	16,060	22,813	47,550	53,495	3,017,710	3,268,061	282,970	295,098	1,747,030	2,134,599	172,470	568,256	5,283,790	6,342,322
Iowa	131,960	166,918	30,250	40,642	3,259,290	3,683,548	35,040	67,214	2,082,660	3,085,374	45,700	335,645	5,584,900	7,379,341
Kansas	177,860	221,545	20	40	1,730,460	2,291,637	85,720	104,372	674,200	1,048,300	17,830	97,550	2,686,090	3,763,444
Kentucky	5,640	7,716	----------	----------	3,726,350	4,538,656	420,800	332,122	824,100	983,870	13,280	13,210	4,990,170	5,875,574
Louisiana	----------	----------	----------	----------	180,720	115,793	----------	----------	----------	----------	711,390	711,391	892,110	827,184
Maine	(1)	(1)	----------	----------	36,230	40,802	----------	----------	(1)	(1)	(1)	(1)	124,430	392,486
Maryland	----------	----------	----------	----------	797,620	980,420	41,080	49,296	20,740	111,769	----------	----------	859,440	1,141,485
Massachusetts	(1)	(1)	21,320	41,053	(1)	(1)	----------	----------	207,500	725,247	46,380	276,570	275,990	1,044,117
Michigan	1,700	3,200	10,028,300	5,415,227	2,459,080	1,803,708	184,270	179,647	611,600	681,442	5,269,490	4,294,917	18,554,440	12,378,141
Minnesota	5,030	6,207	5,180	8,540	942,020	1,077,715	1,250	2,000	164,110	241,970	27,220	98,249	1,144,810	1,434,681
Mississippi	----------	----------	----------	----------	----------	----------	----------	----------	(1)	(1)	----------	----------	(1)	(1)
Missouri	458,260	739,776	18,730	26,587	3,242,690	4,478,649	102,080	119,553	2,071,890	3,397,264	369,100	846,785	6,262,750	9,608,614
Montana	(1)	(1)	(1)	(1)	(1)	(1)	----------	----------	----------	----------	34,950	83,772	158,440	214,352
Nebraska	114,380	125,151	----------	----------	(1)	(1)	(1)	(1)	----------	----------	72,140	353,579	219,780	537,824
Nevada	----------	----------	(1)	(1)	(1)	(1)	----------	----------	----------	----------	(1)	(1)	(1)	(1)
New Jersey	----------	----------	(1)	(1)	(1)	(1)	----------	----------	(1)	(1)	(1)	(1)	258,050	1,011,808
New Mexico	----------	----------	----------	----------	(1)	(1)	----------	----------	----------	----------	----------	----------	(1)	(1)
New York	94,290	164,852	130,470	151,269	6,570,860	8,155,146	893,380	742,429	473,030	1,596,724	1,740,610	1,852,319	9,902,640	12,662,739
North Carolina	----------	----------	----------	----------	1,229,620	1,691,535	31,730	34,900	3,660	5,195	----------	----------	1,265,010	1,731,630
Ohio	32,110	38,018	6,238,210	5,246,279	7,506,830	8,000,664	1,170,340	1,157,135	2,494,610	3,545,090	1,017,510	2,001,826	18,459,610	19,989,012
Oklahoma	28,310	32,666	(1)	(1)	1,050,770	1,140,621	(1)	(1)	249,190	395,751	39,040	95,376	1,557,170	1,820,194
Oregon	----------	----------	----------	----------	----------	----------	----------	----------	45,660	46,980	70,020	71,836	115,680	118,816

See footnote at end of table.

Limestone (crushed and broken stone) sold or used by producers in the United States in 1947, by States and uses—Continued

State	Riprap		Fluxing stone		Crushed stone				Agriculture		Miscellaneous		Tota	
					Concrete and road metal		Railroad ballast							
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Pennsylvania	141,440	$191,255	9,410,360	$10,529,644	6,471,190	$8,278,711	342,590	$413,396	1,056,180	$2,943,634	1,769,030	$3,193,097	19,190,790	$25,549,737
Puerto Rico	----------	----------	----------	----------	71,040	152,890	(1)	(1)	(1)	(1)	3,550	2,924	83,650	170,084
Rhode Island	----------	----------	----------	----------	----------	----------	----------	----------	12,610	62,478	----------	----------	12,610	62,478
South Carolina	----------	----------	----------	----------	(1)	(1)	----------	----------	(1)	(1)	(1)	(1)	(1)	(1)
South Dakota	1,830	2,888	50	100	424,650	488,974	----------	----------	----------	----------	12,030	18,682	438,560	510,644
Tennessee	7,420	8,540	28,200	33,543	4,539,250	5,405,724	539,690	490,210	1,284,170	1,520,148	336,480	641,007	6,735,210	8,099,172
Texas	(1)	(1)	166,000	165,100	1,706,030	1,834,358	247,740	189,851	(1)	(1)	725,220	596,240	2,911,330	2,840,570
Utah	----------	----------	(1)	(1)	(1)	(1)	----------	----------	----------	----------	74,170	219,953	172,760	298,933
Vermont	(1)	(1)	(1)	(1)	88,680	126,958	----------	----------	(1)	(1)	(1)	(1)	289,990	1,312,969
Virginia	12,240	16,307	456,530	542,532	3,537,210	4,575,274	567,460	543,398	752,460	907,979	1,024,360	1,539,028	6,350,260	8,124,518
Washington	----------	----------	2,210	2,975	690	2,370	----------	----------	29,930	152,658	129,170	323,586	162,000	481,589
West Virginia	----------	----------	2,185,260	2,199,363	1,069,780	1,487,634	400,990	439,985	150,230	299,578	569,610	764,204	4,375,870	5,190,764
Wisconsin	18,110	18,723	111,790	112,796	3,090,210	3,135,455	161,740	139,445	1,607,800	2,375,513	50,190	80,905	5,039,840	5,862,837
Wyoming	(1)	(1)	(1)	(1)	28,700	25,556	247,650	224,987	----------	----------	(1)	(1)	452,500	567,525
Undistributed	58,200	62,647	309,800	352,388	271,780	408,359	208,950	178,803	502,270	1,278,929	502,660	2,107,983	458,000	679,495
	1,460,340	2,014,278	32,570,270	28,687,950	69,589,880	80,997,542	6,782,150	6,399,884	22,605,500	35,075,883	16,858,050	26,151,258	149,866,190	179,326,795
Average unit value	----------	$1.38	----------	$0.88	----------	$1.16	----------	$0.94	----------	$1.55	----------	$1.55	----------	$1.20

[1] Included with "Undistributed."

Limestone (crushed and broken stone) sold or used by producers in the United States for miscellaneous uses, 1946–47

Use	1946 Short tons	1946 Value	1947 Short tons	1947 Value
Alkali works	7,418,690	$5,230,804	7,074,270	$5,295,318
Calcium carbide works	411,660	437,231	846,860	846,293
Coal-mine dusting	208,830	632,729	386,980	1,351,922
Filler (not whiting substitute):				
Asphalt	459,020	1,270,734	486,470	1,422,998
Fertilizer	553,680	1,076,728	483,770	862,389
Other	220,370	645,440	143,270	371,921
Filter beds	16,410	33,324	33,970	61,566
Glass factories	648,250	1,163,161	756,930	1,576,701
Limestone sand	622,230	437,882	743,060	651,607
Limestone whiting [1]	405,380	3,523,025	492,040	4,237,606
Magnesia works (dolomite) [2]	294,360	464,750	358,320	458,075
Mineral food	373,630	1,697,507	402,070	1,937,359
Mineral (rock) wool	22,200	23,400	25,780	30,489
Paper mills	385,620	685,912	569,930	1,049,591
Poultry grit	117,630	822,985	66,710	543,476
Refractory (dolomite)	1,035,110	1,146,864	1,540,740	1,728,623
Road base	283,820	252,806	771,010	523,573
Stucco, terrazzo, and artificial stone	25,830	171,113	32,560	309,919
Sugar factories	378,720	693,058	649,420	1,349,886
Other uses [3]	447,350	543,291	579,450	955,037
Use unspecified	753,930	1,101,884	414,440	586,909
	15,082,720	22,054,628	16,858,050	26,151,258

[1] Includes stone for filler for calcimine, caulking compounds, ceramics, explosives, floor coverings, foundry compounds, glue, insecticides, leather goods, paint, paper, phonograph records, picture-frame moldings, plastics, pottery, putty, roofing, rubber, tooth paste, wire coating, and unspecified uses.

[2] Includes stone for refractory magnesia.

[3] Includes stone for acid neutralization, athletic-field marking, carbon dioxide, chemicals (unspecified), concrete blocks and pipes, dyes, fill material, light bulbs, motion-picture snow, oil-well drilling, patching plaster, pharmaceuticals, rayon, roofing granules, spalls, and water treatment.

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 Lime chapter of this volume. 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, however, declined and none has been reported since 1945.

Sales of dolomite and its primary product of calcination—dolomitic lime—for certain uses are covered in the accompanying table.

Dolomite and dolomitic lime sold or used by producers in the United States for specified purposes, 1946–47

	1946 Short tons	1946 Value	1947 Short tons	1947 Value
Dolomite for—				
Basic magnesium carbonate [1]	294,360	$464,750	358,320	$458,075
Refractory uses	1,035,110	1,146,864	1,540,740	1,728,623
Dolomitic lime for—				
Refractory (dead-burned dolomite)	1,077,980	10,101,707	1,395,200	14,295,359
Paper mills	35,000	323,000	48,000	453,000
Total (calculated as raw stone)	3,555,000	-----------	4,785,000	-----------

[1] Includes dolomite for refractory magnesia.

The following table shows the tonnages and values of fluxing stone sold for use in various metallurgical operations.

Sales of fluxing limestone, 1943–47, 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
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
1946	19,674,130	15,803,857	4,869,300	4,342,467	449,050	490,566	165,280	154,943	25,157,760	20,791,833
1947	25,817,270	22,000,942	6,059,440	5,862,292	512,880	593,811	180,680	230,905	32,570,270	28,687,950

[1] Includes flux for copper, gold, lead, zinc, and unspecified smelters.
[2] Includes flux for foundries and for cupola and electric furnaces.

Inasmuch as the statistics of the lime and cement industries are presented in separate chapters of the Minerals Yearbook, they are not covered in the Stone chapter. However, a commodity review of limestone would be incomplete without recognition of the large tonnage of limestone consumed by these industries. Consequently, the following table shows the total tonnage of limestone consumed for all purposes.

Limestone sold or used for all purposes in the United States, 1945–47, in short tons

Use	1945	1946	1947
Limestone (as given in this report) (approximate)	112,574,000	134,717,000	150,409,000
Portland and natural cement and cement rock [1]	27,332,000	43,877,000	49,530,000
Lime [2]	11,841,000	11,985,000	13,558,000
	151,747,000	190,579,000	213,497,000

[1] Reported in terms of cement in Cement chapter of this volume.
[2] Reported in terms of lime in Lime chapter of this volume.

SANDSTONE

Sales of crushed and broken sandstone increased 62 percent in quantity and 42 percent in value in 1947 compared with 1946. Increases in tonnage were registered for all uses of crushed and broken sandstone, the greatest of which was for concrete and road metal while refractory stone showed the least increase. Average unit values increased for refractory stone and concrete and road metal, and decreased for all other uses. Details are indicated in an accompanying table.

MISCELLANEOUS STONE

Crushed and broken stone, other than the five principal varieties already discussed, includes light-colored volcanic rocks, schists, boulders from river beds, serpentine, and flint. A following table shows sales of stone of these types in 1947. Total sales increased 49 percent in quantity and 77 percent in value in 1947 compared with 1946. See second table following for details.

Sandstone (crushed and broken stone) sold or used by producers in the United States in 1947, 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			18, 220	$10, 800							18, 220	$10, 800
Arkansas	[2]	[2]			[2]	[2]					93, 730	179, 683
California	[2]	[2]	255, 930	241, 392	1, 158, 800	$1, 089, 623	[2]	[2]	418, 550	$120, 620	1, 842, 270	1, 509, 981
Colorado	[2]	[2]	[2]	[2]	70, 170	43, 576					245, 300	150, 942
Illinois	580	$6, 024									580	6, 024
Kansas			95, 410	152, 714	70, 570	112, 912	66, 730	$80, 073			232, 710	345, 699
Massachusetts					[2]	[2]					[2]	[2]
Minnesota			[2]	[2]	[2]	[2]			[2]	[2]	4, 900	7, 133
Missouri			[2]	[2]							[2]	[2]
Montana							205, 780	157, 778			205, 780	157, 778
Nevada			[2]	[2]							[2]	[2]
New Mexico			73, 600	32, 714	101, 380	18, 835	301, 500	196, 700			476, 480	248, 249
New York					65, 000	96, 500					65, 000	96, 500
North Carolina					[2]	[2]					[2]	[2]
Ohio	47, 040	423, 225	[2]	[2]					[2]	[2]	143, 510	969, 921
Oklahoma					[2]	[2]					[2]	[2]
Pennsylvania	686, 840	2, 146, 272	[2]	[2]	609, 350	884, 881	[2]	[2]	[2]	[2]	1, 419, 040	3, 195, 323
South Dakota	76, 600	160, 684	[2]	[2]	213, 020	368, 775			[2]	[2]	397, 820	669, 270
Tennessee			[2]	[2]							[2]	[2]
Texas					75, 480	132, 096					75, 480	132, 096
Utah	[2]	[2]	[2]	[2]							[2]	[2]
Virginia	86, 650	197, 624			37, 860	84, 721	15, 360	11, 520	5, 390	6, 092	145, 260	299, 957
Washington			280	1, 020							280	1, 020
West Virginia	[2]	[2]	[2]	[2]	471, 400	784, 104			[2]	[2]	502, 590	821, 301
Wisconsin	171, 780	523, 935	12, 000	12, 900					439, 120	3, 292, 493	622, 900	3, 829, 328
Wyoming			[2]	[2]	[2]	[2]					[2]	[2]
Undistributed	73, 350	277, 833	337, 800	325, 623	153, 060	280, 687	120, 870	159, 903	86, 080	495, 895	129, 700	299, 539
	1, 142, 840	3, 735, 597	793, 240	777, 163	3, 026, 090	3, 896, 710	710, 240	605, 974	949, 140	3, 915, 100	6, 621, 550	12, 930, 544
Average unit value		$3. 27		$0. 98		$1. 29		$0. 85		$4. 12		$1. 95

[1] Includes sandstone for chemical use, concrete blocks, fill material, poultry grit, road base, rock wool, roofing granules, stone sand, and unspecified uses.
[2] Included with "Undistributed."

Miscellaneous varieties of stone (crushed and broken stone) sold or used by producers in the United States in 1947, 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)
Arizona	7,210	$6,805	9,810	$9,561					17,020	$16,366
Arkansas	(2)	(2)	(2)	(2)	(2)	(2)			(2)	(2)
California	1,486,300	1,472,116	4,630,620	3,712,880	217,020	$61,251	487,450	$451,032	6,821,390	5,697,279
Colorado			148,230	292,761					148,230	292,761
Florida			30,000	120,000					30,000	120,000
Georgia			(2)	(2)					(2)	(2)
Idaho			(2)	(2)					(2)	(2)
Kansas [3]			[4] 486,830	[4] 216,546	1,369,000	294,555			[4] 1,855,830	[4] 511,101
Maine	(2)	(2)	(2)	(2)					(2)	(2)
Maryland	(2)	(2)	(2)	(2)			(2)	(2)	(2)	(2)
Massachusetts	(2)	(2)	(2)	(2)					194,000	275,500
Michigan			(2)	(2)			(2)	(2)	30,440	188,629
Missouri [5]	[4] 220	[4] 163	[4] 613,750	[4] 204,171	[4] 984,300	[4] 312,272	486,210	228,075	[4] 2,084,480	[4] 744,681
Montana					(2)	(2)			(2)	(2)
Nevada			1,569,890	843,423					1,569,890	843,423
New Jersey			(2)	(2)					(2)	(2)
New Mexico	(2)	(2)							(2)	(2)
New York			(2)	(2)	(2)	(2)			201,220	164,168
North Carolina			338,740	435,074					338,740	435,074
Ohio			(2)	(2)					(2)	(2)
Oklahoma [3]			292,900	145,550	740,890	185,222			1,033,790	330,772
Oregon			620,050	1,067,273					620,050	1,067,273
Pennsylvania			165,250	243,957			84,740	584,620	249,990	828,577
Puerto Rico			(2)	(2)					(2)	(2)
Rhode Island			(2)	(2)					(2)	(2)
South Carolina			(2)	(2)					(2)	(2)
South Dakota			22,410	22,933					22,410	22,933
Texas	(2)	(2)	(2)	(2)	(2)	(2)			656,190	459,920
Virginia	(2)	(2)	147,020	241,227			(2)	(2)	148,140	244,668
Washington	(2)	(2)	(2)	(2)					224,060	229,071
Wisconsin			26,240	33,236					26,240	33,236
Wyoming	(2)	(2)			(2)	(2)			(2)	(2)
Undistributed	297,470	335,334	1,791,880	2,168,472	824,180	629,776	129,150	333,729	1,735,650	2,146,582
	1,791,200	1,814,418	10,893,620	9,757,064	4,135,390	1,483,076	1,187,550	1,597,456	18,007,760	14,652,014
Average unit value		$1.01		$0.90		$0.36		$1.35		$0.81

[1] Includes stone used for agriculture, asphalt filler, concrete blocks, fill material, refractory, road base, roofing granules, spalls, stucco, and unspecified uses.
[2] Included with "Undistributed."
[3] Chats; figures collected by Denver, Colo., office of the Bureau of Mines.
[4] Includes a small quantity of stone.
[5] Chats and chert aggregates; figures collected by Denver, Colo., office of the Bureau of Mines.

MARKETS

As indicated in preceding sections of this chapter, one of the chief uses of crushed stone is as concrete aggregates and road metal in the construction of buildings and highways. It is to be expected, therefore, that crushed-stone sales will follow the trend of cement shipments, the area of new concrete pavements, and the value of new construction. These relationships are indicated in figure 3. There is a definite correlation of trends; and, inasmuch as the demand for crushed stone in construction was upward in 1947, the prospect for continued increases is excellent.

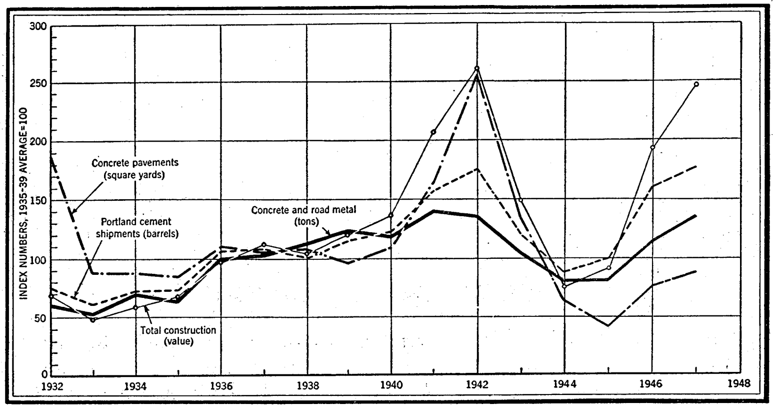

FIGURE 3.—Crushed-stone aggregates (concrete and road metal) sold or used in the United States compared with shipments of portland cement, total construction (value), and concrete pavements (contract awards, thousands of square yards), 1932–47. Data on construction and concrete pavements from Bureau of Foreign and Domestic Commerce.

The metallurgical industries operated at high rates during 1947. Pig-iron production—more than 58 million short tons—was 30 percent greater than in 1946; and steel production—nearly 85 million tons—was 27 percent greater than in the preceding year. As a result of these increases, metallurgical stone sales increased 29 percent. Similarly, sales of refractories, such as dead-burned dolomite and ganister used as silica brick, increased. The correlations of fluxing-stone output with pig-iron production and of refractory stone with steel-ingot production are shown in figure 4.

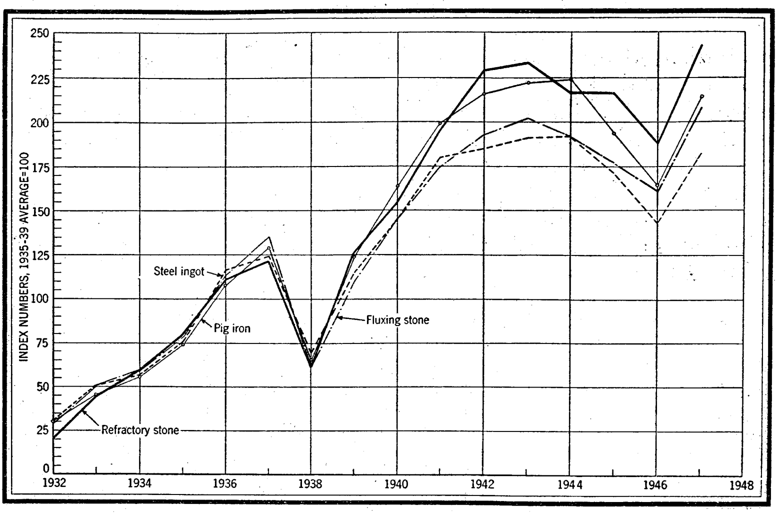

FIGURE 4.—Sales (tons) of fluxing stone and refractory stone (including that used in making lime) compared with production of steel ingot and pig iron, 1932–47. Statistics of steel-ingot production compiled by American Iron and Steel Institute.

TECHNOLOGIC DEVELOPMENTS

The use of "skull crackers" or the drop-ball method for reducing large fragments of stone to smaller sizes was mentioned in the 1946 Stone chapter. Further developments with this apparatus during 1947 were use of plexiglass sheets (1 by 18 by 36 inches) set in rubber on the crane to protect the operator from flying pieces of stone and the use of a small ball above the breaking ball to keep the wire rope taut. Several operators report that the success of the drop-ball method depends largely upon the skill of the crane operator. The use of this method for reducing the size of stone promises to become widely accepted in the industry.[2]

Other developments of interest to the stone industry included use of rotary-type drill bits, faster and denser explosives to increase production of smaller sizes, and the use of plastic crusher bearings. It is stated that a plastic type of bearing used in the swinging jaw bearings of a 60- by 40-inch jaw crusher gave far better results than any other type used. Another advantage of this type of bearing is that upon failure it causes no damage. One manufacturing concern reported that a curved jaw plate gives a finer product or more capacity with somewhat less wear on the jaw plates.[3]

FOREIGN TRADE [4]

Importation of stone into the United States in 1947 showed a considerable increase in value over the 1946 figures. The total value for 1947 was approximately 1¼ times as great as in 1946. The greatest gain, from the standpoint of value, was made by granite. Value of

[2] Rock Products, vol. 50, No. 3, March 1947, p. 82.
[3] Pit and Quarry, vol. 39, No. 8, February 1947, pp. 74–75.
[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.

imports decreased for travertine, granite paving blocks, and "all other manufactures" under the marble, breccia, and onyx group.

The export trade, although relatively small, increased in 1947 compared with 1946. The increases for marble and other building and monumental stone were 42 percent in quantity and 26 percent in value. Other manufactures of stone increased 102 percent in value in 1947.

Stone and whiting imported for consumption in the United States, 1946–47, by classes

[U. S. Department of Commerce]

Class	1946		1947	
	Quantity	Value	Quantity	Value
Marble, breccia, and onyx:				
Sawed or dressed, over 2 inches thick----cubic feet--	1	$4	21	$77
In blocks, rough, etc----do----	105,997	520,479	169,812	703,311
Slabs or paving tiles----superficial feet--	39,792	22,075	83,739	30,345
All other manufactures----	----------	101,588	----------	99,115
	----------	644,146	----------	832,848
Granite:				
Dressed----cubic feet--	17,379	138,788	51,046	484,574
Rough----do----	100,765	261,879	89,697	262,390
Paving blocks, wholly or partly manufactured number--	8	295	1	29
	----------	400,962	----------	746,993
Quartzite----short tons--	215,084	548,004	215,688	592,485
Travertine stone----cubic feet--	84,710	133,334	24,860	43,108
Stone (other):				
Dressed----	----------	1,175	----------	3,498
Rough (monumental or building stone)--cubic feet--	3,183	5,111	5,872	10,500
Rough (other)----short tons--	33,727	59,316	43,774	81,831
Marble chip or granito----do----	3,881	44,533	11,928	81,224
Crushed or ground, n. s. p. f----	----------	4,585	----------	6,328
	----------	114,720	----------	183,381
Whiting:				
Chalk or whiting, precipitated----short tons--	2,190	85,506	2,375	99,488
Whiting, dry, ground, or bolted----do----	5,381	67,437	3,089	43,971
Whiting, ground in oil (putty)----do----	1	121	(1)	22
	----------	153,064	----------	143,481
Grand total----	----------	1,994,230	----------	2,542,296

1 Less than 1 ton.

Stone exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Marble and other building and monumental stone		Other manufactures of stone (value)
	Cubic feet	Value	
1943----	65,614	$184,772	$151,650
1944----	78,164	201,036	176,423
1945----	119,004	337,666	174,874
1946----	224,692	463,572	280,380
1947----	320,016	583,826	567,388

Sulfur and Pyrites

By G. W. JOSEPHSON and M. G. DOWNEY [1]

GENERAL SUMMARY

DEMAND from both foreign and domestic buyers of American native sulfur was so great that production and shipments were at record highs in 1947. On the other hand, although it increased slightly, Italian production was still greatly curtailed owing to high production costs and foreign exchange difficulties.

The postwar dislocation of trade, particularly in Europe, was still a serious deterrent to pyrites production, but gradually larger quantities were moving through the channels of international trade. This benefitted major pyrites-exporting countries, such as Spain and Cyprus. Output in Germany, Japan, and Italy was expanding rather slowly. In the United States pyrites production attained a record level, as industrial and agricultural demand for sulfuric acid was extremely high.

The trend toward increases in prices of sulfur noted in 1946 continued in 1947, and new base prices for crude sulfur at the mine were established.

[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 sulfur industry in the United States, 1935–39 (average) and 1944–47

	1935–39 (average)	1944	1945	1946	1947
Sulfur:					
Production of crude sulfur..long tons..	2, 175, 057	3, 218, 158	3, 753, 188	3, 859, 642	4, 441, 214
Shipments of crude sulfur—					
For domestic consumption..do....	1, 420, 236	2, 865, 397	2, 914, 603	2, 939, 140	3, 529, 043
For export....do....	566, 361	653, 686	918, 691	1, 189, 072	1, 299, 060
Total shipments....do....	1, 986, 597	3, 519, 083	3, 833, 294	4, 128, 212	4, 828, 103
Imports:					
Ore....do....	555				
Other....do....	3, 427	32	33	35	15
Exports of treated sulfur....do....	16, 374	21, 546	23, 971	56, 748	50, 477
Producers' stocks at end of year [1]..do....	3, 560, 000	3, 500, 000	3, 500, 000	3, 200, 000	2, 800, 000
Price of crude sulfur per long ton f.o.b. mines....	$17. 40	$16	$16	$16	$16–$18
Pyrites:					
Production....long tons..	544, 144	788, 530	722, 596	813, 372	940, 652
Imports....do....	433, 485	180, 763	186, 507	182, 893	126, 553
Price of imported pyrites c. i. f. Atlantic ports, cents per long-ton unit..	12–13	14	14	14	15
Sulfuric acid: Production of pybroduct sulfuric acid (basis, 100 percent) at copper and zinc plants....short tons..	564, 794	900, 989	842, 635	716, 216	725, 197

[1] Stocks held at mines only.

RESERVES

In 1947, a reserve study, made jointly by the Bureau of Mines and the Geological Survey, was published by the United States Senate.[2] The section on sulfur reserves (as of 1944) is quoted as follows:

[The accompanying table] lists the reserves of sulfur in known domestic deposits of native sulfur and pyrite, including both the sulfur available under conditions as in 1944 and the additional sulfur that may become available under future demand. Byproduct sources now supply a substantial part of the sulfur and may become more important in future; the estimated reserves from these sources are listed in [the accompanying table]. Although the reserves in by-product sources are large, the sulfur only becomes available slowly in quantities determined by the rate at which the main product is made.

Estimated reserves of sulfur in the United States available in deposits of native sulfur and pyrite

[In long tons of sulfur]

	Available under conditions as in 1944	Additional available in future
Native sulfur:		
Gulf Coast region....	60, 000, 000	20, 000, 000
Western States....		2, 000, 000
Alaska....		200, 000
Total....	60, 000, 000	22, 200, 000
Pyrite:		
Arizona (United Verde mine)....		35, 000, 000
California (Hornet mine)....	1, 000, 000	
Maine (Katahdin deposit)....		10, 000, 000
Missouri....		1, 000, 000
New York....		3, 000, 000
Southeastern States....	25, 000, 000	
Alaska....		1, 000, 000
Total....	26, 000, 000	50, 000, 000
Grand total....	86, 000, 000	72, 000, 000

[2] Hearings before a Subcommittee of the Committee on Public Lands, United States Senate, 80th Cong., 1st Session, on investigations of the Factors Affecting Minerals, Fuels, Forestry, and Reclamation Projects, May 15, 16, and 20, 1947, pp. 292–296.

Estimated reserves of sulfur available in pyrite and sulfur compounds from byproduct sources in the United States

[In millions of long tons of sulfur]

Source	Approximate quantity in known deposits	Sulfur recoverable in 100 years at present rates
Deposits of sulfide ores of copper, lead, and zinc:		
Pyrite recoverable in milling the ores	75	6.0
Sulfuric acid and other compounds recoverable from waste gases of smelters	45	20.0
Coal deposits:		
Coal brasses recoverable in washing coal	3,000	.8
Sulfuric acid and other compounds from gases of coking and coal-gas plants	3,000	2.4
Sulfuric acid from stack gases of power plant	3,000	
Sulfuric acid from natural gas and crude petroleum	16	
Deposits of gypsum and anhydrite	(1)	

[1] Virtually unlimited.

For the deposits of native sulfur in the Gulf coast region, the reserves in the two largest deposits—the Boling Dome and the Grande Ecaille Dome—constitute a large part of the reserves classed as available under present conditions. Reserves in the Western States are comparatively small; and although some have produced sulfur in recent years, in terms of the industry as a whole they are considered as available only in the future.

At current production rates, the known deposits of native sulfur have a probable life of at least 30 years. Although the reserves of native sulfur are being depleted more rapidly than those of pyrite, the life expectancy of both is being extended by exploration and by imports of pyrite, as well as by increase in the domestic supply of byproduct sulfur. Byproduct sources are not thoroughly exploited and may be expected to continue to yield large and possibly increasing quantities. In any case, it is generally believed that, even if the Nation's known reserve of native sulfur is not substantially bolstered by future discoveries, other domestic sources will be able to supply its needs, possibly at somewhat higher prices. The total domestic reserves available are so great that, assuming that the technology of recovery shows average improvement, any probable annual requirement could be obtained, from one source or another, for generations.

It should be noted that the rate of production of native sulfur is now substantially higher than during the period in which the above report was prepared.

SULFUR

DOMESTIC PRODUCTION

In response to an unprecedented demand from both domestic and foreign buyers, the production of native sulfur attained a new record of 4,441,214 long tons in 1947—15 percent more than in 1946. Shipments from mines, also a new record, totaled 4,828,103 tons—an increase of 17 percent. These tonnages apply only to the output of Frasch-process mines. In addition, comparatively small quantities were produced by conventional mining methods in California, Colorado, Nevada, and Texas principally for agricultural purposes.

REVIEW BY STATES

Texas furnished 80 percent and Louisiana almost 20 percent of the native sulfur output of the United States in 1947.

Sulfur produced and shipped in the United States, 1943–47 [1]

Year	Produced (long tons)			Shipped	
	Texas	Louisiana	Total	Long tons	Approximate value
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
1946	2, 975, 472	884, 170	3, 859, 642	4, 128, 212	66, 100, 000
1947	3, 561, 214	880, 000	4, 441, 214	4, 828, 103	85, 200, 000

[1] In addition to the refined sulfur shown, native sulfur ore (10–70 percent S) for agriculture use was produced in Colorado and Texas in 1943–47 and in California and Nevada in 1946–47. Total shipments of this material were as follows, in long tons: 1943—2,572 ($26,215); 1944—1,639 ($8,950); 1945—1,615 (corrected figure) ($12,170); 1946—6,344 ($95,531); 1947—4,303 ($65,124).

California.—Roy Kitching produced at the Crater claims and Bailey Miche at the Fraction No. 1 mines. Both of these operations were at Big Pine, Inyo County.

Colorado.—Sulfur ore was mined by the General Agricultural Products Co. in Delta County.

Louisiana.—Output of the Grande Ecaille mine of the Freeport Sulphur Co. in Plaquemines Parish totaled 880,000 long tons in 1947. The Company announced [3] an expansion program of $4,900,000 at this mine.

Nevada.—Production of sulfur in Humboldt County was reported by W. S. Peterson at the Oscar Streeter mine.

Texas.—The following companies operated in Texas in 1947: 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, and at Long Point Dome, Fort Bend County; Texas Gulf Sulphur Co. at Boling Dome, Wharton County; and the Pecos Orla Sulphur Co., Inc., at Michigan Claims, Culberson County. Exhaustion of the deposit at Clemens Dome operated by Jefferson Lake Sulphur Co. has been expected for some time. However, a modest but steady output was maintained throughout 1947. The construction program of the Texas Gulf Sulfur Co. at Moss Bluff Dome, Liberty County, progressed rapidly during 1947. The mine was scheduled to be in production sometime in 1948.

Sulfur produced in Texas in 1947, by companies, in long tons

Company	First quarter	Second quarter	Third quarter	Fourth quarter	Total
Texas Gulf Sulphur Co	572, 482	669, 132	771, 537	754, 103	2, 767, 254
Freeport Sulphur Co	93, 750	95, 045	93, 825	89, 700	372, 320
Jefferson Lake Sulphur Co., Inc	62, 680	60, 285	65, 977	56, 238	245, 180
Duval Texas Sulphur Co	45, 465	52, 670	44, 410	33, 915	176, 460
Total	774, 377	877, 132	975, 749	933, 956	3, 561, 214

Wyoming.—The F. A. Sheridan Construction Co. is reported to have produced sulfur from a deposit in a geyser basin about 3 miles west of Cody, Wyo.

[3] Pit and Quarry, vol. 40, No. 4, October 1947, p. 57.

RECOVERY AS BYPRODUCT

Whereas native sulfur and pyrites that are mined primarily for their sulfur content continue to serve as the major sources in the United States, substantial quantities of sulfur are also obtained as byproducts.

A large tonnage of pyrites is recovered as flotation concentrate in milling copper and zinc ores. Some of our domestic coals contain massive coal brasses that can be easily separated by washing and jigging. Statistics of these concentrates are included in the Pyrites section of this chapter.

During smelting, concentrates of copper and zinc sulfides give off sulfur-bearing gases which are converted into acid at many smelters. The equivalent of 237,000 long tons of sulfur was recovered from this source in 1947. The following table shows the output of acid at smelters during the past 5 years. The figures in this table are expressed as 100 percent sulfuric acid rather than as 60° B. as in previous Minerals Yearbooks.

Byproduct sulfuric acid (basis, 100 percent) produced at copper, zinc, and lead plants in the United States, 1943–47, in short tons

	1943	1944	1945	1946	1947
Copper plants [1]	270, 938	248, 988	231, 697	171, 687	126, 494
Zinc plants	682, 926	652, 001	610, 938	544, 529	598, 703
	953, 864	900, 989	842, 635	716, 216	725, 197

[1] Includes sulfuric acid produced as byproduct at a lead smelter.

Other industrial gases also yield sulfur either in elemental form or as hydrogen sulfide. Coke-oven, refinery, natural, and other industrial gases produced in 10 States provided a total of 43,427 tons (calculated as 100 percent sulfur) in 1947 when treated by the Thylox, Ferrox, Nickel, or Sasco processes. Shipments totaled 40,315 long tons, of which 83 percent was sold as brimstone and the remainder as paste containing 35 to 50 percent sulfur. The Phenolate, Phosphate, and Girbotol processes were used in recovering hydrogen sulfide from fuel gases. The product is converted to sulfuric acid or burned as fuel. Hydrogen sulfide, recovered in three States, in 1947 contained 20,631 long tons of sulfur.

CONSUMPTION AND USES

As shown in the accompanying table, consumption of sulfur in the United States attained a new record in 1947—20 percent greater than the previous high established in 1945. Apparent sales (including exports) reached the record total of 4,839,548 long tons.

Apparent consumption of sulfur in the United States, 1943–47, in long tons

	1943	1944	1945	1946	1947
Shipments to consumers (apparent)	3, 191, 051	3, 580, 058	3, 849, 591	4, 094, 191	4, 839, 548
Imports	16, 658	32	33	35	15
Total	3, 207, 709	3, 580, 090	3, 849, 624	4, 094, 226	4, 839, 563
Exports:					
Crude	657, 393	653, 686	918, 691	1, 189, 072	1, 299, 060
Refined	25, 079	21, 546	23, 971	56, 748	50, 477
Total	682, 472	675, 232	942, 662	1, 245, 820	1, 349, 537
Apparent consumption	2, 525, 237	2, 904, 858	2, 906, 962	2, 848, 406	3, 490, 026

The pattern of sulfur consumption, by industries, has been estimated by Chemical Engineering as follows:

Sulfur consumed in the United States, 1943–47, by uses, in long tons

[Chemical Engineering]

Use	1943	1944	1945	1946	1947
Chemicals [1]	1, 320, 000	1, 585, 000	1, 605, 000	1, 460, 000	1, 830, 000
Fertilizer and insecticides	500, 000	580, 000	600, 000	620, 000	730, 000
Pulp and paper	305, 000	300, 000	297, 000	305, 000	370, 000
Explosives [1]	90, 000	88, 000	90, 000	90, 000	100, 000
Dyes and coal-tar products	65, 000	75, 000	75, 000	80, 000	95, 000
Rubber	45, 000	55, 000	58, 000	65, 000	65, 000
Paint and varnish	80, 000	90, 000	94, 000	105, 000	122, 000
Food products	7, 000	7, 000	7, 000	7, 000	8, 000
Miscellaneous	120, 000	140, 000	135, 000	175, 000	220, 000
Total	2, 532, 000	2, 920, 000	2, 961, 000	2, 907, 000	3, 540, 000

[1] To avoid disclosing estimated consumption of sulfur in direct war applications, such as military explosives, sulfur so used is included with "Chemicals."

Sulfur is used in elemental form in rubber compounding and insecticides; the paper industry consumes a considerable quantity in liquors used in manufacturing paper. The major portion of the native sulfur consumed in the United States, however (approximately three-fourths) is converted into sulfuric acid before entering its ultimate use. Sulfuric acid is so inexpensive and effective that it has found uses in virtually every industry. Consumption of sulfuric acid by the major industries has been estimated by Chemical Engineering as follows:

Sulfuric acid (basis, 100 percent) consumed in the United States, 1943–47, by industries, in short tons

[Chemical Engineering]

Industry	1943	1944	1945	1946	1947
Fertilizer	2, 500, 000	2, 640, 000	2, 850, 000	3, 020, 000	3, 510, 000
Petroleum refining	940, 000	1, 020, 000	1, 020, 000	1, 000, 000	1, 065, 000
Chemicals and defense [1]	2, 285, 000	2, 490, 000	2, 220, 000	1, 780, 000	1, 970, 000
Coal products	580, 000	625, 000	600, 000	510, 000	630, 000
Iron and steel	535, 000	560, 000	570, 000	475, 000	550, 000
Other metallurgical	360, 000	350, 000	330, 000	280, 000	315, 000
Paints and pigments	495, 000	510, 000	520, 000	550, 000	665, 000
Industrial explosives	115, 000	120, 000	100, 000	105, 000	115, 000
Rayon and cellulose film	415, 000	450, 000	495, 000	556, 000	610, 000
Textiles	85, 000	75, 000	70, 000	75, 000	73, 000
Miscellaneous	350, 000	350, 000	400, 000	345, 000	400, 000
Total	8, 660, 000	9, 190, 000	9, 175, 000	8, 696, 000	9, 903, 000

[1] To avoid disclosing estimated consumption of acid in direct war applications, such as military explosives, acid so used is combined with "Chemicals."

An outstanding feature of the war and postwar period has been the substantial increase in consumption of acid for the manufacture of fertilizers—principally superphosphate. Consumption in the manufacture of military explosives has declined since the war, but demands of other chemical industries have made up much of the difference. The tremendous demand for pulp and paper has similarly been reflected in a substantial increase in sulfur requirements.

Sulfur is applied to the soil in several ways. It may be applied in native form or as a constituent of superphosphate. Substantial quantities are now being added to irrigation waters in California by bubbling sulfur dioxide into them. Crushed pyrites are being tried experimentally in the Western citrus groves. In addition to their sulfur content pyrites also provide other fertilizing elements such as manganese, copper, and zinc.

Data showing the distribution of sulfuric acid by market areas are not available for 1947. However, the 1945 and 1946 figures were published in Minerals Yearbook, 1946, page 1141.

STOCKS

During 1947 producers' stocks of native sulfur declined 11 percent to 3,371,034 long tons, 2,804,151 of which were at the mine and 566,883 at ports, consuming centers, or in transit.

PRICES

After a long period during which crude sulfur was quoted at $16 per long ton f. o. b. mines, the basic price was increased by some producers in 1947. Trade journals quoted crude sulfur at $16 to $18 f. o. b. Texas mines for the domestic market and $20 for export.

After an extensive investigation the Federal Trade Commission issued on June 16, 1947, its report entitled, "The Sulphur Industry and International Cartels." This report included specific recommendations for readjustment of the business practices of the Sulphur Export Corporation to avoid agreements and acts that tend to "restrain the export trade of its domestic competitors in violation of law." [4]

FOREIGN TRADE

American sulfur is of such high quality and comparatively low price that it is in great demand in foreign countries as well as in the United States. As sulfur is a basic material required in rehabilitation programs, the demand has been increasing substantially since the end of hostilities and, as shown in the accompanying table, exports in 1947 reached a record total of 1,349,537 long tons. The wide distribution of American sulfur throughout the world is shown in the export table by countries. Imports into the United States have been very small since virtual termination of receipts of high-grade material from Canada. It is reported that small quantities of sulfur ore are imported from Mexico from time to time for use in agricultural application.

[4] Federal Trade Commission, report on The Sulphur Industry and International Cartels, Summary: June 16, 1947, 17 pp.

Sulfur imported into and exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Imports				Exports			
	Ore		In any form, n. e. s.		Crude		Crushed, ground, refined, sublimed, and flowers of	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
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
1946	(1)	$20	35	11,226	1,189,072	21,589,966	56,748	2,624,873
1947			15	5,014	1,299,060	25,388,093	50,477	2,318,956

[1] Less than 1 ton.

Sulfur exported from the United States, 1946–47, by countries

[U. S. Department of Commerce]

Country	Crude				Crushed, ground, refined, sublimed, and flowers of			
	1946		1947		1946		1947	
	Long tons	Value	Long tons	Value	Pounds	Value	Pounds	Value
North America:								
Canada	248,811	$4,883,054	315,698	$6,249,777	8,492,849	$230,967	8,541,250	$250,188
Central America	188	6,434	66	3,581	556,090	20,589	651,217	22,224
Mexico	2,726	69,308	1,209	33,492	2,899,826	63,091	4,043,962	73,544
Newfoundland and Labrador	10,376	168,532	11,493	203,772	3,960	177	2,160	117
West Indies	22,158	401,087	26,339	516,368	245,998	11,955	247,960	9,867
	284,259	5,528,415	354,805	7,006,990	12,198,723	326,779	13,486,549	355,940
South America:								
Argentina	27,400	488,931	40,151	801,578	420,987	36,529	648,664	53,173
Brazil	26,334	496,668	31,763	634,387	8,736,590	195,802	9,104,510	252,437
Chile					4,560	175	4,000	1,343
Colombia	1,002	22,891	655	20,949	611,840	19,280	653,858	19,022
Ecuador					105,877	7,766	132,482	5,962
Peru	74	2,223	2	112	772,598	15,708	706,454	19,306
Uruguay	12,922	229,994	2,600	47,990	4,528,448	76,690	1,536,282	28,907
Venezuela	11	487	11	605	274,682	6,969	208,739	4,476
Other South America	255	5,985			35,381	1,311	34,096	1,228
	67,998	1,247,179	75,182	1,505,621	15,490,963	360,230	13,029,085	385,854
Europe:								
Albania					244,000	2,953	577,900	8,843
Austria					922,200	15,677	79,000	1,148
Belgium and Luxembourg	67,555	1,268,813	65,777	1,316,102	1,390,742	30,865	722,926	14,151
Czechoslovakia	11,365	217,528	700	14,130	1,277,600	20,462	4,080	240
Eire			27	888	40,000	860		
France	174,455	3,124,153	113,400	2,268,000			13,600	3,396
Germany	7,800	140,400	4,500	146,250			274,750	4,503
Greece	125	6,377	7	150	41,359,398	648,896	45,370,065	652,895
Malta, Gozo, and Cyprus Islands	295	9,900			174,800	2,884	218,460	3,230
Netherlands	9,400	169,200	44,467	996,153	2,546,260	51,893	2,954,619	53,499
Norway					11,048	3,785	69,875	1,823
Portugal					65,210	2,421	784,159	15,095
Rumania					330,730	7,331	320,490	5,625
Spain	6,000	108,000	15,020	288,000	44,800	977	33,000	1,056
Sweden	13,705	243,515	9,820	193,900	1,181,473	34,156	328,796	11,742
Switzerland	6,520	117,770	78	3,240	1,078,690	23,482	558,174	51,447
United Kingdom	276,957	4,581,121	316,773	5,715,310	7,950	3,223	15,300	5,865
U. S. S. R.	16,458	296,240	14,627	341,459				
Yugoslavia	1,694	34,170			8,343,733	155,269	22,046	416
Other Europe	6,100	109,800			1,171,389	29,006	2,200	70
	598,429	10,426,987	585,196	11,283,582	60,190,023	1,034,140	52,349,440	835,044

Sulfur exported from the United States, 1946–47, by countries—Continued

Country	Crude				Crushed, ground, refined, sublimed, and flowers of			
	1946		1947		1946		1947	
	Long tons	Value	Long tons	Value	Pounds	Value	Pounds	Value
Asia:								
China	727	$17,890	340	$13,375	4,101,058	$121,157	1,448,561	$28,802
French Indochina							295,981	7,693
Hong Kong	760	23,227	389	15,651	1,306,480	36,840	1,996,213	41,110
India	46,051	929,370	28,518	623,888	12,109,421	219,541	6,132,847	141,988
Indonesia (Netherlands Indies)			954	20,988	17,628	716	27,324	2,521
Iran			16,478	375,047				
Palestine and Trans-Jordan	786	17,669	2,198	61,765	997,672	14,362	2,604,290	38,879
Philippines, Republic of	1	40			53,970	2,298	47,745	3,819
Syria					55,100	1,127	55,500	981
Turkey	1,803	51,150			4,974,860	104,516	13,382,963	275,956
Other Asia			253	8,047	224,345	5,984	207,977	6,718
	50,128	1,039,346	49,130	1,118,761	23,840,534	506,541	26,199,401	548,467
Africa:								
Algeria	8,300	149,400	13,500	270,000	6,867,480	124,979		
Belgian Congo					181,034	4,984	2,000	63
British East Africa	450	15,432	250	5,885	112,000	2,546	218,300	5,000
Egypt	841	19,394	1,000	27,180	2,031,342	37,570	3,724,687	62,592
Madeira Islands					5,000	145	221,605	6,903
Mauritius and Dependencies					220,000	5,300	530,442	15,245
Morocco, French					1,456,265	33,911		
Mozambique			294	15,558	382,050	11,632	265,353	6,263
Tunisia	3,500	63,000	1,100	22,000				
Union of South Africa	28,072	477,967	39,767	678,475	3,197,052	115,007	2,660,547	82,287
Other Africa					571,256	18,151	1,028	636
	41,163	725,193	55,911	1,019,098	15,023,479	354,225	7,623,962	178,989
Oceania:								
Australia	101,361	1,807,501	93,490	1,830,200	92,518	8,242	131,912	7,703
New Zealand	45,734	815,345	85,346	1,623,841	279,220	34,708	247,935	6,959
Other Oceania					40	8		
	147,095	2,622,846	178,836	3,454,041	371,778	42,958	379,847	14,662
	1,189,072	21,589,966	1,299,060	25,388,093	127,115,500	2,624,873	113,068,284	2,318,956

WORLD REVIEW

As shown in the accompanying table, native sulfur is produced in many countries, but the bulk comes from only a few. Owing principally to the great expansion of output in the United States, production of native sulfur has been increasing in recent years and in 1947 attained a record output estimated at approximately 4,800,000 long tons. In addition, there is a considerable production of elemental sulfur derived from pyrites and industrial gases. Total world sulfur production, including both native and elemental sulfur derived from other sources, is estimated to have attained a record of 5,100,000 tons.

World production of native sulfur, 1942–47, by countries, in long tons [1]

[Compiled by P. Roberts]

Country [1]	1942	1943	1944	1945	1946	1947
Argentina	2,148	10,649	11,092	9,072	(2)	(2)
Bolivia (exports)	3,626	7,079	6,151	640	468	[3] 1,516
Chile	29,570	32,360	30,380	28,617	15,185	(2)
Ecuador	----------	61	13	102	26	(2)
France (content of ore)	703	1,000	1,021	[4] 2,923	[4] 5,610	[4] 10,565
Greece	4,685	6,373	1,860	448	87	[5] 780
Guatemala	[5] 10	[5] 10	----------	(2)	(2)	(2)
Italy (crude) [6]	220,808	[7] 91,773	[5] 37,000	[5] 80,000	140,765	145,003
Japan [8]	[9] 160,917	[9] 145,368	[9] 70,394	[9] 21,088	21,051	28,740
Mexico	[4] 26,115	[4] 4,400	[4] 5,100	[4] 7,100	(2)	(2)
Palestine	[4] 713	----------	----------	----------	----------	(2)
Peru	1,126	564	601	1,197	363	[10] 489
Spain	5,000	5,511	6,280	4,840	4,000	(2)
Turkey [11]	[5] 2,600	3,326	3,348	3,097	376	(2)
United States	3,460,686	2,538,786	3,218,158	3,753,188	3,859,642	4,441,214
Total [12]	4,000,000	3,000,000	3,500,000	4,000,000	4,200,000	4,800,000

1 Native sulfur believed to be produced also in China, Cuba, Egypt, Formosa, India, Indonesia (Netherlands Indies), Iran, and U. S. S. R., but complete data are not available; however, estimates by senior author of chapter are included in total.
2 Data not available; estimate included in total.
3 January to September, inclusive.
4 Incomplete data.
5 Estimate.
6 In addition, 30,734 tons of sulfur rock reported in 1942. Similar data not available for later years.
7 Production of Sicily for fiscal year ended July 31 of year stated.
8 Preliminary data.
9 Fiscal year ended Mar. 31 of year following that stated.
10 January to June, inclusive.
11 Data cited appear to be concentrates of 65 to 70 percent sulfur content.
12 Estimated by senior author of chapter.

Canada.—In December 1947 operation of a pilot plant designed to produce elemental sulfur and iron sinter from pyrite was started by Noranda Mines, Ltd. Pellets of pyrite concentrate are roasted, and from the gases elemental sulfur is collected in Cottrell equipment.[5] The market for elemental sulfur in Canada approaches a quarter million tons per year. Noranda has a very large deposit of pyrite that can provide the raw material for such an operation for many years. The ore has some metal values as well.[6] Diamond drilling has revealed 130,000,000 tons of pyrite ore containing 0.05 ounce of gold to the ton, 0.035 percent copper, and 0.75 percent zinc, and company officials indicate there is a good prospect that further exploration would reveal several hundred million more tons.[7]

France.—A modest tonnage of sulfur ore containing approximately 10 percent sulfur is mined in France. Output of this low-sulfur ore in 1947 is reported to have been about 107,700 metric tons.

Iran.—Sulfur is produced intermittently from several mines in Iran. The Government operates a mine at Delazian, about 40 kilometers south of Semnan. The deposit is reported to measure 50 by 300 meters and the ore to contain about 20 percent sulfur. The deposit, which is in a plain, apparently was deposited from gases. Output has been about 700 metric tons per year. The Government also operates the Bostaneh mine (latitude 26°36′/longitude 54°46′) on the southern coast of Iran. Output is now small but the deposit is said to be large—possibly as much as several million tons of ore. A private firm oper-

5 Mine and Quarry Engineering (London), vol. 14, No. 3, March 1948, p. 69.
6 Canadian Mining Journal, vol. 69, No. 2, February 1948, p. 111.
7 Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 5, November 1947, p. 47.

ates a mine in a district named Kuhi-Googuerd at the edge of the Kavir Desert about 100 kilometers west of the Delazian deposits.[8] Recovery of byproduct sulfur from oil refineries at Abadan has increased so greatly that it has been predicted that sulfur imports into Iran will soon be a thing of the past.[9]

Italy.—Although slightly more sulfur was produced in Italy in 1947 than in 1946, output was much below the prewar level, and the industry was seriously depressed. The cost of production was high, and prices were increased to a point substantially above the delivered price of American sulfur. Under these conditions Italian producers, particularly those on the island of Sicily, had great difficulty marketing their products. They strongly urged resumption of prewar agreements with producers in the United States as a means of regaining lost markets. Some special agreements with European countries for the sale of sulfur were reported, but the movement was comparatively small. Stocks accumulated for marketing through Ente Zolfi Italiani became large. Domestic consumption in Italy is estimated at somewhat less than 100,000 tons, most of which is supplied by mines on the mainland.

Although conditions in 1947 were difficult, there were some indications of better prospects for the future. Productivity of the Sicilian miners, which had fallen from the prewar level of 6½ quintals per day per man to 4½ quintals postwar, has now begun to rise. Further devaluation of the foreign exchange rate of the lira would improve the competitive position of Italian sulfur. Shortage of dollar exchange in Europe will encourage European countries to purchase sulfur with other currencies.[10]

PYRITES

DOMESTIC PRODUCTION

For the second consecutive year, record production of pyrites was attained in the United States. Output was 16 percent greater than in 1946.

Pyrites (ores and concentrates) produced in the United States, 1943–47

Year	Quantity: Gross weight (long tons)	Quantity: Sulfur content (percent)	Value	Year	Quantity: Gross weight (long tons)	Quantity: Sulfur content (percent)	Value
1943	802,384	42.0	$2,844,000	1946	813,372	41.5	$3,228,000
1944	788,530	42.2	2,598,000	1947	940,652	41.7	4,070,000
1945	722,596	41.0	2,700,000				

Although native sulfur generally has the competitive advantage, pyrite is the lowest-cost source of sulfur in some localities. As indicated in the accompanying table, there has been a considerable increase in domestic production of pyrites in recent years. As prices

[8] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 4, October 1947, pp. 30–31.
[9] Chemical Age, Sulphur's Role in Oil Refining: Vol. 57, No. 1478, Nov. 8, 1947, pp. 627–628.
[10] Harris, R. J., American Consulate, Palermo, Report of March 17, 1948, 15 pp.

are low and there is little incentive for production of pyrites for sale in the open market in the United States, the bulk of production is by companies that utilize the material locally. In 1947 producing companies consumed 738,923 tons and sold only 205,298 tons.

REVIEW BY STATES

California.—The production of pyrites from the Hornet mine of the Mountain Copper Co., Shasta County, increased in 1947, making California the second-largest pyrites-producing State.

Colorado.—The New Jersey Zinc Co. recovered pyrites from the Gilman mine in Eagle County.

Illinois.—After many years of production of coal brasses at its Atkinson mine, Henry County, the operation was reported to have been discontinued by the Midland Electric Coal Corp., and no output was recorded in 1947.

Indiana.—The Snow Hill Coal Corp. recovered pyrites (coal brasses) as a byproduct of coal washing at its Talleydale mine, Vigo County.

Montana.—The Anaconda Copper Mining Co. recovered a substantial tonnage of pyrites in 1947 as a byproduct of its copper plant operations at Anaconda, Deer Lodge County.

New York.—In 1947 the St. Joseph Lead Co. produced pyrites at the Balmat mine, St. Lawrence County.

Pennsylvania.—Pyrites was produced by the Bethlehem Steel Co. in Lebanon County.

Tennessee.—As in many years past, the output of the Tennessee Copper Co. in Ducktown, Polk County, made Tennessee the leading pyrites-producing State. Pyrites is recovered as flotation concentrates and converted by the company into sulfuric acid and iron sinter.

Virginia.—The General Chemical Division of the Allied Chemical and Dye Corp. produced pyrites at the Gossan mine, Carroll County, and the output was consumed by the company in its acid plant at Pulaski. A report of exploratory drilling at the Boyd Smith property in Louisa County was published in 1947.[11]

Wisconsin.—Pyrites was recovered by the Vinegar Hill Zinc Co. and converted into acid at Cuba City.

PRICES

Pyrite prices are quite variable according to the locality and distance from market. In past years the quoted price of Spanish pyrites has been considered to be the most reliable indicator of trends but recently Spanish material has been a comparatively small factor in the market, and only nominal prices—12 cents per unit of sulfur delivered to East coast ports—have appeared in E&MJ Metal and Mineral Markets. It is understood from sources in the trade that Spanish pyrites is probably valued for its sulfur content at a price somewhat higher than this—probably about 15 cents per unit. Oil, Paint and Drug Reporter quoted Spanish pyrites at $8—$10 per ton ex-dock New York. The average value f. o. b. mine of pyrites produced in the United States was estimated by producers at $4.33 per ton.

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[11] Hickman, R. C., Pyrites, Mineral, Louisa County, Va.: Bureau of Mines Rept. of Investigations 4116, 1947, 3 pp.

FOREIGN TRADE

Historically the United States has been a substantial consumer of foreign pyrites. Before the war our imports, which came principally from Spain, commonly ranged from 300,000 to 400,000 long tons. As shown in the accompanying table, Canada became our principal source of foreign supplies during the war, and since the war price and shipping problems have interfered with Spain's efforts to recover its position in the American market. During the past few years our receipts of Canadian pyrites have declined. Total imports in 1947 were 31 percent lower than in 1946.

Pyrites, containing more than 25 percent sulfur, imported for consumption in the United States, 1943–47, by countries

[U. S. Department of Commerce]

Country	1943		1944		1945		1946		1947	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Canada	197, 750	$683, 110	166, 575	$302, 747	137, 238	$276, 832	121, 807	$269, 179	85, 094	$266, 698
Mexico	273	916			57	160				
Norway					1, 150	1, 725				
Portugal									300	2, 664
Spain	58, 285	147, 533	14, 188	36, 896	48, 062	133, 900	61, 086	170, 053	41, 159	106, 136
	256, 308	831, 559	180, 763	339, 643	186, 507	412, 617	182, 893	439, 232	126, 553	375, 498

The principal market for foreign pyrites is on the East coast; consequently, imports entered almost entirely through the Buffalo and Philadelphia customs districts. The accompanying table shows the import pattern for the past 5 years.

Pyrites, containing more than 25 percent sulfur, imported for consumption in the United States, 1943–47, by customs districts, in long tons

[U. S. Department of Commerce]

Customs district	1943	1944	1945	1946	1947
Buffalo	159, 483	134, 955	127, 765	121, 807	36, 610
Connecticut					34
Galveston			19		
Maryland	10, 357				
Massachusetts	69				
Michigan	28, 051	29, 785	9, 414		
New York					300
Ohio	71	1	5		
Philadelphia	47, 928	14, 188	49, 212	61, 086	89, 609
San Diego	273		38		
Vermont	8, 562				
Washington	1, 514	1, 834	54		
	256, 308	180, 763	186, 507	182, 893	126, 553

WORLD REVIEW

Output of pyrites, the major source of sulfur in European countries, has increased as recovery programs progressed. World production statistics are shown in the accompanying table. Complete figures are not yet available for 1947, but it is estimated that the total world output of pyrites totaled about 8,000,000 metric tons in that year.

World production of pyrites (including cupreous pyrites), 1938 and 1944–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1938		1944		1945		1946		1947	
	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content
Algeria	48,250	21,230	32,905	13,491	30,132	13,000	40,358	17,440	35,343	14,491
Australia:										
New South Wales	----	----	35,337	16,765	(2)	(2)	(2)	(2)	(2)	(2)
Tasmania	51,084	25,300	29,604	14,631	40,813	20,000	37,893	18,570	43,008	21,070
Western Australia	----	----	44,349	18,200	67,571	(2)	79,032	(2)	(2)	(2)
Austria	(2)	(2)	3,516	1,400	2,180	800	3,823	1,332	[3] 6,000	(2)
Brazil	----	----	3,000	1,080	(2)	(2)	(2)	(2)	(2)	(2)
Canada	40,464	20,300	226,859	110,470	206,595	99,974	(2)	87,864	(2)	(2)
Cyprus (exports)	523,574	256,551	11,451	5,496	101,681	48,807	260,314	119,744	358,611	175,719
Czechoslovakia	(2)	(2)	(2)	(2)	533	192	7,999	2,880	(2)	(2)
Finland	102,979	44,281	127,660	58,430	110,320	48,541	(2)	(2)	(2)	(2)
France	147,850	67,005	112,908	43,875	146,625	58,650	187,228	74,891	196,180	78,472
Germany	465,241	176,191	(2)	(2)	[4] 73,000	(2)	205,461	84,240	(2)	(2)
Greece	244,000	118,605	4,380	2,102	6,510	3,125	80,140	38,467	58,525	28,100
India	(2)	(2)	594	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Italy	930,312	386,079	(2)	(2)	102,508	49,000	400,519	184,300	[3] 617,200	[3] 283,900
Japan	[5] 2,122,128	[5] 912,515	[5] 716,188	[5] 307,961	[5] 118,750	[5] 51,063	474,842	204,182	832,845	349,795
Korea	132,614	53,146	246,003	98,401	(2)	(2)	(2)	(2)	(2)	(2)
Norway	1,027,776	446,939	750,405	319,409	247,465	106,369	539,850	(2)	[6] 587,100	(2)
Poland	92,209	36,883	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Portugal	558,327	251,250	130,131	[3] 58,560	170,967	[3] 76,900	314,976	[3] 141,740	[3] 380,000	[3] 159,600
Rumania	[3] 80,900	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Southern Rhodesia	27,065	10,900	34,177	[3] 13,670	33,465	[3] 13,390	25,413	[3] 10,160	17,144	[3] 7,115
Spain	2,727,003	[3] 1,145,341	512,249	[3] 215,100	899,760	[3] 377,900	1,175,976	[3] 493,910	1,296,904	[3] 544,700
Sweden	186,390	84,345	317,455	157,458	261,984	131,096	280,208	136,781	(2)	(2)
Tunisia	(2)	(2)	----	----	460	(2)	2,300	1,020	(2)	(2)
Turkey	(2)	(2)	(2)	(2)	----	----	300	(2)	(2)	(2)
Union of South Africa	31,017	13,947	36,155	15,859	38,556	16,745	38,044	16,553	[7] 15,399	[7] 6,749
U. S. S. R.	[5] 600,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United Kingdom	4,351	(2)	10,395	(2)	11,468	(2)	10,926	(2)	(2)	(2)
United States	564,547	222,612	801,186	337,796	734,194	301,000	826,427	342,967	955,749	398,975
Uruguay	70	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Yugoslavia	150,402	67,681	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Total [8]	11,000,000	4,700,000	7,000,000	3,000,000	5,500,000	2,300,000	7,000,000	3,000,000	8,000,000	3,400,000

[1] In addition to countries listed, Belgium, China, Egypt, Eire, Hungary, and Iran produce or have produced pyrites, but production data are not available; however, estimates by senior author of chapter are included in total.
[2] Data not available; estimate included in total.
[3] Estimate.
[4] British zone only.
[5] Preliminary data for fiscal year ended Mar. 31 of year following that stated.
[6] January to October, inclusive.
[7] January to June, inclusive.
[8] Estimated by senior author of chapter.

Argentina.—In addition to its native sulfur mines in the Andes, Argentina makes use of another domestic source—furnace gases. Acid plants in the Buenos Aires region and in the Provinces of Santa Fe and Cordoba are reported to use waste gases from metallurgical plants.[12]

Cyprus.—Since the war the pyrites-mining industry has revived, although labor has been in short supply. Cyprus Mines Corp. reopened the Mavrovouni mine in 1946, but the Skouriotissa, Apliki, and Mathiati mines were closed. The Hellenic Co. of Chemical Products & Manures, Ltd., mined 105,951 tons at Kalavasso. Cyprus Sulphur & Copper Co., Ltd., operated the Limni mine for a short period in 1945; the property was idle in 1946, but preparations were being made to reopen.[13] Total output of pyrites in Cyprus exceeded 350,000 tons in 1947.

Southern Rhodesia.—The bulk of the output of pyrites recovered in Southern Rhodesia is exported to Northern Rhodesia. Smaller quantities go to the Union of South Africa.[14]

Union of South Africa.—Many gold mines in South Africa have large quantities of pyrites available, but the market is very limited and only the West Rand Consolidated mine recovers it.[15]

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[12] Foreign Commerce Weekly, vol. 28, No. 6, Aug. 9, 1947, p. 4.
[13] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 3, September 1947, pp. 36–39.
[14] Bureau of Mines, Mineral Trade Notes: Vol. 26, No. 1, January 1948, p. 55.
[15] Bureau of Mines, Mineral Trade Notes: Vol. 24, No. 5, May 1947, p. 33.

O

Talc and Pyrophyllite[1]

By BERTRAND L. JOHNSON AND F. M. BARSIGIAN

GENERAL SUMMARY

MINE production of talc, pyrophyllite, and ground soapstone again made a new high record in 1947, according to reports from producers. All-time records were also made in both total quantity and value of these commodities sold or used. (See fig. 1.) Total imports were slightly lower in quantity in 1947 than in 1946 but higher in value. Exports of "talc, steatite, soapstone, and pyrophyllite, crude and ground" increased both in quantity and value in 1947, and exports of "powders—talcum (in packages), face, and compact" were nearly three-quarters of a million dollars greater in value in 1947 than they were in 1946.

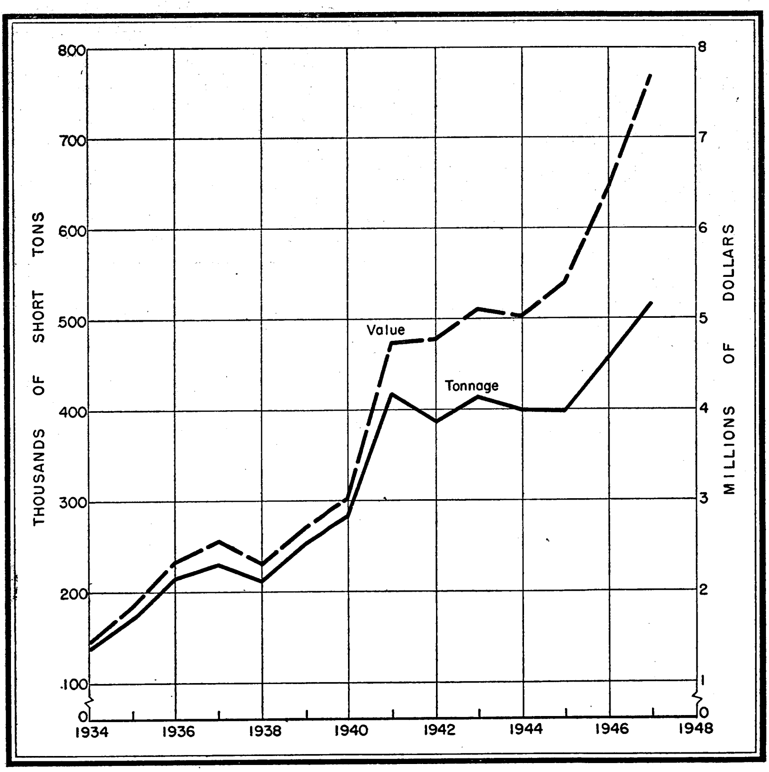

FIGURE 1.—Sales of domestic talc, pyrophyllite, and ground soapstone, 1934–47.

[1] Including data for ground soapstone.

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Pyrophyllite (a hydrous aluminum silicate) is included with talc (a hydrous magnesium silicate) 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. Mine production and sales of pyrophyllite are given in a table in the Sales section of this chapter.

Twelve States reported sales of talc, pyrophyllite, or ground soapstone in 1947, the same States as in 1946. The greater part of the total sales in 1947 was made by producers in the Eastern States.

Salient statistics of the talc, pyrophyllite, and ground-soapstone industries in the United States, 1946–47

	1946		1947	
	Short tons	Value	Short tons	Value
Mined	460,554	(1)	[2] 516,453	(1)
Used by producers	423,591	(1)	470,478	(1)
Sold by producers:				
Crude [2]	36,963	$348,484	47,925	$389,535
Sawed and manufactured	756	227,751	1,018	239,407
Ground	419,347	5,869,109	467,151	7,053,539
	457,066	6,445,344	516,094	7,682,481
Imports for consumption: [3]				
Crude and unground steatite and French chalk	8	530	48	1,962
Cut and sawed	34	4,856	27	8,235
Ground, washed, or pulverized	18,407	394,881	17,629	414,726
	18,449	400,267	17,704	424,923
Exports:				
Talc, steatite, soapstone, and pyrophyllite, crude and ground	16,373	394,799	17,557	429,803
Powders—talcum (in packages), face, and compact	(4)	3,517,827	(4)	4,252,161
	-----------	3,912,626	-----------	4,681,964

[1] Data not available.
[2] Includes pinite in 1947; no sales in 1946.
[3] Exclusive of "Manufactures, n. s. p. f., except toilet preparations," as follows: 1946: $15,687; 1947: $13,525. Quantities not available.
[4] Quantity not recorded.

Several publications treating of talc, pyrophyllite, or soapstone deposits have appeared recently. A description was published[2] of the talc and soapstone deposits, resulting from the alteration of serpentine, in the southeastern corner of Carroll County, Md., now being worked by the Clinchfield Sand & Feldspar Corp. and by Herbert I. Oursler. In the same volume was described[3] the occurrence of greenish-gray talc schist along the borders of a mass of dark-green pyroxenite, altered almost completely to yellowish-green serpentine, intrusive into Wissahickon schist in southeastern Carroll County. This talc schist was formerly quarried and shipped unground for use in the manufacture of graphite products and soap.

Details were presented [4] regarding formation of the talc deposits

[2] Singewald, J. T., Jr., Mineral Resources of Carroll and Frederick Counties, in The Physical Features of Carroll County and Frederick County: Maryland Board of Natural Resources, Dept. of Geology, Mines, and Water Resources, Baltimore, Md., 1946, 312 pp. See pp. 132–162. See pp. 146–147 for talc data.
[3] Stose, Anna J., and Stose, George W., Geology of Carroll and Frederick Counties, in The Physical Features of Carroll County and Frederick County: Maryland Board of Natural Resources, Dept. of Geology, Mines, and Water Resources, Baltimore, Md., 1946, 312 pp. See pp. 11–131. See p. 90 for talc data.
[4] Faessler, Carl, and Badollet, Marion S., The Epigenesis of the Minerals and Rocks of the Serpentine Belt, Eastern Township, Que.: Canadian Min. Jour., vol. 68, No. 3, March 1947, pp. 157–167.

of the Eastern Townships, Quebec, Canada, by the hydrothermal alteration of pre-Devonian ultrabasic, magnesium-bearing, igneous rocks, chiefly peridotites, in Devonian times. The talc deposits and talc industry of Murray County, Ga., were described.[5] The talc is considered to have been formed in pre-Cambrian time by the alteration of serpentinized dolomite beds in the pre-Cambrian meta-sedimentary Cohutta schist, which occurs as inclusions in an upthrust-faulted pre-Cambrian coarse-grained biotite granite (the Fort Mountain gneiss) in the Fort and Cohutta Mountains near Chatsworth. Previous observers have held that the talc was produced by alteration of basic igneous intrusive bodies.

A slaty variety of pyrophyllite was discovered in 1947 on Graves Mountain, Ga.[6] The occurrence is 11 miles from Washington, Ga. on the Lincolnton-Washington Highway a short distance west of Lincolnton.

Steatite mines in California and the geological origin of the deposits were outlined.[7]

The talc deposits of the Gouverneur district, St. Lawrence County, N. Y., were discussed.[8] The talc occurs as interlayered zones in a northwest-trending belt of impure marble of the pre-Cambrian Grenville series. The talc is considered to have been formed by the replacement in pre-Cambrian time of tremolite that had previously replaced beds of quartzite and dolomite. A modernization program was completed in 1947 by the W. H. Loomis Talc Corp., Gouverneur, N. Y.[9] This company operates three talc mines near Fowler, N. Y., and three mills at Emeryville just outside Gouverneur. The R. T. Vanderbilt Co. of New York during the year acquired talc mineral rights on the McLear property near Balmat, N. Y., in this district and is expected to begin operations in 1948.

The dust hazards in tremolite talc mining were discussed.[10] In a group of 221 tremolite talc miners and millers, advanced fibrosis was found in 32 men, all of whom had been working with tremolite talc for 10 or more years.

SALES

The total quantity of domestic talc, pyrophyllite, and ground soapstone sold or used in 1947 was considerably greater than in 1946, according to reports of producers to the Bureau of Mines. This output—516,094 short tons—was another new record, exceeding the 1946 record by 59,028 tons. The total value of $7,682,481 in 1947 was nearly a million and a quarter dollars greater than in 1946 and was an all-time high.

A new record in the quantity of pyrophyllite sold was made in 1947. Sales of pyrophyllite are shown in tabular form for the first time, although they have been included for several years in footnote references to some of the tables in this series of chapters.

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[5] Furcron, A. S., and Teague, K. H., Talc Deposits of Murray County, Ga.. Calver, J. L., Mineralogy of Talc Deposits: Georgia State Div. of Conservation, Dept. of Mines, Mining, and Geology, Geol. Survey, Bull. 53, 1947, 75 pp.

[6] Georgia Mineral Society News Letter, January 1948, Atlanta, Ga.

[7] Page, B. M., Some California Talc Deposits of Steatite Grade: Paper presented at Pacific coast Am. Inst. Min. and Met. Eng. meeting, October 1947. Ab. in Rock Products, vol. 50, No. 12, December 1947, p. 146.

[8] Engel, A. E. J., The Talc Deposits of the Gouverneur District, New York: Econ. Geol. vol. 52, No. 4, June–July 1947, p. 419.

[9] Avery, W. M., Loomis Talc Makes Improvements in Mining and Packing Facilities: Pit & Quarry, vol. 40, No. 4, October 1947, pp. 77–79, 83.

[10] Greenburg, L., Dust Hazard in Tremolite Talc Mining: Yale Jour. Biology and Medicine, vol. 19, 1947, pp. 481–501.

Talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1943–47, by classes

Year	Crude[1]			Sawed and manufactured		
	Short tons	Value at shipping point		Short tons	Value at shipping point	
		Total	Average		Total	Average
1943	30,200	$289,563	$9.59	1,669	$316,973	$189.92
1944	45,654	514,476	11.27	938	223,924	238.72
1945	35,979	367,488	10.21	733	182,904	249.53
1946	36,963	348,484	9.43	756	227,751	301.26
1947	47,925	389,535	8.13	1,018	239,407	235.17

Year	Ground			Total		
	Short tons	Value at shipping point		Short tons	Value at shipping point	
		Total	Average		Total	Average
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	361,672	4,856,843	13.43	398,384	5,407,235	13.57
1946	419,347	5,869,109	14.00	457,066	6,445,344	14.10
1947	467,151	7,053,539	15.10	516,094	7,682,481	14.89

[1] Includes pinite from Nevada in 1944 and 1947; no sales in 1943 and 1945–46.

Pyrophyllite[1] mined and sold by producers in the United States, 1943–47

Year	Production (short tons)	Sales					
		Crude		Ground		Total	
		Short tons	Value	Short tons	Value	Short tons	Value
1943	64,198	5,432	$34,306	56,710	$460,485	62,142	$494,791
1944	67,252	5,683	52,343	60,560	504,739	66,243	557,082
1945	77,716	6,215	38,166	71,379	613,034	77,594	651,200
1946	97,765	10,716	85,002	85,835	913,301	96,551	998,303
1947	108,450	6,204	27,626	97,536	1,135,100	103,740	1,162,726

[1] Exclusive of pinite.

Talc, pyrophyllite, and ground soapstone, sold by producers in the United States, 1946–47, by States

State	1946		1947	
	Short tons	Value	Short tons	Value
California	78,170	$1,434,978	91,537	$1,595,422
Georgia	36,410	380,477	49,441	673,251
Maryland, Pennsylvania, and Virginia	42,505	424,334	47,111	401,599
Nevada[1]	7,589	141,180	9,767	175,489
North Carolina	87,718	976,524	97,484	1,186,463
Vermont	75,144	843,247	77,327	999,704
Washington	5,084	38,051	(2)	(2)
Other States[3]	124,446	2,206,553	143,427	2,650,553
	457,066	6,445,344	516,094	7,682,481

[1] Includes pinite in 1947; no sales in 1946.
[2] Included with "Other States"; Bureau of Mines not at liberty to publish figure.
[3] Montana, New York, Texas, and—in 1947—Washington.

Sales by States.—In 1947 New York was still the leading producing State by a considerable margin, with North Carolina in second place and California a close third. Increased sales were reported in many of the States in 1947; some of them reached new highs.

CONSUMPTION AND USES

Five industries—paint, ceramics, rubber, insecticides, and roofing—consumed 79 percent of the sales of domestically produced talc, pyrophyllite, and ground soapstone in 1947. Sales to all of these industries increased in 1947 over 1946, as well as sales for foundry facings and crayons. Sales for paper and for toilet preparations decreased. The 52-percent increase in sales for ceramic purposes was noteworthy. Consumption in paint was still the leading use, comprising 22 percent of the total, slightly less than its share of the total in 1946. The gain in sales for ceramics from 14 percent of the total in 1946 to 18 percent in 1947 places that industry in second place and makes it an important contender for the lead. The rubber, insecticides, and roofing industries are close competitors for the third position.

Talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1946–47, by uses [1]

Use	1946		1947	
	Short tons	Percent of total	Short tons	Percent of total
Paint	103,828	23	112,101	22
Ceramics	62,389	14	94,755	18
Rubber	65,980	14	71,840	14
Insecticides	64,954	14	66,952	13
Roofing	54,581	12	63,545	12
Paper	32,300	7	31,772	6
Toilet preparations	17,111	4	13,147	3
Foundry facings	7,045	2	7,496	1
Crayons	306	(2)	603	(2)
Other uses [3]	24,803	5	36,120	7
Unclassified	23,769	5	17,763	4
	457,066	100	516,094	100

[1] Partly estimated. Includes pinite.
[2] Less than 0.5 percent.
[3] Refractory, asphalt filler, textile, plaster, plastics, and miscellaneous other uses.

The use of talc in the ceramic industry was discussed in recent articles. The relation of specific surface of talcs to casting and dry pressing characteristics of talc bodies was considered.[11] The use of steatite was noted in an illustrated article on printed electronic circuits.[12] Shrinkage of steatite bodies was discussed.[13]

Block talc was described.[14] Microscopic and X-ray examinations of steatite compositions revealed[15] that the body having the best di-

[11] Gaskins, W. W., Relation of Specific Surface in Various Talcs to Casting and Dry Pressing Characteristics of Talc Bodies: Ceram. Ind., vol. 49, No. 2, August 1947, p. 90.
[12] Chemical and Engineering News, Printing Electronic Circuits: Vol. 25, No. 10, Mar. 10, 1947, pp. 698–699.
[13] Stone, R. L., Factors Affecting the Firing Shrinkage of Dry-Pressed Steatite Bodies: North Carolina State College, Bull. 27, 1945, 57 pp.
Stone, R. L., Shrinkage Control in Steatite and Development of Electrical Insulators: North Carolina State College, Bull. 29, 1945, 74 pp.
[14] Eagle, J. E., Block Talc: Bull. Am. Ceram. Society, vol. 26, 1947, pp. 272–274.
[15] Rigterink, M. D., Microscopic and X-ray Investigation of Some Steatite Bodies: Jour. Am. Ceram. Soc., vol. 30, No. 7, July 1, 1947, pp. 214–218.

electric properties also had the simplest and most homogeneous physical structure.

PRICES

The prices of ground talc and ground pyrophyllite at the beginning, midpoint, and end of 1947 are shown in the following tables.

Ground talc prices in 1947, carlots, bags

[Oil, Paint, and Drug Reporter]

Class	Jan. 13	June 30	Dec. 27
Domestic, f. o. b. works:			
Ordinary	$14.50–$24.50	$24.50	(1)
California	22.00– 30.00	22.00– 30.00	$22.00–$30.00
New York	(1)	18.00	21.00
Pennsylvania	11.00– 13.50	(1)	(1)
Vermont	14.00	14.00	14.00
Fibrous (New York):			
Offcolor	15.00	15.00	24.00
325-mesh:			
88.95–99.95 percent	(1)	21.00	21.00
93–94 percent	17.50	(1)	(1)
98–99.5 percent	(1)	24.50	25.00
Imported (Canadian)	35.00– 44.50	35.00– 45.00	35.00– 45.00

[1] Prices not quoted.

Ground pyrophyllite prices in 1947, carlots, bulk, f. o. b. mines [1]

[Oil, Paint, and Drug Reporter]

Class	Jan. 13	June 30	Dec. 27
Standard:			
200-mesh	$10.00–$11.50	$11.00–$12.00	$11.00–$11.50
325-mesh	13.00– 13.90	14.00	14.00
No. 3:			
200-mesh	9.50	9.00	9.50
325-mesh	11.50	11.00	(2)
Insecticide grade, 200-mesh	(2)	(2)	9.00– 10.00
Rubber grade:			
140-mesh	(2)	(2)	7.00
230-mesh	(2)	(2)	12.00

[1] Pyrophyllite in paper bags—$1.50–$2.50 per ton extra.
[2] Prices not quoted.

The average value of domestic talc, pyrophyllite, and ground soapstone sold or used was $14.89 a short ton in 1947 compared with $14.10 in 1946. Average values in 1943–47, by separate classes, are given in a table in the Sales section of this chapter. Most of the pyrophyllite is sold in ground form, the average value of which rose from $8.12 a ton in 1943 to $11.64 in 1947. Crude sales of pyrophyllite fluctuated between $4.45 a ton in 1947 and $9.21 in 1944.

FOREIGN TRADE [16]

Imports.—The quantity of "talc, steatite, or soapstone, and French chalk" imported for consumption in the United States in 1947 decreased a few hundred tons below the 1946 figure, owing principally to the somewhat smaller quantity of ground material imported. Italy was the principal source of the ground material, with Canada in second place. (See fig. 2.) The total value of the imports was nearly $25,000 above that of 1946. The value of "manufactures, n. s. p. f., except toilet preparations" decreased considerably in 1947.

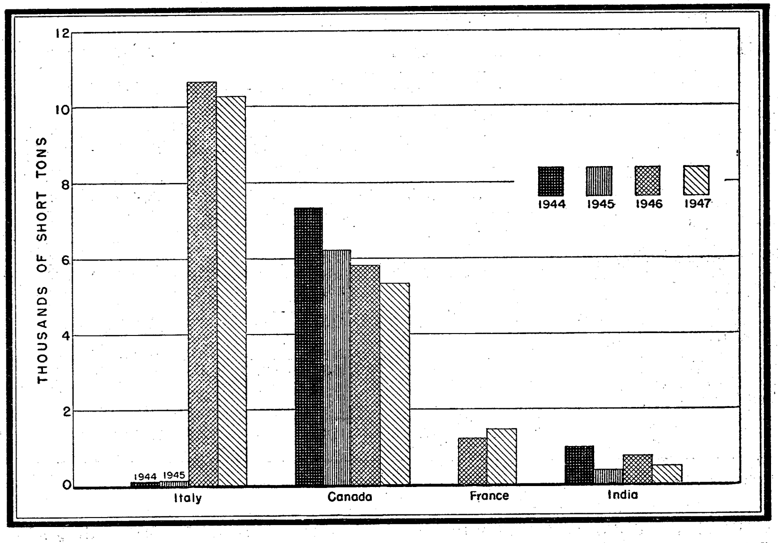

FIGURE 2.—Talc, steatite, or soapstone, and French chalk imported for consumption in the United States 1944–47, by leading countries.

Talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1943–47, by classes

[U. S. Department of Commerce]

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	
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
1946	8	530	18,407	394,881	34	4,856	18,449	400,267	15,687
1947	48	1,962	17,629	414,726	27	8,235	17,704	424,923	13,525

[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.

Talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1946–47, by classes and by countries

[U. S. Department of Commerce]

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	
1946									
Canada			5,787	$63,911	(1)	$1	5,787	$63,912	
China									$15,634
France			1,241	26,656			1,241	26,656	
Greece			(1)	15			(1)	15	5
Hong Kong									29
India	8	$530	714	20,920	22	1,179	744	22,629	
Italy			10,665	283,379	12	3,676	10,677	287,055	
United Kingdom									19
	8	530	18,407	394,881	34	4,856	18,449	400,267	15,687
1947									
Belgium and Luxembourg			101	1,364			101	1,364	
Canada	30	285	5,261	59,168	3	624	5,294	60,077	
China			(1)	334			(1)	334	13,515
Egypt	3	170					3	170	
France			1,500	32,545	3	713	1,503	33,258	
Hong Kong									9
India	11	1,336	480	13,352			491	14,688	
Italy			10,287	307,963	21	6,898	10,308	314,861	
Union of South Africa	4	171					4	171	
United Kingdom									1
	48	1,962	17,629	414,726	27	8,235	17,704	424,923	13,525

[1] Less than 1 ton.

Exports.—New records were made in 1947 in both the quantity and value of "talc, steatite, soapstone, and pyrophyllite, crude and ground" exported from the United States. The previous record of 1946 (16,373 tons) was exceeded by 1,184 short tons, the 1947 exports reaching 17,557 tons. The value of the shipments in 1947 was $35,004 greater than in 1946. The value of the exports of "powders—talcum (in packages), face, and compact" in 1947 was $734,334 more than in 1946.

Talc, pyrophyllite, and talcum powders exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Talc, steatite, soapstone, and pyrophyllite, crude and ground		Powders—talcum (in packages), face and compact (value)
	Short tons	Value	
1943	10,693	$236,268	$756,024
1944	10,709	229,293	1,328,890
1945	11,314	280,590	2,276,758
1946	16,373	394,799	3,517,827
1947	17,557	429,803	4,252,161

WORLD REVIEW

The production of talc, pyrophyllite, and ground soapstone in various countries during recent years is shown in the accompanying table.

World production of talc, pyrophyllite, and soapstone, 1941–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1941	1942	1943	1944	1945	1946	1947
Argentina	1,975	4,770	3,557	3,421	2,681	3,760	(2)
Australia:							
New South Wales	1,153	1,454	1,814	1,874	1,776	(2)	(2)
South Australia	2,972	2,577	3,336	3,930	3,037	3,727	4,532
Tasmania	----	----	----	4	155	50	(2)
Western Australia	----	308	74	266	----	396	216
Austria	35,956	42,933	57,639	44,628	4,470	21,430	25,211
Canada	31,417	27,096	23,735	29,571	24,574	26,629	22,608
Chile	(2)	----	276	935	477	640	(2)
China	76,000	80,000	(2)	(2)	(2)	(2)	(2)
Egypt	5,229	1,875	2,054	4,265	3,868	4,760	4,630
Finland	(2)	(2)	(2)	(2)	75	300	(2)
France	(2)	50,150	48,300	26,720	42,461	66,580	69,576
Germany	12,170	13,526	(2)	(2)	6,300	13,800	(2)
Greece	(2)	(2)	(2)	(2)	(2)	(2)	[3] 500
India	26,571	32,262	16,700	21,735	22,704	95,996	(2)
Indochina, French	370	260	360	532	----	----	(2)
Italy	73,475	80,462	(2)	(2)	16,287	(2)	(2)
Japan	----	----	----	----	----	200	(2)
Kenya	(2)	(2)	(2)	(2)	202	490	297
Korea	(2)	4,121	(2)	41,211	(2)	[3 4] 300	[3 4] 700
Madagascar	(3)	(2)	39	(2)	(2)	(2)	(2)
Newfoundland	508	1,580	2,439	224	711	660	220
New Zealand	(2)	15	63	25	----	----	----
Norway	29,059	30,174	30,454	(2)	(2)	(2)	(2)
Rumania	3,347	3,052	1,609	(2)	(2)	267	(2)
Spain [5]	29,148	36,497	14,238	10,470	19,319	30,665	31,616
Sweden	5,233	6,153	5,335	5,512	7,806	8,851	(2)
Union of South Africa	2,458	1,985	5,344	2,875	1,947	3,680	2,700
United Kingdom	4,552	2,231	2,815	2,829	2,170	(2)	(2)
United States [6]	377,722	351,952	374,546	361,841	361,406	414,641	468,190
Uruguay	2,111	4,588	1,985	2,257	1,823	1,818	2,675
Total (estimate) [1]	780,000	780,000	670,000	660,000	610,000	800,000	850,000

[1] In addition to countries listed, talc or pyrophyllite is reported produced in Brazil, Bulgaria, French Morocco, Tanganyika, and U. S. S. R., but no estimates for these countries are included in totals.
[2] Data not available; estimate by senior author of chapter included in total.
[3] Estimate.
[4] South Korea only.
[5] Includes steatite, as follows: 1941, 18,948; 1942, 24,859; 1943, 9,741; 1944, 7,369; 1945, 15,577; 1946, 19,541; 1947, 20,835.
[6] Talc, pyrophyllite, pinite, and ground soapstone sold by producers.

Canada.—The Canadian talc and soapstone industry in 1946 was described as follows: [17]

Producers' shipments of crude and milled talc and soapstone totaled 29,353 tons valued at $303,684 in 1946, compared with 27,088 tons worth $294,888 in the previous year. Operators in Quebec shipped 14,914 tons of talc and soapstone worth $150,004 and mines in Ontario sold 14,439 tons, mostly high-grade talc, valued at $153,680.

Imports of talc and soapstone in 1946 amounted to 6,737 tons valued at $150,972, and the exports of talc totaled 6,402 tons worth $74,991.

The industry employed 87 persons to whom $117,551 were paid in salaries and wages. Fuel and electricity cost $25,401, and the expenditures for freight and process supplies amounted to $38,167.

[17] Deir, A. R., The Talc and Soapstone Industry in Canada, 1946: Canada Dept. of Trade and Commerce, Dominion Bureau of Statistics, Mining, Metallurgical, and Chemical Statistics, Ottawa, Canada, 1948, 4 pp.

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The Bureau of Mines, Ottawa, has given the following information on the talc industry:

Talc and soapstone production in Canada comprises powdered material made from both these raw materials, sawn soapstone furnace blocks and bricks, and talc crayons. For a number of years there has been a steady production of these three classes of material centered in the Eastern Townships, Quebec, and of ground talc in the Madoc area, Hastings County, Ontario. The ground talc produced in Quebec consists of grey, slightly off-colour material, classed for statistical purposes as soapstone; that from Ontario is of prime white grade.

The market value of ground talc varies widely and is dependent upon purity (determined by freedom from lime and gritty or iron-bearing substances, slip and colour), particle shape, and fineness of grinding, the specifications for which vary in the different consuming industries. 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 at about $6 to $7 a ton, f. o. b. rail. Domestic grey talc suitable for roofing, rubber, and paper use, sold in 1946 for $7.50 to $10 a short ton, according to fineness; similar talc from Vermont was quoted at $9.50 to $11 in bulk. White talc from Madoc, Ontario, was quoted at $9.50 for the coarser grades, $10.50 to $17.50 for finer mesh sizes, and $44 for minus 400 mesh material, output of the last material being only a small part of the total. New York fibrous talc, 325 mesh, sold for $12 to $15. Imported European cosmetic talcs cost as high as $80 per ton delivered.

Additional statistical details are contained in the report, as well as the names and addresses of the five operating firms. Preliminary figures on the production of talc and soapstone in Canada in 1947 show 13,500 tons of talc produced valued at $135,000, and 11,421 tons of soapstone (includes some low-grade talc) valued at $117,874.[18]

[18] Deir, A. R., Preliminary Report on the Mineral Production of Canada During the Calendar Year 1947: Canada Dept. of Trade and Commerce, Dominion Bureau of Statistics, Census of Industry, Mining, Metallurgical, and Chemical Statistics, Ottawa, 1948, 29 pp. See p. 29.

Tin

By C. E. NIGHMAN AND J. B. UMHAU

GENERAL SUMMARY

ALTHOUGH world output of 112,400 tons of tin in 1947 was about 28 percent greater than in 1946, it remained roughly 40 percent below estimates of world needs. A part of the deficit was met by further drafts on world stocks, which by the year end were believed to have approached a minimum working level at about 137,000 tons. Highly disappointing was the revival from wartime damage in the Far East. In the major world tin fields of Malaya and the Netherlands Indies, production did not reach one-third the 1940–41 peak levels, and in Siam, not one-tenth. These rates suffer in comparison with that of coal in the Ruhr region, for example, where, despite chaotic damage and a demoralized, nation-less people, production exceeded half the average high 1939–41 period.

The average price of tin was about 43 percent above that of 1946. Much of the disparity between the price of tin and the other important base metals was thus removed, and an approach toward the over-all commodity price level was attained. Opening the year at 70 cents a pound, the price of tin rose to 80 cents as of April 1 and about mid-

Salient statistics of tin in the United States, 1925–29 (average) and 1943–47

	1925–29 (average)	1943	1944	1945	1946	1947
Production—						
From domestic mines ______ long tons	24	6	5	----------	----------	1.3
From domestic smelters [1] ______ do	----------	21,489	30,884	40,475	43,500	33,300
From secondary sources ______ do	30,600	33,800	29,100	31,400	24,700	26,800
Imports for consumption:						
Metal ______ do	78,009	11,919	13,338	8,493	15,520	24,899
Ore (tin content) ______ do	175	21,857	35,548	33,527	38,070	30,510
Exports (domestic and foreign) ______ do	1,740	1,770	843	882	881	420
Monthly price of Straits tin at New York:						
Highest ______ cents per pound	70.67				70.00	94.00
Lowest ______ do	39.79	[2] 52.00	[2] 52.00	[2] 52.00	[2] 52.00	70.00
Average ______ do	56.64				54.58	77.94
World mine production ______ long tons	163,400	144,000	102,400	86,600	87,600	112,400

[1] Including tin content of ores used direct to make alloys.
[2] Ceiling price.

December jumped to 94 cents to meet the prices fixed by the British Ministry of Supply in agreements with Malayan producers. The British price, then at £513 10s. a long ton for English refined tin set a new record high, which early in January 1948 was further raised by £9 to the equivalent of 94.06 cents.

The International Tin Study Group was formally organized at a meeting at Brussels in April 1947. It recommended to member Governments that a management committee comprising representatives from Belgium, Bolivia, China, France, Netherlands, United Kingdom, and the United States be set up and a permanent secretariat established in The Hague. Much of the group's effort was directed toward an assessment of the current and prospective world production and requirements position. The International Tin Research and Development Council resumed publication of the Statistical Bulletin in February 1946. As of January 1948, publication of a new and improved series was undertaken by the permanent secretariat.

The partial loss of concentrate supply that began in 1946 resulted in a drop of 23 percent to 33,292 tons, in the Government-owned Texas City smelter output in 1947. About 60 percent of the decline was offset by an increase of 60 percent in metal imports compared with 1946. The intake of concentrates, which fell 20 percent in terms of tin, was expected to be bettered in 1948 despite possible diversion of as much as 8,000 tons (tin content) of the Bolivian product. That country remained the principal supplier in 1947 but furnished 5,547 tons or nearly 20 percent less than in 1946. Receipts from the Netherlands Indies increased 122 percent to 4,894 tons; and Siam, with 2,280 tons, appeared for the first time as a source. Consumption of primary pig tin was 59,166 tons, 8 percent more than in 1946, of which the major part was attributable to expansion of tin-plate output. Tin-plate exports jumped 56 percent over the 1946 figure and were about 92 percent of the 1942 record.

Total stocks at the end of 1947, including metal and concentrates afloat or stored abroad, at 95,400 tons were 8 percent higher than a year earlier. They were divided as follows: Industry 26,900 and Government (including defense stocks of 12,140) 42,900 in metal and 25,600 in concentrates. Momentary availability was, however, not materially improved, because the bulk of the increase—about 6,000 tons—was in materials stored abroad or afloat. Consumers' pig-tin stocks were the equivalent to about 3 months' current requirements and those of the Government about 8 months.

GOVERNMENT TIN OPERATIONS

Tin imports continued to be restricted to Government hands in 1947. The general Imports Order M–63 of the Civilian Production Administration was revoked as of May 1, 1947. This order, which covered all strategic materials at one time, came into effect December 27, 1941, but at the end covered tin only. Coincident with revocation, the import controls were embodied in Conservation Order M–43 and CPA was replaced by the Office of Materials Distribution set up in the Bureau of Foreign and Domestic Commerce. Purchase of tin as well as ore or concentrates continued to be centered in the Reconstruction Finance Corporation, whose authority under 1946 legislation expired as of June 30, 1947. Early in June a strongly supported joint congressional resolution providing for a 2-year extension was taken under consideration, quickly passed both Houses, and was approved by the President on June 28, 1947 (Public Law 125, 80th Cong., 61 Stat. 190).[1] The principal provisions were authority (1) to buy, sell, and transport tin, and tin ore and concentrates; (2) to improve, develop, maintain, and operate by lease or otherwise the Government-owned tin smelter at Texas City, Tex.; and (3) to finance research in tin and smelting and processing. It was also required that a full report on all activities be submitted to the Congress not later than December 31, 1947, and at 6-month intervals thereafter.

Various contracts for purchase of tin and concentrates were made during the year, among them one covering about 35 percent of the Netherlands Indies 1948 production. The principal contracts again were made with Bolivia. The first covering the year 1947 was concluded at the end of March after about 2 months haggling over price. Bolivia held out for 76 cents a pound payable tin f. o. b. vessel Peruvian or Chilean ports. RFC offered some concessions in price and treatment charges but eventually was forced to come to the 76-cent base because of the negotiation of a broad Argentine-Bolivian trade pact that provided among other things for the annual delivery of 8,000 metric tons of fine tin in concentrates for 5 years, with a 1947 price of 76 cents. The RFC contract provided for such shipments, as well as for those of the Patiño group to the United Kingdom, for the use of the Oruro smelter, and to Chile. In October RFC undertook to acquire Bolivian concentrates for the assured smelter life. In these negotiations, as theretofore, the major obstacle to quick settlement was the matter of price, with Bolivia said to have asked $1.07 a pound. Before agreement was reached, the British Ministry of Supply announced new buying and selling prices for tin closely equivalent to 90 cents for tin in Bolivian concentrates at ports of export. On that basis agreement was reached as of December 30, 1947. The new agreement was called a supplemental contract extending and amending the "1947 Tin Contract" made March 28, 1947. Principal features were provisions for purchase of all concentrates, but not to exceed 25,000 tons tin content, after making allowance for the Patiño group shipments, up to 8,000 metric tons committed to Argentine under the trade agreement, 600 metric tons for the Oruro smelter, and up to 250 metric tons to Chilean purchasers. Beginning January 1, 1948, the basic price was 90 cents a pound payable tin but to be increased or decreased by the same amount as RFC's selling price for grade A tin, ex dock New York, varied from 94 cents.[2]

GOVERNMENT CONTROLS

The general unpopularity of Government controls was evidenced in congressional actions relating to use of tin. At the beginning of the year CPA recommended that, because of the continuing gap between demand and supply, its powers under the Second War Powers Act, which were to expire March 31, 1947,[3] especially those relating to

[1] An amendment (Public Law 824, 80th Cong.) approved June 29, 1948, extended authority to June 30, 1951.
[2] Texts of the 1947 and the 1948–49 supplemental contract were given respectively in American Metal Market, vol. 54, No. 98, May 21, 1947, pp. 4–5, and vol. 55, No. 20, January 29, 1948, p. 6.
[3] Act of June 29, 1946 (60 Stat. 345).

priorities, allocation, and import and export controls be extended for a year. Legislation to that end was introduced but was amended to limit the period to 3 months. The amended bill was passed on March 31.[4] In May President Truman asked for a full year's extension from June 30, and a corresponding bill was introduced late in May. Although some opposition appeared, there was strong Government and industry support for the measure, at least insofar as it related to tin. The houses of Congress differed on the term of the extension—7 or 12 months—but final action was delayed beyond June 30 principally because of difficulties in resolving questions related to export controls. A temporary extension to July 15 [5] was, meanwhile, approved by the Congress and the President. On July 11 a compromise bill setting the expiration date of February 29, 1948,[6] was passed by the Congress and on July 15 signed by the President. This act, incidentally, permitted unrestricted importation of tin ores and concentrates but retained control on imports of tin and tin products.

Restraints on the use of tin were effected principally through Conservation Orders M–43, tin distribution, and M–81, containers. Direction 10 to Iron and Steel Production Order M–21, which became Direction 1 to Allocations Regulation 2 in April, provided further means of directing the use of tin-mill products to certain purposes, notably tin plate for export. Early in the year, amendments to these several orders among other things lifted the quota system, permitted heretofore prohibited uses, liberalized uses of tin plate, and allowed a higher tin content in body solders. Later largely because of the failure of world output of tin to reach the anticipated rate and the unexpected potential diversion of a large part of the United States share in Bolivian output, there was a tendency to maintain rather than expand consumption. Near the year end there were proposals to cut the use of tin plate for nonfood packs, notwithstanding an improving over-all stock position, but no definite action was taken. At about that time, another factor was introduced—namely, the application of use controls to provide increments for the national defense stock pile, a proposal that became an actuality a few months later.

DOMESTIC PRODUCTION

MINE OUTPUT

No domestic production of tin ore or concentrates was reported to the Bureau of Mines for 1945–47. However, early in 1948 the Office of Metals Reserve acquired about 2.5 tons of alluvial concentrates that originated in Alaska. The year of production is not known but has been credited to 1947.

The Bureau of Mines was active in Alaska field investigations during 1947. A report [7] was issued on New Mexican deposits covering extensive field work carried out between 1939 and 1943 and accompanied by numerous maps and sampling and metallurgical test results.

[4] The First Decontrol Act of 1947, approved March 31, 1947 (Public Law 29, 80th Cong., 61 Stat. 34) extended powers to June 30, 1947.

[5] Extended to July 15, 1947, by joint resolution of June 30, 1947 (61 Stat. 214).

[6] The Second Decontrol Act of 1947 (Public Law 188, 80th Cong., 61 Stat. 322; 50 U. S. C. Supp. App. sec. 633, 645). The act of February 28, 1948 (Public Law 427, 80th Cong.) extended this to May 31, 1948; and the act of June 4, 1948 (Public Law 606, 80th Cong.) extended the powers to June 30, 1949.

[7] Volin, M. E., Russell, P. L., Price, F. L. C., and Mullen, D. H., Catron and Sierra Counties Tin Deposits, N. Mex.: Bureau of Mines Rept. of Investigations 4068, May 1947, 60 pp.

Mine production of tin (content) in the United States, 1943–47, by States, in long tons

Year	Alaska	South Dakota	Other States [1]	Total	
				Long tons	Value
1943	0.1	0.6	5.2	5.9	$6,800
1944		(2)	(2)	5.4	6,200
1945					
1946					
1947	1.3			1.3	2,200

[1] 1943: California, Nevada, and New Mexico; 1944: California, New Mexico, North Carolina, and South Dakota.
[2] Included in total.

The tin potential of the district is indicated by the estimated production from 1940 to 1943, amounting in all to 21,900 pounds of concentrates ranging from 15 percent to 60 percent tin. Excluding 2,000 pounds of low grade from Taylor Creek lode production, the total tin content was about 4.4 long tons.

SMELTER OUTPUT

Domestic output of refined tin in 1947 was essentially that of the Government-owned smelter. The Longhorn smelter's production of 33,292 long tons was 23 percent below the 1946 peak, because of the low rate of high-grade concentrates intake that had begun in the autumn of 1946. Output was curtailed to a minor extent by work stoppages at plants that supplied hydrochloric acid and by a nitrate-ship explosion that virtually wrecked Texas City. The Vulcan Detinning Co. continued experimental production of tin from low-grade, complex ores. It was reported in midsummer that this company was planning to construct a 3,000-ton-per-year plant to treat such materials on a commercial basis. As noted in a preceding section, the RFC was authorized (Public Law 125, 80th Cong.) to continue operation of the Longhorn smelter to June 30, 1949, unless the Congress should fix an earlier termination date. The actual operation has been conducted by the Tin Processing Corp., a subsidiary of the N. V. Billiton Maatschappij, on a management-fee basis of $150,000

Longhorn tin-smelter production, by months, April 1942–December 1947, in long tons

Month	1942	1943	1944	1945	1946	1947
January		2,611	2,153	3,114	3,812	3,024
February		2,334	2,419	3,162	3,823	2,815
March		1,491	2,513	3,310	3,881	2,877
April	525	1,055	2,611	3,407	3,891	2,816
May	1,246	1,032	2,402	3,451	3,904	3,112
June	1,663	1,498	2,439	3,502	3,856	2,712
July	1,924	1,184	2,618	3,548	3,853	2,517
August	1,655	1,347	2,553	2,912	3,672	2,237
September	2,026	2,029	2,501	3,323	3,323	2,356
October	2,014	2,089	2,651	3,558	3,125	3,026
November	2,300	2,020	2,852	3,628	3,119	2,759
December	2,343	2,037	2,907	3,676	3,209	3,041
Total	15,696	20,727	30,619	40,591	43,468	33,292

annually. Its contract, which expired June 30, 1947, was extended for a year with a $200,000 fee.

Pursuant to Public Law 125 the RFC transmitted a report on the Longhorn smelter,[8] to the Congress, December 30, 1947, from which nearly all the following notes have been abstracted. Capacity of the plant is about 40,000 tons a year on Bolivian concentrates and about 90,000 tons if only high-grade, alluvial concentrates (72–75 percent tin) were smelted. The smelter has used a mixture of the two classes. The total plant cost to the end of the fiscal year 1947 was $8,273,127. Authorization to spend an additional $2,665,000 for a waste-acid recovery plant was approved. The tin-casting machine, construction of which was begun in 1946, was put into use in July 1947. The pigs are longer and thinner than those of the Straits Trading Co. and E. S. Coy, and they weigh 83 pounds on the average compared with 106 and 100 pounds, respectively, for the other brands.

To June 30, 1947, the total cost of the tin-smelting program was $277,434,560, including plant cost; and the cost of concentrates was $248,124,434, including transportation and delivery charges. Sales to that date were $203,213,469 and inventory at the then-ruling market price, $53,803,637. If the total plant cost were written off, the indicated loss would be $20,417,454. It was also stated that a loss (included above) of $25,007,866 was incurred by the U. S. Commercial Company in buying concentrates in the world market and reselling to Metals Reserve Company at the equivalent of the 52 cents a pound OPA ceiling. Metals Reserve Company also sustained a loss on concentrates purchased at a price above the domestic selling price. After the removal of price control in November 1946, inventory appreciation was more than enough to have counterbalanced losses attributable to price control. Without considering losses under price control or inventory appreciation, the smelter operated on about a break-even basis before plant amortization. However, an operating loss will arise in 1947, owing to decreased output and two wage increases.

The report closes with suggestions relative to continuation of the domestic smelting program for 5 to 10 years as a defense measure. Operating costs are higher than at European or Asiatic smelters, principally because of the higher wages of American workers and despite cheap fuel and acid. An adequate ore supply is also insecure because of economic and political relationships between miner and smelter. For these reasons, smelter operation would appear to be unattractive to private industry. RFC believes Government operation should be considered only as an emergency measure and that private operation would have to be subsidized. The subsidy could take the form of a purchase-and-sale arrangement for metal or concentrates, the Government absorbing any loss, or a direct subsidy per pound of metal produced, or be in the form of an import duty on metal with concentrates duty free. The last alternative offers some practical advantages. No determination of a duty rate was made. However, on an annual consumption of 75,000 tons and 4 cents a pound duty, the additional cost to consumers would be $6,700,000. If half the tin were smelted domestically, the Government would receive $3,350,000 in duty and the domestic smelter indirectly an equivalent sum.

[8] Reconstruction Finance Corporation, Report on the Government-owned Tin Smelter at Texas City, Tex., Printed for use of Senate Committee on Banking and Currency, 80th Cong., 2d sess., 1948, 10 pp.

SECONDARY TIN

Recovery of tin in all forms was about 26,800 tons or roughly 9 percent more than in 1946. Recovery by detinners alone was 10 percent more than in 1946. Comparable with the rise in tin-plate production, treatment of new tin-plate clippings increased 28 percent, but recovery of tin rose only 15 percent because of the large percentage of electrolytic plate. (See section on Consumption by Uses following.) Partly offsetting was a further sharp drop—41 percent—in the quantity of old containers treated.

Virtually all the tin was recovered by privately owned detinning plants. In addition to tin obtained from tin-plate clippings and old containers, detinners in 1946 treated white-metal scrap and chemical residues. In 1946 they recovered 27 tons as metal and 7 as compounds; in 1947 corresponding quantities were 88 and 71 tons. It is to be noted that, to maintain comparability, the quantities shown in the columns entitled "Tin recovered at detinning plants" in the accompanying table include that recovered from tin-plate clippings and old containers only. The Government-owned detinning plant at Birmingham, Ala., which had cost $1,233,185, was sold by War Assets Administration in July 1947 for $120,000.

Secondary tin recovered in the United States, 1925–29 (average) and 1943–47, in long tons

Year	Tin recovered at detinning plants			Tin recovered from all sources			
	As metal	In chemicals	Total	As metal	In alloys and chemicals	Total: Long tons	Total: Value
1925–29 (average)	900	2,000	2,900	7,500	23,100	30,600	$38,034,120
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
1946	2,480	330	2,810	2,600	22,100	24,700	30,205,663
1947	2,720	360	3,080	2,900	23,900	26,800	46,848,175

CONSUMPTION

APPARENT CONSUMPTION

Apparent consumption of tin, reckoned by adding net imports to domestic smelter output, was less than 1 percent under that of 1946. Neither changes in any stocks within the country nor in quantities afloat are taken into account in this procedure. Consequently, the calculated figure usually departs somewhat from the actual. In 1947

Apparent consumption of tin, 1939–47, in long tons [1]

1939	67,997
1940	123,537
1941	141,618
1942	42,512
1943	31,638
1944	43,379
1945	48,086
1946	58,144
1947	57,771

[1] Exports of domestic tin are not included in 1939–41. They are included in the figures for 1942–47 and are 244, 398, 405, 708, 859, and 415, respectively.

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the deviation was only 2 percent below the actual, largely because of withdrawals from Government supplies to meet the relaxation in use limitations. The accompanying table gives data for 1939–47. A comparable series for 1910–38 was published in Minerals Yearbook, 1939 (p. 680).

CONSUMPTION BY USES

Total consumption of tin in 1947 was 9 percent larger than in 1946 and 14 percent over the 1935–39 average. In comparison with 1946, the gain was attributable to the improved availability of virgin tin—about 4,500 tons. Pig-tin use (59,166 tons) was the greatest since the extraordinary peak of 1941 (103,086 tons) but was 5 percent less than the 1935–39 average. On the other hand the use of secondary tin in 1947 was 10 percent higher than in 1946 and nearly twice that of the prewar period.

The use pattern of both primary and total tin remained unchanged from 1946 in its principal elements, and their relative importance continued to be modified not only by the control measures still in effect but by the now unquestioned acceptance for many uses of thin-coated electrolytic tin plate.

Tin plate and terneplate used slightly more than half the total virgin tin consumed and 18 percent more than in 1946. This was about 1,200 tons (4 percent) less than in the prewar (1935–39) period, but the tin and terneplate output was closely 60 percent greater—a remarkable achievement, due in part to numerous improvements in hot-dipping techniques but more to the widespread application of continuous strip electroplating. In 1946 shipments of electrolytic plate were 32 percent, in 1947 nearly 44 percent, while in some months production of the two varieties was nearly equal. Some authorities believe that hot-dipped plate soon will be relegated to second place; and, if a substantially heavier coating than that mostly now applied (nominally a half pound per base box) can be plated at high speed, the great bulk of the total production will be electrolytic.

Consumption of primary and secondary tin in the United States, 1942–47, in long tons

	1942	1943	1944	1945	1946	1947
Stocks on hand Jan. 1 [1]	67,421	43,853	34,735	27,391	25,789	27,100
Net receipts during year:						
Primary	33,126	40,548	55,323	54,663	56,603	59,882
Secondary	5,096	4,462	2,536	2,623	2,236	2,836
Terne	405	188	228	312	257	417
Scrap	26,941	29,903	28,883	28,498	26,057	26,598
Total receipts	65,568	75,101	86,970	86,096	85,153	89,733
Available	132,989	118,954	121,705	113,487	110,942	116,833
Stocks on hand Dec. 31 [1]	43,853	34,735	27,391	25,789	27,100	25,743
Total processed during year	89,136	84,219	94,314	87,698	83,842	91,090
Intercompany transactions in scrap	2,547	2,889	3,205	3,239	2,091	1,957
Total consumed in manufacturing	86,589	81,330	91,109	84,459	81,751	89,133
Plant losses	902	1,000	1,140	876	808	1,033
Tin content of manufactured products	85,687	80,330	89,969	83,583	80,943	88,100
Primary	56,288	46,253	59,156	55,642	54,627	59,166
Secondary	29,399	34,077	30,813	27,941	26,316	28,934

[1] Stocks shown exclude tin in transit or in other warehouses on Jan. 1, as follows: 1942, 2,700 tons; 1943, 78 tons; 1944, 316 tons; 1945, 1,941 tons; 1946, 1,600 tons; 1947, 1,000 tons; and 1948, 940 tons.

Consumption of tin in the United States, 1945–47, by finished products (tin content), in long tons

Product	1945			1946			1947		
	Primary	Secondary	Total	Primary	Secondary	Total	Primary	Secondary	Total
Tin plate	26,080		26,080	26,127		26,127	30,980		30,980
Terneplate	493	248	741	208	238	446	192	309	501
Solder	10,930	3,399	14,329	13,443	3,673	17,116	14,126	5,954	20,080
Babbitt	4,144	3,684	7,828	4,125	2,874	6,999	3,708	2,952	6,660
Bronze and brass	9,093	17,972	27,065	5,963	16,594	22,557	4,545	16,429	20,974
Collapsible tubes	515	44	559	701	88	789	853	91	944
Tinning	2,390	202	2,592	1,903	205	2,108	2,172	335	2,507
Foil	181	64	245	174	46	220	162	182	344
Pipe and tubing	204	89	293	273	64	337	408	83	491
Type and metal	10	1,281	1,291	123	1,865	1,988	130	1,457	1,587
Bar tin	963	131	1,094	891	78	969	881	65	946
Miscellaneous alloys	378	228	606	373	168	541	226	234	460
White metal	65	151	216	68	77	145	57	202	259
Chemicals Miscellaneous	196	448	644	255	346	601	726	641	1,367
	55,642	27,941	83,583	54,627	26,316	80,943	59,166	28,934	88,100

As reported by the American Iron and Steel Institute, net shipments of tin plate comprised 2,093,149 short tons of hot-dipped and 1,617,659 of electrolytic tin plate in 1947. Shipments for export were 506,347 tons and 59,470, respectively. (In 1947 tin cans exported were 29,189 short tons compared with 15,473 in 1946.) By difference and in the same order, domestic absorption was 1,586,802 and 1,558,189 short tons, a very narrow margin in favor of the hot-dipped variety. It was widely thought that the electrolytic variety of tin plate (1,772,088 net tons produced in 1947) was suitable only for general-line or nonfood cans. In 1947 shipments of tin plate for that class of container were reported at 787,040 short tons, of which 178,376 was hot-dipped and 608,664 electrolytic. Electrolytic tin plate shipped for cans was 1,378,501 short tons in 1947, including 769,837 for sanitary and 608,664 for general-line cans. Furthermore, the 1947 new supply of hot-dipped tin plate was about 560,000 tons less than shipments of metal cans for food packaging. This was more than double the tonnage of metal cans shipped for processed milk, for which it had been proposed to use 0.75 electrolytic plate. It seems a fair conclusion, then, that electrolytic tin plate has been demonstrated a suitable material for a considerable variety of food packs.

If for no other reason than the success of the conservational use of electrolytic tin plate, it would seem that the continued estimates of a 90,000-ton annual virgin-tin requirement are excessive. The use of primary tin for solder was 5 percent greater than in the preceding year and was exceeded only in 1941. The effect of the wartime degradation in quality (tin content) and use restraint continued to be marked. For babbitt, the year's decrease in new tin use was 10 percent. Bronze and brass again ranked third in consumption of virgin metal but were about 24 percent less than in 1946 and constituted only 22 percent of the total use, for that purpose, whereas in the 1935–39 period it exceeded one-half.

In respect to total tin used, in descending order of rank were tin plate, 36 percent; bronze and brass, 24 percent; solder, 23 percent; babbitt, 8 percent.

Consumer receipts of primary tin, by brands, 1939–47, in long tons

Brand	1939	1940	1941	1942	1943	1944	1945	1946	1947
Longhorn				[1] 1,238	12,600	25,540	39,575	48,745	37,657
Straits	48,677	82,980	88,213	21,105	5,951	7,560	4,157	1,244	11,144
Katanga	1,902	530	6,589	3,334	14,983	13,182	6,935	677	2,884
Banka	3,540	6,333	5,238	2,899	4,524	6,717	857	588	2,856
Chinese	3,407	3,154	4,594	1,428	1,700	1,730	2,303	1,000	636
Other	13,206	5,128	9,647	3,122	790	594	836	4,349	4,705
Total	70,732	98,125	114,281	33,126	40,548	55,323	54,663	56,603	59,882

[1] First shipment in June 1942.

Tin contained in tin plate, waste-waste, strips, cobbles, etc., produced in the United States, 1946–47

Product	Quantity manufactured (gross weight, short tons)		Tin content: Total (long tons)		Tin content: Pounds per short ton of tin plate	
	1946	1947	1946	1947	1946	1947
Tin plate:						
Hot-dipped	1,716,591	1,872,152	20,770	22,159	27.1	26.5
Electrolytic	882,537	1,734,535	4,702	7,981	11.9	10.3
Total tin plate	2,599,128	3,606,687	25,472	30,140	22.0	18.7
Waste-waste, strips, cobbles, etc	76,782	124,661	655	840	19.1	15.1
Grand total	2,675,910	3,731,348	26,127	30,980	21.9	18.6

Tin contained in terneplate produced in the United States, 1946–47

Product	Terneplate produced (gross weight, short tons)		Tin content: Purchased as— Pig tin (long tons)		Tin content: Purchased as— Terne metal (long tons)		Tin content: Total (long tons)		Tin content: Pounds of tin per short ton of terneplate	
	1946	1947	1946	1947	1946	1947	1946	1947	1946	1947
Short ternes	69,861	92,683	87	(1)	91	(1)	178	221	5.7	5.3
Long ternes	142,917	142,818	118	(1)	144	(1)	262	270	4.1	4.2
Waste-waste	2,976	4,798	3	(1)	3	(1)	6	10	4.7	4.8
Total	215,754	240,299	208	71	238	430	446	501	4.6	4.7

[1] Figure not available for publication.

STOCKS

Although the over-all stock position in the United States trended downward into the third quarter, a marked upturn in receipts ensued, so that at the year end the stocks of pig tin and tin in ore at 83,672 tons were 10 percent higher than the 76,236 tons at the end of the preceding year. In addition, about 12,200 tons were in process, in scrap, and as secondary tin. Government stocks of pig tin increased 38 percent, but tin in ore declined 12 percent. Defense stocks held by the Navy and Bureau of Federal Supply remained unchanged at 12,140 long tons. The total Government stock was equivalent to something over a year's requirements at the 1947 use rate, but about 8,000 tons locked up in smelter rejects is slowly recoverable at the current operating level and grade of concentrate available.

Stocks of virgin pig tin in the United States, Dec. 31, 1943–47, in long tons [1]

	1943	1944	1945	1946	1947
At consumers' plants	22,861	17,337	14,102	14,532	13,677
At other warehouses and in transit	316	1,941	1,600	1,000	940
Held by jobbers	50	47	69	124	157
Total consumers' stocks	23,227	19,325	15,771	15,656	14,774
Afloat to United States (estimated)	1,650	1,800		1,570	6,220
Total stocks [1]	24,877	21,125	15,771	17,226	20,994

[1] Excludes Government purchases delivered for stock piling or at Texas City smelter. Also excludes tin in process and secondary pig tin.

PRICES

There was no free market price for tin in 1947. British Commonwealth producers continued to press strongly for reopening of the London Metal Exchange, but to no avail. Nor does it appear probable or desirable that an absolutely unrestricted market will appear until the gap between world production and needs is closed. Nevertheless, the 33-percent jump in price during the year perhaps approached that which would have been obtained in a free market.

In November 1946, with lifting of price controls in the United States, the price of fine tin was increased 35 percent to 70 cents to correspond with that being paid for Bolivian tin, wiping out the consumer subsidy of 18 cents. This price held until April 1, when it was raised to 80 cents, the equivalent of the 76-cents-a-pound contract made with Bolivia a few days before under pressure exercised by Argentina in its trade pact with Bolivia. Although the new price had been exceeded only in 1917 and 1918, producers, especially in Bolivia and Malaya, were strongly dissatisfied, and it became evident that further increases would follow. While RFC in December was negotiating a Bolivian contract renewal, the British Ministry of Supply announced increases in home prices of from £73 to £75 a long ton or roughly 13½ cents a pound. Effective on December 19, RFC announced a new price of 94 cents a pound for grade A tin.

In the United Kingdom, corresponding to the United States change, the price of common tin was increased at the end of March from £380 10s. a long ton to £437 0s. 0d. (78.52 cents a pound) and on English Refined from £382 0s. 0d. to £438 10s. (78.80 cents), delivered buyers' works or port of export. On December 17 prices were sharply

Tin prices, 1925–29 (average) and 1943–47

	1925–29 (average)	1943	1944	1945	1946	1947
Average prices:						
New York:[1]						
Straits tin .... cents per pound..	56.64	[2] 52.00	[2] 52.00	[2] 52.00	[3] 54.58	77.94
99.75-percent tin (English refined) cents per pound..	(4)	[5] 51.625	[5] 51.625	[5] 51.625	[5] 54.208	77.512
99-percent tin .... do....	55.50	[6] 51.125	[6] 51.125	[6] 51.125	[6] 53.708	76.896
London:[7]						
Standard tin .... £ per long ton..	254.6	[8] 275.0	[8] 300.0	[8] 300.0	[9] 321.2	426.3
Do .... cents [10] per pound..	55.17	49.54	54.04	[11] 54.04	57.83	77.66
Premium allowed over standard:						
Straits .... £ per long ton..	5.1	(4)	(4)	(4)	(4)	(4)
Banka .... do....	6.9	(4)	(4)	(4)	(4)	(4)
English .... do....	-.7	(4)	(4)	(4)	(4)	(4)
Price indexes (1925–29 average=100):						
Straits tin (New York)	100	92	92	92	96	138
Copper (New York)	100	80	80	80	93	143
Lead (New York)	100	87	87	87	109	196
Nonferrous metals [12]	100	87	87	87	100	142
All commodities [12]	100	105	106	108	121	155

[1] American Metal Market.
[2] Maximum for grade A, 99.8 percent or higher (includes Straits).
[3] Maximum price for grade A, 52 cents until Nov. 10, 1946; 70 cents thereafter.
[4] Data not available.
[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] British Government maximum price.
[9] British Government maximum. To Sept. 26, £300, thereafter £380 10s.
[10] Conversion of British quotations into American money based upon average rates of exchange recorded by Federal Reserve Board.
[11] Official rate; free rate, 53.98.
[12] Based upon price indexes of U. S. Department of Labor.

raised to £510 (91.81 cents) and £513 10s. (92.44 cents) for the common and refined grades. On January 6, 1948, ostensibly to meet the 94-cent United States price, a further £9 rise for both grades was made effective. In Canada price changes were as follows: February 10 from 63½ cents a pound to 71 cents, September 11 to 80 cents, and on January 28, 1948, to 96 cents—all for 99.75 percent grade.

Purchase prices for Nigerian tin in concentrates f. a. s. port and for Malayan tin were adjusted within 2 days to correspond with United Kingdom prices. Nigerian producers received £357 10s. to April 1; then £405 15s., which was raised to £477 (85.87 cents a pound) on December 19. Malayan buying prices were changed as of the same dates as follows: From £370 to £423 and then to £500 (90 cents a pound). Comparable selling price changes at Singapore or Penang were from £372 to £426 to £504 (90.73 cents a pound). When the January 1948 domestic price adjustment was made Nigerian producers received an additional increase of £8 10s., making a new price of £485 10s. Notwithstanding complaints of Malayan producers, a corresponding increase was not granted at once on the score that it would force a rise in the RFC price for Bolivian ore which was tied to Straits tin price at New York and thus force the British to pay more for their share of Bolivian concentrates.

FOREIGN TRADE [9]

Reversion to the traditional world tin industry pattern, in which the great ore producers were likewise the great smelters, had a marked

[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.

effect on the foreign trade of the United States. In the first full year of participation in World War II, the importation of tin in concentrates exceeded that of metal by about 8 percent; in the last year of war the excess was nearly 300 percent, but in 1947 it had dropped to little more than 20 percent. In 1948 it appears that imports of metal will again predominate, although it is unlikely that they will be almost exclusively tin for some years to come. Receipts of foreign tin were 60 percent greater than in 1946. British Malaya, with 54 percent of the total, regained its usual position as the dominant source. Metal from Siam was produced almost entirely during the Japanese occupation. Intake of tin in concentrates declined 20 percent compared with the preceding year's record, in part owing to redirection of the producing country's output to home smelters but in the main to the decline in Bolivian production. In terms of tin content, Bolivia furnished 22,973 tons (28,520 in 1946) or 75 percent. The Netherlands Indies supplied 4,894 (2,206 tons in 1946); Siam, with 2,280 tons from stocks left after the Japanese occupation, became a new and possibly long-term source, while the Belgian Congo delivered only 350 tons compared with 7,214 in 1946. Other sources were United Kingdom 5 (27 in 1946); Mexico 5 (none in 1946); Australia 2 (none in 1946); and Brazil 1 (7 in 1946).

Foreign trade of the United States in tin concentrates and tin, 1943–47

[U. S. Department of Commerce]

Year	Imports				Exports			
	Concentrates (tin content)		Bars, blocks, pigs, grain, or granulated		Ingots, pigs, bars, etc.			
					Domestic		Foreign	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
1943	21,857	$24,804,842	11,919	$13,081,756	398	$464,053	1,372	$1,567,043
1944	35,548	32,346,412	13,338	15,049,200	405	488,508	438	532,861
1945	33,479	32,711,772	8,493	9,213,425	708	890,661	174	223,623
1946	38,070	26,968,713	15,520	18,507,043	859	1,153,936	22	31,939
1947	30,510	20,244,793	24,899	42,684,651	415	650,162	5	9,887

Tin [1] imported for consumption in the United States, 1945–47, by countries

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Long tons	Value	Long tons	Value	Long tons	Value
Belgian Congo	6,494	$6,853,883	627	$730,238	4,550	$8,104,276
British Malaya			2,139	2,492,099	13,432	23,207,914
Canada	53	50,000				
China	1,946	2,309,542	984	1,210,129	2,639	4,323,184
Japan			1,969	2,290,890		
Mexico			24	27,215		
Netherlands Indies			5,409	6,402,249	39	66,850
Portugal			9	10,517	([2])	66
Siam			87	100,906	4,031	6,648,718
United Kingdom			4,272	5,242,800	208	333,643
	8,493	9,213,425	15,520	18,507,043	24,899	42,684,651

[1] Bars, blocks, pigs, grain, or granulated.
[2] Less than 1 ton.

The United States maintained—uninterruptedly since 1941—its preeminent position as the world's tin-plate supplier. Exports—including terneplates and taggers tin—in 1947 jumped 56 percent compared with 1946 and came within 7 percent of the 1942 record but exceeded it by 23 percent in reported value. Tin-plate exports, as such, in 1947 established a new high of 542,274 tons—about 3 percent more than the previous high of 525,377 in 1942. This trade developed despite a limitation of exports and a rise in United Kingdom exports. United Kingdom exports were 40,000 tons, or 34 percent, more than in 1946 but, despite efforts to redevelop a favorable export balance, were little more than one-third the 1937 peak quantity.

With few exceptions (notably France, Paraguay, and U. S. S. R.) deliveries of tin plate from the United States increased to all countries. Western Hemisphere States with roughly 45 percent of the increase took approximately 46 percent of the total. Asia and the Far East accounted for about 20 percent of the increase, with almost as much to Europe and Near East and the remainder to Africa. Canada, closely followed by Australia and Brazil, as in 1946, were the major recipients, taking in all 38 percent of the total exports.

According to the American Iron and Steel Institute, producers in 1947 shipped for export 565,817 tons of tin plate, of which 506,347 were hot-dipped and 59,470 electrolytic.

Foreign trade in tin plate, taggers tin, and terneplate in various forms, 1943–47, in long tons

[U. S. Department of Commerce]

Year	Tin plate, taggers tin, and terneplate		Tin-plate scrap		Tin-plate circles, strips, cobbles, etc. (exports)	Waste—waste tin plate (exports)	Terneplate clippings and scrap (exports)
	Imports	Exports	Imports	Exports			
1943	101	396, 550	19, 591	27	1, 607	50	56
1944	112	436, 632	17, 323	112	1, 294	3, 103	161
1945	147	471, 080	18, 072	433	1, 684	12, 215	378
1946	298	355, 794	24, 530	141	4, 036	6, 690	590
1947	585	553, 748	30, 797		5, 340	21, 209	9

Tin plate, taggers tin, and terneplate (including long ternes) exported from the United States, 1946–47,[1] by principal countries

[U. S. Department of Commerce]

Country	1946		1947	
	Long tons	Value	Long tons	Value
Algeria	1, 430	$177, 754	2, 831	$481, 019
Argentina	25, 097	3, 312, 461	52, 142	8, 830, 093
Australia	48, 215	6, 096, 902	69, 591	10, 854, 731
Belgium and Luxembourg	15, 452	1, 943, 753	18, 299	2, 855, 240
Brazil	44, 447	5, 444, 229	68, 237	10, 783, 982
British Malaya			2, 029	282, 701
Canada	57, 808	6, 514, 646	70, 047	9, 081, 802
Chile	4, 542	585, 231	9, 537	1, 510, 501
China	3, 127	374, 605	7, 780	1, 183, 645
Colombia	1, 693	240, 662	4, 284	675, 869
Cuba	14, 817	1, 858, 748	18, 893	3, 067, 336
Czechoslovakia	1, 118	122, 818	285	38, 033
Denmark	3, 209	408, 968	6, 993	1, 070, 164
Eire	169	19, 144	802	128, 518
France	12, 469	1, 558, 031	7, 289	1, 194, 015

See footnote at end of table.

Tin plate, taggers tin, and terneplate (including long ternes) exported from the United States, 1946–47,[1] by principal countries—Continued

Country	1946 Long tons	1946 Value	1947 Long tons	1947 Value
Greece	1,507	$171,969	1,977	$300,555
Hong Kong	710	83,444	2,761	451,038
India	34	4,067	1,714	286,884
Italy	8,681	1,003,576	11,175	1,675,386
Madagascar	537	68,802	1,292	202,520
Mexico	8,744	1,142,338	18,826	2,856,987
Morocco, French	5,148	662,653	7,633	1,263,832
Netherlands	24,228	2,976,894	30,880	4,843,337
Netherlands Indies			2,476	388,165
New Zealand	9,938	1,227,904	12,056	1,860,494
Norway	7,137	854,704	20,758	2,953,828
Palestine and Trans-Jordan	406	55,101	1,133	180,940
Paraguay	3,559	439,304	842	123,563
Peru	1,709	226,555	2,879	450,977
Philippines, Republic of	2,219	307,443	8,096	1,169,720
Poland			313	92,010
Portugal	6,118	803,468	14,251	3,658,221
Spain	247	31,304	211	32,783
Sweden	8,607	1,040,780	13,720	2,162,632
Switzerland	3,962	362,347	7,878	1,307,271
Tunisia	400	48,542	1,164	186,851
Turkey	2,231	247,999	6,018	1,048,143
Union of South Africa	12,174	1,427,238	25,253	3,804,232
U. S. S. R.	3,768	457,148	676	90,497
United Kingdom			15	2,900
Uruguay	3,186	396,005	8,530	1,427,029
Venezuela	1,933	258,837	3,020	493,763
Yugoslavia	1,830	202,022	378	79,703
Other countries	3,188	410,425	8,784	1,485,892
Total	355,794	43,568,821	553,748	86,917,802

[1] Changes in Minerals Yearbook, 1946, p. 1171, should read as follows: 1945: Argentina, $3,688,062; Spain, 1,646 tons, $209,475. Total: 471,080 tons, $55,457,364.

Foreign trade in miscellaneous tin, tin manufactures, and tin compounds, 1943–47

[U. S. Department of Commerce]

Year	Miscellaneous tin and manufactures: Imports: Tin foil, tin powder, flitters, metallics, and tin manufactures, n. s. p. f. (value)	Imports: Dross, skimmings, residues, and tin alloys, n. s. p. f.: Pounds	Imports: Dross, skimmings, residues, and tin alloys, n. s. p. f.: Value	Exports—tin scrap and other tin-bearing material, except tin-plate scrap (value)	Tin compounds: Imports (pounds)	Tin compounds: Exports (pounds)
1943	$4,140	294,884	$12,379	$202,423		25,042
1944	3,682	113,556	11,640	654,498		25,992
1945	1,403	127,680	29	453,816	25	35,107
1946	5,298	1,100	596	482,733	308	(1)
1947	2,023	2,800	500	883,782	30,760	(1)

[1] Not separately classified.

TECHNOLOGY

As a part of the Bureau of Mines wartime activities, metallurgical services were extended to other Government agencies interested in strategic materials. Under this program, tests were made on samples of three Mexican ores to determine whether they could be beneficiated to meet the minimum grade acceptable to the Metals Reserve Company. The lowest-grade material (1.9 percent tin) responded readily to gravity concentration with a 73-percent recovery and 20 percent tin in the concentrate. The high-grade samples (12.4 and 13.9 percent tin) were not readily amenable to ore-dressing methods because the cassiterite could not be liberated from the intimately associated hematite, even at 200-mesh. These ores, however, were readily amenable to sulfide volatilization at minus 10-mesh, with recoveries from 90 percent upward. The recovered sublimate assayed 30 to 63 percent tin.[10]

Another project was undertaken at the request of the Bolivian Government. A 3-month field study of methods of concentration currently used was carried out with the object of improving techniques or developing other means. Especial emphasis was given to the problem of recovery from tailings dumps that represent a substantial part of the Bolivian reserves and to the possibility of exploiting deposits now not being worked or only very slightly because of metallurgical difficulties. The major problem is recovery of very fine cassiterite lost in slimes, which range from 20 to 65 percent of the tin in the mine ore. Various fields of investigation were suggested, two of the most promising being flotation and sulfide volatilization. It is expected these schemes will be tested on a laboratory scale in 1948.

WORLD REVIEW

INTERNATIONAL TIN STUDY GROUP

At a conference between representatives of eight major tin-producing and consuming countries held in London in October 1946, it was agreed that a study group should be established at once. The organizational meeting was held at Brussels in April 1947, with about 70 delegates or observers from 21 countries and the United Nations in attendance. The principal objects of the meeting were to consider the organization of the study group and to review the world tin situation in the light of changes since the London conference. The terms of reference adopted provided that (1) membership would be open to all countries interested in the production, consumption, or trade in tin; (2) that the group should consider possible solutions to any problems or difficulties which are unlikely to be resolved by the ordinary development of world trade in tin, and (3) that the group should establish a permanent secretariat.

An examination of the statistical position and review of conditions in tin-producing countries showed that estimates made at the London conference were too high. Revised production estimates, with London figures in parentheses, were: 1947, 117,000 tons (141,600); 1948, 163,000 tons (198,000); 1949, 201,000 tons (218,000). World consumption in 1947 might range from 140,000 to 150,000 tons if substantial reduction in world stocks were to be made. Potential consumption in 1949 and in 1950 was assessed at 184,000 and 190,000 tons, respectively, figures that appear unduly large.

The group recommended to member countries that a management committee be established as soon as possible to supervise the establishment and work of the secretariat, this committee to comprise members from Belgium, Bolivia, China, France, Netherlands, United Kingdom, and the United States and to meet alternately in Brussels

[10] Sandell, W. G., Banerle, L. C., and Dean, K. C., Beneficiation of Oxide Tin Ores from the States of Zacatecas and Guanajuato, Mexico: Bureau of Mines, Rept. of Investigations 4080, June 1947, 10 pp.

and The Hague. Donald D. Kennedy, chief, Division of International Resources, Department of State, was named as United States representative. Th. Heyse, Director General of the Mines Bureau, Belgian Colonial Office, was elected chairman at the October meeting of the management committee, which provided for a permanent secretariat. The secretariat is located in The Hague. It took over the duties of preparing a monthly statistical bulletin previously in the hands of the International Tin Research and Development Council. The first issue of an expanded and improved bulletin was for January 1948. The second meeting of the group took place in Washington, D. C., April 1948.

In view of the forecast of a production deficit for a few years, the group recommended continuing allocation of tin, surplus to the needs of the producing country, by the Combined Tin Committee.

The basic reason for the existence of the study group is to effectuate stabilization of the tin industry through international cooperation free from artificial trade restraints, as outlined by the Department of State in its proposal to establish an international trade organization, which, subject to ratification by member Governments, came into being at a meeting in Havana in the spring of 1948. Notwithstanding the high standards for international trade relations set forth in its charter, and within which the study group functions, there have been hints that the study group may be approached to approve some sort of international cartel-like tin control. Whether such pressures may be resisted remains to be seen, but at least one forward step has been attained. Malaya has rescinded its long-existent, prohibitive export duty on concentrates shipped to non-Commonwealth countries but with a proviso that it be effective if the recipient country, viz, the United States, cease its subsidization of internal tin smelting.[11] In the light of the suggestions of Reconstruction Finance Corporation (see preceding section on Smelter Output) concerning future smelter operation, the resolution of the problem now posed appears attended with difficulties.

WORLD MINE PRODUCTION

Mine production of tin in 1947 rose 28 percent over 1946 but did not reach half that of the high years 1940–41. Of the eight major countries output dropped substantially—12 percent—in two, Bolivia and Nigeria. In four there were moderate relative gains, but quantitatively insufficient to balance the Bolivian loss. Production from the remaining two—Malayan Union and Netherlands Indies—more than provided the 25,000-ton gain in world output. In Malaya, with one exception, each month showed an increase over the preceding one, with December production more than treble that of January. In the Netherlands Indies work was retarded severely by labor strikes of several months' duration. However, as newly received dredges were put in operation, a sharp recovery was made.

The accompanying table is based on Bureau of Mines surveys and data contained in the Statistical Bulletin of the Tin Study Group.

[11] Analysis of General Agreement on Tariffs and Trade Signed at Geneva, October 30, 1947 (Preliminary), Department of State Publication 2983, Commercial Policy Series 109, November 1947, pp. 128–129, and 195–196.

World mine production of tin (content of ore) 1925–29 (average) and 1942–47, by countries, in long tons [1]

[Compiled by B. B. Mitchell]

	1925–29 (average)	1942	1943	1944	1945	1946	1947
North America:							
Canada		553	347	231	379	390	319
Mexico	2	364	426	317	174	262	174
United States	24	6	6	5			1
Total North America	26	923	779	553	553	652	494
South America:							
Argentina	32	998	1,070	986	[2] 700	[2] 837	[2] 500
Bolivia (exports)	37,169	38,291	41,523	38,720	42,487	37,619	33,266
Brazil			60	160	140	150	120
Peru		75	79	73	54	31	79
Total South America	37,201	39,364	42,732	39,939	43,381	38,637	33,965
Europe:							
Germany [3]	98	547	[2] 980	[2] 980			[2] 100
Italy		197	[4] 82		[2] 20	[2] 100	[2] 240
Portugal	625	2,670	3,460	[2] 1,800	[2] 600	[2] 1,000	[2] 400
Spain	145	151	206	452	1,167	921	303
United Kingdom	2,658	1,363	1,359	1,289	1,152	793	898
Total Europe	3,526	4,928	6,087	4,521	2,939	2,814	1,941
Africa:							
Belgian Congo	967	16,191	17,480	17,326	17,077	14,091	14,369
Cameroon, French		238	199	163	132	110	114
Morocco, French	4	4	11	9	11	12	12
Nigeria	8,319	12,574	12,835	12,512	11,230	10,338	9,139
Portuguese East Africa	5	10	6	8	2	2	[2] 2
Rhodesia:							
Northern		2	3	6	18	6	1
Southern	15	162	178	123	125	100	117
South-West Africa	149	116	146	126	180	174	146
Swaziland	138	113	109	77	53	37	23
Tanganyika (exports)	22	192	158	123	136	131	103
Uganda (exports)	98	283	296	281	215	206	169
Union of South Africa	1,174	508	526	505	503	487	485
Total Africa	10,891	30,393	31,947	31,259	29,682	25,694	24,680
Asia:							
Burma	2,228	[2] 500	[2] 1,000	[2] 500	[2] 200	[2] 350	[2] 600
China	[5] 7,085	[2] 7,000	[2] 7,500	[2] 3,000	[2] 1,500	1,320	[2] 4,000
Indochina, French	691	1,029	653	358	86		
Japan	590	1,894	1,107	374	[1] 100	57	110
Malayan Union	56,837	15,748	26,000	9,309	3,152	8,432	27,026
Netherlands Indies	33,266	9,938	17,632	6,753	948	6,473	15,915
Siam	8,204	7,833	5,840	3,296	1,775	1,056	1,403
Total Asia	108,901	43,942	59,732	23,590	7,761	17,688	49,054
Oceania: Australia	2,830	2,931	2,635	2,547	2,282	2,127	2,245
World total	163,400	122,500	144,000	102,400	86,600	87,800	112,400

[1] Based to some extent upon the Statistical Bulletin of the International Tin Study Group, The Hague.
[2] Estimate by authors of chapter.
[3] Data include Sudetenland, 1942–45.
[4] January to June, inclusive.
[5] Exports.

WORLD SMELTER PRODUCTION

Notably since the outbreak of World War II and in some instances before, data on smelter production were not available or not released by important smelting countries. Many data are now becoming available through the International Tin Study Group. Use of such figures in the accompanying table is hereby acknowledged.

World smelter production of tin, 1925–29 (average) and 1941–47, by countries, in long tons

[Compiled by B. B. Mitchell]

Country	1925–29 (average)	1941	1942	1943	1944	1945	1946	1947
Argentina	--------	768	709	552	467	714	837	[1] 480
Australia	2,952	3,656	3,024	2,565	2,442	2,359	2,225	2,371
Belgian Congo	--------	11,818	13,963	11,068	[2] 10,000	[2] 8,500	[2] 4,210	[2] 3,588
Belgium	720	--------	--------	--------	--------	--------	1,405	12,059
Canada	--------	29	553	347	231	379	390	320
China	[2] 7,080	6,862	7,677	3,708	2,160	3,268	1,929	3,907
Germany	[3] 3,444	424	965	1,174	1,020	--------	--------	--------
Indochina, French	--------	69	337	389	213	14	--------	--------
Italy	--------	73	232	[1] 110	--------	--------	--------	[1] 120
Japan [4]	606	2,620	3,870	2,058	759	121	162	190
Malayan Union	[5] 88,855	119,381	12,912	30,462	10,983	3,038	11,533	[1] 30,000
Mexico	(6)	150	320	395	286	166	263	[1] 240
Netherlands	[7] 1,000	--------	--------	--------	--------	--------	945	8,750
Netherlands Indies	14,749	[1] 23,000	[1] 8,000	[1] 12,000	[1] 3,000	[1] 500	--------	--------
Norway	(6)	98	48	23	27	80	308	(6)
Portugal	[8] 2	1,481	2,381	3,058	373	182	114	[1] 240
Siam	[9] 113	--------	[1] 1,000	[1] 4,000	[1] 3,000	[1] 2,000	[1] 1,000	[1] 600
Spain	--------	86	99	121	515	1,111	1,440	703
Union of South Africa	--------	143	535	862	1,150	1,033	858	601
United Kingdom	45,800	40,000	37,279	31,573	28,589	27,549	28,680	27,544
United States [10]	--------	1,839	16,168	21,489	30,884	40,475	43,500	33,300
Total (estimate)	165,000	212,500	110,100	126,000	96,100	91,500	99,800	125,000

[1] Estimated by authors of the chapter and in a few instances from Statistical Bulletin of the International Tin Study Group.
[2] Exports.
[3] Includes production of some secondary tin.
[4] Preliminary data.
[5] Exports plus difference between carry-over (on lighters and warrants) at end and beginning of year.
[6] Data not available; estimate by authors of chapter included in total.
[7] Estimated production in 1929.
[8] Average for 1926–27.
[9] Average for 1926–28.
[10] Including tin content of ores used direct to make alloys.

REVIEW BY COUNTRIES

Argentina.—The premier source of tin since its discovery in 1930 has been the Pirquitas tin-silver property, at an altitude of about 4,250 meters in the northwestern corner of Argentina, about 130 kilometers west of Abea Pampa, the nearest rail point. The mine is owned and operated by the Sociedad Minera Pirquitas Picchetti y Cia., S. A.[12]

Most of the tin concentrate has been obtained from a placer extending downstream from the mouth of a canyon in which are located the underground workings, now the principal source. At the

[12] Clayberg, G. A., and Lancaster, Hugh K., Treatment of Tin-Silver Ore, Sociedad Minera Pirquitas Picchetti y Cia., S. A., Argentina: Deco Trefoil, vol. 12, No. 1, January–February 1948, pp. 5–12.

canyon mouth the placer was about 400 meters wide; productive gravel was 1 to 1.50 meters thick with about 5 meters overburden. As high as 15 kilograms of 58-percent tin concentrate per cubic meter was recovered. The present workings, about 4 kilometers downstream, are about 200 meters wide. Workable gravel 0.60 meter thick runs 4 kilograms per cubic meter. Overburden is approximately 4 meters thick. Stripping always has been done with electric draglines. The gravel was excavated by hand and trammed to a stationary washing plant. For some time, the gravel was then mined by dragline and dumped on a movable conveyor that discharged in a movable washer, made up of vibrating screens and jigs. For some months stripping has continued as before, but gravel washing is carried out by contractors using hand jigs.

The tin-silver veins are narrow, steeply dipping fault fractures in Paleozoic sediments, mostly slightly metamorphosed shales and sandstones. The most important vein, the Potosi, now stoped out, was about 1 meter wide and averaged about 3.5 percent tin. There was pronounced secondary enrichment of the silver in the oxidized part of the vein but little difference in the tin content of the oxide and sulfide zones. Work is now concentrated in the Chocaya vein that commonly runs 16 percent tin over 0.15 meter (stoping width, 0.70 meter). Rock drills are employed, but in small oreshoots and very narrow, branch veins drilling is done with hand steel. A high-grade product is made by hand-sorting in the mine.

A coarse-crushing plant is located about midway between the mine and the concentrator at the canyon mouth. At the crushing plant about one-quarter of the feed is rejected as waste by hand-sorting. Conventional practice is followed in the mill. Spiral concentrators recently were added, but their use is still in an experimental stage. Gravity concentration and flotation provide primary silver and tin concentrates. The latter (about 44 percent tin) is combined with the hand-sorted mine product and re-treated in a flotation unit to reduce the sulfide content. The final tin concentrate averages 52 percent tin. It is calcined in an oil-fired furnace, sacked, and shipped to the company smelter in Buenos Aires. Final tailings from the gravity section carry about 3 percent tin. They are being stored for re-treatment; some older tailings have been re-treated.

In March 1947 the mill treated 1,824.9 metric tons of feed averaging 4.7 percent tin. Tin concentrate of 69.8 tons contained 38.9 tons of fine tin or 45.4 percent of the tin in the mill feed. The silver tailing contained about 24, jig tailing 10.5, and tin tailing 17.2 percent of the tin with the residue of about 2.6 percent in the silver concentrate.

Bolivia.—Exports in 1947, in terms of contained tin (33,266 tons), were 12 percent less than in the preceding year and were at the lowest point of the past 8 years. Nearly 60 percent was consigned to the United States, with approximately 40 percent to the United Kingdom, leaving about 50 tons for delivery to Argentina and Chile. There were no great changes in the relative export shares of the several mine groups. That of the Patiño mines declined from 44 percent in 1946 to 39 percent in 1947, with a corresponding increase distributed nearly proportionately between Hochschild (28 percent), Aramayo (9 percent), medium mines (14 percent), and the small producers (10 percent). The small Oruro smelter, which began operation in 1946, exported 10 tons of pig tin.

Labor difficulties continued to beset operators. In January there were civil disturbances at Potosi; miners from Hochschild's Unificada mine attacked military and police quarters with considerable loss of life, many injuries, and considerable property damage. Strong citizen reaction forced the Government quickly to restore quiet. The strikes and other disturbances had a serious effect on production. The Patiño Co. stated that at its Oploca mine, in the same veins and with the same number of workers, output had dropped 70 percent, and losses had reached $60,000 monthly late in 1946. As a consequence, the mine was closed in the first week of February 1947. About 1,500 workers were released. In May, after rejection of an arbitration board's decisions on wages and other points, workers at Patiño's principal mines and plants at Catavi, Llallagua, and Siglo Veinte went on strike. After 16 days the Government enforced the reopening of the mines against the company's desires. After a difficult period, new contracts were concluded. Incentive pay and a monthly bonus for production over 1,000 tons were included. Additional recreational and school facilities were provided, and a labor relations department was established. These several changes were reported by the company to have promoted better discipline and sufficiently improved efficiency with no appreciable increase in labor cost.

About mid-June the Compania Minera de Oruro (Hochschild) announced that the San Jose mine and Machamarca mill would be closed June 30 because of unsupportable labor costs. The Government intervened but permitted a 30-day suspension. During that period, negotiations between the owners and Government were undertaken. As of August 1, the properties were reopened under the immediate direction of the Banco Minero on a lease basis. Late in the year it was reported that production was 120 tons a month compared with 60 to 70 tons under private management. However, the number of workers had been doubled, and at the end of June the Government reduced Banco Minero's export taxes to less than 30 percent of those paid by other exporters.

Simon I. Patiño, founder and president of Patiño Mines and Enterprises, Inc., died in May 1947, aged 84. In his youth he had taken over a mining claim for a debt and in the course of working it discovered a rich lode that became the Salvadura mine. On this foundation he built a worldwide tin business, with large interests in British and German smelters and Malayan mines while dominating Bolivia's production; he was one of the founders in 1931 of the tin cartel. In January 1948, his widow was elected president of the Patiño concern.

As in 1946, producers withheld exports pending conclusion of a new purchase contract with the United States. Negotiations were undertaken late in January 1947 but remained deadlocked until the end of March, principally because of the Bolivian demand for an increase in price from 67 to 76 cents. The final acceptance of that price was, in essence, the result of the announcement about March 7 of a 5-year Bolivian-Argentine trade pact that threatened to divert all the available and uncontracted-for tin from the United States and called for a 1947 price of 76 cents a pound, at the same ports from which tin is shipped to the United States. Although the original Bolivian communiqué named only 3,500 tons of tin, it was soon reported to be 8,000 tons in 1947 and up to 12,000 tons more in succeeding years, at prices to be agreed upon at the beginning of each year. The Bolivian Congress approved the trade treaty in principle June 8 and the Argentine, in August. Formal signature by the presidents of the two countries was reported to have taken place October 23. Numerous difficulties, notably in respect to payment for the tin, delayed implementation, so that the parts relating to tin were not ratified until March 6, 1948. In general, the terms [13] are essentially those of the RFC–Bolivian contracts. The agreement calls for sale and purchase of 8,000 metric tons fine tin in form of concentrates annually for 5 years "from the date of commencement of this contract." The initial basic price was to be 90 cents a pound, f. o. b. steamer Pacific port or inland point of transfer. The price was subject to adjustment semiannually to correspond with prices paid by other buyers (excepting the United Kingdom). All monetary units were expressed in terms of United States dollars, and all payments for the tin are to be made therein. Although Argentina apparently was entitled to receive a large share of Bolivian output in 1947, no deliveries seem to have been made. It remains unexplained what use the Argentine could make of 8,000 tons of tin in concentrate form, lacking facilities for reduction and with needs of about 2,500 tons. If reduction were undertaken there or elsewhere, as in the United Kingdom, which readily could handle the material, the resultant metal would be included in the allocations of the Combined Tin Committee. The Argentine position becomes even more anomalous in view of the probable balance between world demand and supply expected in 1949.

The 1947 contract with the United States concluded March 28 (final signatures were not affixed until May), features are summarized in the section on Government Tin Operations, provided for the possible export of 8,000 tons to other than the United Kingdom or the United States. In October 1947 negotiations for a supplemental contract were instituted. As early as June, Bolivian producers were talking of $1.03 tin and in these negotiations asked for $1.07. A 2-year (1948–49) agreement was reached December 31 at a basic price of 90 cents a pound and again making provision for but not to exceed 8,000 metric tons that might be needed to fulfill commitments under the Argentine Trade Agreement.

The Oruro smelter resumed operation in October. It was claimed that it could produce 150 tons a month of 99.5-percent tin. In October it exported 10 tons of 98-percent grade.

Burma.—At least as far as metals production is concerned, little improvement has been noted in Burmese recovery from World War

[13] A translation of the text was given in American Metal Market, vol. 55, No. 53, Mar. 18, 1948, p. 6.

II. In large part, that may be ascribed to difficulties incident to its establishment as an autonomous nation and connate economic and social reconstruction all in the wake of severe war damage, much of it self-inflicted at Government direction, before and during the Japanese occupation.

Cassiterite deposits have been worked from remote antiquity to the present, but output was negligible up to the turn of the century. At the outbreak of World War II, Burma, with an output of about 6,000 tons of tin in concentrates, ranked eighth among producing countries. Tin- and tungsten-bearing veins have been found over 750 miles from the Southern Shan States to Mergui. Surface deposits are both eluvial and alluvial. Cassiterite and wolframite are found in the former, but the tungsten is never found in the alluvial areas that are remote from the quartz veins. Although several hundred scattered mines have been exploited, the bulk of production has been concentrated in three districts—from north to south, Mawchi, Tavoy, and Mergui. The Tavoy district, where much of the production is obtained by dredging, has been the principal source in recent years, closely followed by Mawchi, with about 50 percent greater output than Mergui.

China.—Although China has large ore reserves and has a production potential of about 10,000 tons of refined metal annually, its output dropped sharply after the outbreak to perhaps 2,000 tons at the end of the war. The principal producing area is about Kochiu in Yunnan Province; the industry there was jeopardized seriously by the defense removal of steel from the railroad to Haiphong, the continued scarcity of food, fuel, and other staples, deterioration of plant and equipment, and violent inflation. In 1947 the Government, through the Bank of China, made substantial advances to tin miners who were to turn over their output to the Yunnan Tin Corp. for smelting and sale. What effect this may have had has not been determined, but with the increase in price and ready convertibility for stable currencies some improvement took place in 1947. At times, Chinese tin was freely offered in various markets; but because of poor quality—from about 98 percent tin or less from native smelters, to 99.2 percent for the best brand of the Yunnan smelter—it was not quickly absorbed, especially by the United States, because of the substantial production of inferior grades at the Longhorn smelter. China's output in 1947 was the subject of conflicting reports but was possibly of the order of 4,000 tons.

Malayan Union.—The forecasts of a quick recovery of the Malayan tin industry again were unrealized in 1947. Although mine production (27,026 tons) more than trebled that of 1946, it was less than one-third the 1940 record and less than one-half the 1935–39 average. Refined-tin output from the Pulau Brani (Singapore) and Penang smelters (29,318 tons) was, in comparison, substantially less than in the same periods because of the very small intake of Burmese and Siamese concentrates. Nevertheless, the Malayan production surpassed that of the United Kingdom by 2,000 tons and was only 4,000 tons below that of the United States. Malaya again became the principal supplier of foreign tin to the United States, providing slightly more than half its metal imports in 1947.

Industrial rehabilitation advanced slowly, though at an increasing pace. Major impediments continued to be capital weakness and delays in obtaining new equipment as well as repair and maintenance parts, especially electrical supplies and equipment, purchase of which had been restricted to the sterling bloc. Although the Home Government continued to be pressed for favorable action on long-standing orders for materials, it merely acknowledged the importance of Malayan exports as a source of dollar exchange but provided only delivery priorities for its own fuel and power schemes, both socialized industries. Late in 1946 provision was made for limited rehabilitation loans against war-damage claims, which were to be evaluated under the principles of the United Kingdom War Damage Act of 1943. As pointed out by numerous producers, that legislation did not provide sufficiently for self-inflicted damage carried out under Government orders in 1941 and by some was considered grossly inadequate and inequitable. In February a commission began to consider claims that for all claimants were estimated to go as high as £129,000,000. Rehabilitation loans for tin miners were to be a first claim against repaired assets and would be offset against any war-damage compensation. Repayment with interest at 3 percent annually is to begin after approval of compensation claims, or January 1, 1950, whichever is the earlier. The term for dredging companies was set at 15 years. For hydraulic, gravel pumping, open-cut, and lode operations the time would depend on individual circumstances but is not to exceed 10 years. To the end of April, European companies had applied for loans of Straits $46,882,550, of which Straits $27,120,298 had been approved. Corresponding figures for Chinese operations were Straits $24,278,234 and Straits $8,119,800. This group accounted for about 30 percent of the prewar output, was financially much weaker than the European-owned companies, and employed a relatively greater number of workers whose wages were now more than doubled, with supplies and food up 100 to 500 percent. Consequently, many of these operations seemed certain to be discontinued unless better consideration were to be accorded and the price of tin were increased notably. At the opening of the year about 216 mines, including 20 dredges (100 prewar), were at work. At the year end 488 properties were in operation, divided as follows: Dredges, 56 (13 being rehabilitated); gravel pumping, 323; hydraulic, 24; open-cut, 10; miscellaneous 27; and small, strictly hand-operated 48. The Malayan Tin Dredging Co. acquired a new dredge at a cost of nearly £400,000. It has a rated monthly capacity of 340,000 cubic yards and can dig to a depth of 130 feet. Since there is much deeper ground, experiments on the workability of such tracts have been undertaken.

Shortage of deliveries from the seriously damaged Batu Arang coal mines had already retarded output in the latter part of 1946. The effect was intensified by a 2-month strike that began in January. Some dredges reverted to wood for fuel, some were converted to oil-firing, as were several power plants, but four dredges had to cease work, and gravel pumping mines were restricted to 12 hours' daily operation for a time. The first-quarter output was, as a result, little more than 10 percent above that in the final quarter of 1946. By May a promising upturn had taken place, and by December production had reached a yearly rate of 40,000 tons.

The price policies (see preceding section on Prices) of the British Ministry of Supply, which continued to control tin sales, were assailed by all producers, who had little or no voice in fixing prices that would reflect the greatly increased cost of production. The Ministry's actions were arbitrary and merely a weak following of a pattern set by the United States in dealing with Bolivia for a grade of material that would ordinarily sell at a discount compared with the high-grade Malayan concentrates. There were, too, repeated and widespread demands for the reopening of a free market in tin and estimates that the price then would reach £600 a ton. Whether these repeated outcries were the cause is not certain, but the Ministry went a long way toward that goal when in December it set the Singapore-Penang sales price at £504 or 90.7 cents a pound and within another 6 months brought it up to the equivalent of $1.03. It may be noted that, long before these prices could be reflected in earnings, reports of important tin companies showed distributed profits. At the new ruling prices, production should be markedly stimulated, as would profits, despite reported doubled costs compared with those of the prewar period and a 20-percent income tax to be levied in 1948.

Netherlands Indies.—The greatest tin-industry rehabilitation progress in 1947 was accomplished in the Netherlands possessions, despite labor difficulties. The success therein was attributable not only to favorable natural advantages, but to the early removal of the tin islands from the sphere of the Indonesian conflict and notably so to effective war-end planning. Two of the world's largest dredges were ordered in the United States, and the construction of six smaller ones was undertaken in the Netherlands. All were completed by or in 1947, all were towed to their destinations without serious incident (though one was turned back by storm in the Bay of Biscay), and all were being broken in or in use by the end of the year—a really notable achievement. Three of the dredges were consigned to Billiton, one to Singkep, and the remaining four, including the larger ones, to Banka. The Netherlands-built units are self-contained, Diesel-electric-powered, and have a digging depth up to 30 meters and an annual capacity of 2½ to 3 million cubic meters. The American-built dredges were likewise Diesel-electric-powered, can dig 100 feet below water level, and have 14-cubic foot buckets and an estimated capacity of 300,000 to 400,000 cubic yards monthly. After a run-in period, one of these dredges was reported to have saved more than 400 tons of tin in a full month's work. The rehabilitation of the Indies tin industry appears to have been in the hands of the N. V. Billiton Maatschappij, which was said to have spent nearly 50,000,000 guilders (approximately $19,000,000) on the project.

The continued disorders and political difficulties in the principal islands did not affect tin operations. However, a strike of Chinese workers on Billiton called about May 1 lasted until August 15 and caused a loss in output of perhaps 2,000 tons. By the year end, production had risen to such a height that the prewar average is likely to be equaled or eclipsed in 1948. Smelting was not resumed in 1947, but the Arnhem (Netherlands) plant stepped up its output. About midyear it was reported that Reconstruction Finance Corporation had contracted for one-half the concentrate output as against one-quarter under the preceding arrangement.

Nigeria.—The decline in production that set in after reaching its highest point in 1943 continued through 1947 but was expected to be arrested in 1948. Curtailed development and exploration during the war, deterioration of equipment, and shortage of replacements combined with reputedly inadequate prices, in the face of largely increased costs, were in great part responsible for the decline. One company reported that in 1933–40 native labor costs had been 35 percent of total cost at railroad. In 1944 the share was more than 42 percent and now was expected to reach 50 percent. As far as price is concerned, Nigerian producers obtained an increase of one-third during 1947 and on January 6, 1948, an additional £8 10s. (See section on Prices.) In some instances, notably among the smaller companies, known reserves fell below 2 years' production needs, and some areas were completely exhausted. The opinion has been expressed that Nigerian reserves will not permit production at present levels for more than 15 years.

Siam.—The recovery of tin mining fell far behind that of other important eastern countries. The year's output of 1,403 long tons (tin content of concentrates) just about equaled 1 month's production in the immediate prewar years. Much of the delay was ascribed by producers to the slowness of the Siamese Government in implementing the agreement of December 7, 1946,[14] with the United States, United Kingdom, and Australia; other retarding factors were increases in royalties and taxes, exchange controls, and retention by the Government of half the foreign exchange proceeds on sales of tin. Early in April, when the above-named agreement was renewed for 3 months, the Government released for export approximately 16,000 tons of tin (in metal and concentrates) that remained after the wartime Japanese occupation. At that time, the Office of Metals Reserve signed the first contracts on behalf of the United States which under the agreement was entitled to obtain one-half of the materials. The first metal shipment from Siam to the United States (except for a quantity received in 1946 via Japan) was 50 tons, reaching New York May 19. The price paid, in 50-ton lots or over, for grade A tin f. o. b. vessel, Siamese ports, was reported to be 75 cents a pound.

In mid-June exporters of tin were exempted from surrendering 50 percent of the foreign exchange received. However, if exporters had

[14] See Minerals Yearbook, 1946, p. 1181.

contracted obligations to surrender such proceeds before the releases were effective, they continued to be bound by their obligations. This apparently affected tin exporters, at least to the end of September.[15]

Under terms of the December 1946 agreement, Siam had agreed to compensate British Commonwealth owners for financial losses suffered during the war. Negotiations then ensued but a settlement was not reached until October 30, 1947. It was then announced that the total sum to be paid was agreed upon at £1,250,000. About 2 weeks later, the Government was overthrown by Marshal Pibul Songkram, a wartime leader. The question of honoring the settlement apparently was resolved favorably, as near the year end it was reported that five companies, including two important ones—Kamuntung Tin Dredging, Ltd., and Tongkah Harbour Tin Dredging, Ltd.—were to receive advances of £500,000 and 18,000,000 ticals, which would permit their operations to be resumed early in 1948. Nineteen companies out of 25 had then received advances.

United Kingdom.—Mine production of tin rose 13 percent to 898 tons. Geevor and South Crofty mines were the only ones in active operation. The East Pool and Agar mine, closed since the middle of 1945, was placed in receivership. The Geevor company reported satisfactory results for the year ended March 31, 1947; there was little change from the preceding fiscal year. The mill treated 45,537 tons of ore, recovering 530 tons of black tin (about 65 percent tin) or 26.07 pounds a ton. Reserves dropped nearly 21,000 tons but were about 3.6 years' supply at the current mining rate. The company works under a contract made with the Ministry of Supply July 1, 1945. The British Malayan Tin Syndicate began to rework old Cornish dumps. By August it was milling 90 tons a day, recovering about 6 tons of concentrates weekly (6 days) containing 1.4 tons of tin. Since April about 6,000 tons had been handled, with a recovery of 67 tons of concentrate (15.25 tons of tin). The operation is expected to be profitable when the mill capacity of 150 tons daily is fully utilized.

Revival of tin smelting in the Far East and in western Europe had a marked influence on the tin trade in 1947. Imports of tin were about 400 tons and concentrates 39,314 tons (estimated tin content 24,000 tons) or roughly 15 percent less than in 1946. Exports of pig tin dropped from 20,608 tons to 4,335. Smelter output of 27,544 tons was 4 percent less than in the preceding year and was virtually the same as domestic consumption. The national fuel and power crisis in the early months of the year had little effect on the output of tin, as the Williams Harvey & Co. plant, which made about 90 percent, largely had been converted to oil-firing. Domestic uses of virgin tin (27,384 tons) were not restricted, increasing 7 percent in 1947 over the preceding year, but the total tin used (34,584 tons) was only 4 percent greater. The major changes were in tin plate (8,932 tons)

[15] Foreign Commerce Weekly, Siam Economic Conditions: Vol. 29, No. 9, Nov. 29, 1947, p. 21.

and foil and tubes (3,318 tons), up respectively 22 and 56 percent, accompanied by declines of 15 percent in solder to 5,621 tons, and 4 percent in alloys to 13,535 tons. Economy of tin used for tin plate in the United States compared with British practice is strikingly evident. In 1947 United States shipments of tin plate (and terneplate) were six times as great as the British but tin consumption therefor was only three and one-half times as great. Government and consumer stocks of tin in metal and in concentrates dropped from nearly 20,400 tons at the beginning to 15,600 tons at the year end.

The British Government in April approved the planned £50,000,000 modernization of the South Wales tin plate and sheet-steel industry. The cold-reduction strip mill is to be erected near Llanelly. It is to have an annual capacity of 7,000,000 base boxes. The hot-strip mill, now under construction near Port Talbot, can roll 72-inch sheared strip, the widest in England. The weekly output is gaged at 22,400 tons. The project is being undertaken by private capital notwithstanding the Labor Government's announced intent to force through nationalization of the iron and steel industry even to the extent of curtailing the already limited powers of the House of Lords that has, at least for the time, blocked the requisite legislative action.

Titanium

By HELENA M. MEYER

GENERAL SUMMARY

PIGMENT manufacturers used record quantities of ilmenite again in 1947, as in 1946 and 1945, in producing more titanium pigments than ever before, or at the new high rate permitted by further expansion of plant capacity in 1947. As for a number of years, the expanding capacity output was inadequate, by a substantial margin, to handle record-breaking demand. Further pigment-plant expansion was in progress when the year closed. Inadequate supplies of steel for plant construction and equipment impeded more rapid expansion of titanium pigments plant capacity.

Domestic production and shipments of ilmenite were likewise at higher rates than ever before. Record domestic production, together with recent increasing activity in the investigation of new domestic sources for the mineral, point to the growing independence of domestic consumers of foreign sources of supply, a move given sharp impetus during World War II, when dislocation of sea lanes prevented the free flow of ore from accustomed Indian and Norwegian sources. Imports also established a new peak in 1947. As a result of the sharply greater supply of crude material, coupled with the limited manufacturing-plant capacity, stocks rose to a new peak and at the year's end were adequate for almost 1 year's requirements at the 1947 peak consumption rate.

Although the manufacture of titanium pigments absorbs most of the ilmenite used, research by the Bureau of Mines and others into the possibilities for use of titanium metal in the light-metal construction field indicates that this use probably will consume substantial quantities of ilmenite when costs of production can be reduced further.

Rutile production continued to break records in 1947, rising 15 percent above the previous peak in 1946, but shipments were 31 percent less than the 1946 record. For the second successive year domestic output was more than adequate for domestic needs, the excess going into stocks. Receipts of rutile from abroad exceeded those for 1946 and statistically were entirely in excess of industry's needs because of the current domestic production-consumption relationship. As a result of the foregoing, industry stocks rose 28 percent in 1947 and at the end of the year were sufficient for almost 2 years' needs at the 1947 rate of consumption.

The Supreme Court, in a decision rendered June 23, 1947, upheld the decree of the lower court in the civil suit by the Government against certain factors in the titanium pigments industry. In summarizing the matter the National Lead Co. stated: [1]

On June 23, 1947, there was affirmed by the Supreme Court of the United States the decree of the lower court in the civil suit by the Government against the Company and others involving charges of violation of the anti-trust laws. In brief, the decree directs the cancellation of certain agreements which provided, among other things, for territorial arrangements and for the exchange of titanium-pigment patent rights, domestic and foreign; it also directs the sale of the Company's stock interests in certain partly owned foreign companies engaged in the titanium pigment business or, in the alternative, the purchase by the company of the interests of the other stockholders in these companies; it further directs the granting of non-exclusive licenses under United States patents in the titanium pigment field on a uniform, reasonable royalty basis. The Company is at the present time proceeding to carry out the provisions of the decree. The disposal of its stock interest in British Titan Products Company, Limited, * * * and the acquisition of the outstanding minority interest in Canadian Titanium Pigments Limited, * * * are steps taken in this connection.

Prices for ilmenite changed little in 1947 following a $9 to $10 drop in 1946. They were quoted nominally at $19–$20 a long ton for ilmenite containing 57–60 percent TiO_2, f. o. b. Atlantic seaboard, according to grade and impurities, when the year ended as when it began, having declined to a low point of $17–$19 in midyear. Rutile prices continued to be quoted nominally at 8–10 cents a pound, guaranteed minimum 94 percent concentrate.

DOMESTIC PRODUCTION

Ilmenite output rose 19 percent in 1947 to a new peak rate, surpassing the previous peak in 1945 by 9 percent, and shipments in 1947 likewise were the highest on record. Rutile production also established a new high, rising 15 percent above the previous peak in 1946, but shipments fell 31 percent below the peak established in 1946. Shipments of ilmenite concentrates in 1947 ranged from 44 to 60 percent TiO_2 and of rutile from 93 to 94 percent TiO_2.

Production and mine shipments of titanium concentrates from domestic ores in the United States, 1943–47, in short tons

Year	Ilmenite				Rutile			
	Production	Shipments			Production	Shipments		
		Gross weight	TiO_2 content	Value		Gross weight	TiO_2 content	Value
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
1946	282,447	282,708	130,624	4,878,917	7,453	7,514	7,046	996,989
1947	336,533	336,061	157,328	5,029,490	8,562	5,157	4,813	533,548

Florida.—In December 1947, E. I. du Pont de Nemours & Co., Inc., signed a long-term lease for State-owned ilmenite-bearing property near Starke, Fla., to provide a large domestic source of supply of the ore. Large-scale mining operations are expected to get under way promptly. The grade of the sand analyzes about 4 to 4.5 percent

[1] Annual Report for 1947, pp. 18 and 19.

heavy mineral. Composition of the heavy mineral fraction runs approximately: Ilmenite 45 percent, staurolite 20 percent, zircon 14 percent and other components in minor quantities. The monazite content is so low as to be almost negligible. The sand will be dug by a suction dredge and pumped to Humphreys spirals for gravity concentration. The spiral concentrate will be dried and fed to electrostatic machines. The conductors will be split on magnets, and nonconductors will be further treated to concentrate zircon. The area, recently investigated and described,[2] is about 45 miles inland from the east coast of north Florida. Drilling extended from a section along U. S. Highway 90 a few miles east of Macclenny, south approximately 32 miles to a section about 3 miles north of Keystone Heights.

Production of ilmenite in Florida in 1947 came again from the Rutile Mining Co. of Florida, near Jacksonville, and of rutile came from this company and the Riz Mineral Co., near Vero Beach, which, however, was inactive most of the year.

New York.—Production of titanium-bearing ore at Tahawus, Essex County, by the National Lead Co. was greater than ever before, an outstanding reason for the record performance of the United States as a whole.

North Carolina.—The Yadkin Valley Ilmenite Co., subsidiary of the Glidden Co., produced 27,349 short tons of ilmenite (averaging 52 percent TiO_2) at Finley, Caldwell County. The 1947 output was 60 percent above that in 1946.

Virginia.—Ilmenite and rutile continued to be produced near Roseland, Nelson County, by the American Rutile Corp., subsidiary of the Metal & Thermit Corp. The Calco Chemical Division of American Cyanamid Co. likewise continued to produce ilmenite at Piney River, Nelson County.

CONSUMPTION AND USES

Consumption of ilmenite established a new high record in 1947 for the fifth successive year, enabled to rise 19 percent above 1946 because of further expansion of pigment-plant capacity. If pigment-plant-capacity expansion had been sufficient to meet all requirements, additional tonnages of ilmenite would have been consumed. The manufacture of titanium pigments again used 99 percent of all ilmenite consumed. Rutile consumption rose 8 percent in 1947; and welding-rod coatings again took by far the largest quantity, 84 percent of the total, in that year.

Titanium Pigments.—New peak records for production and shipments of titanium pigments were established in 1947 for the fourth successive year. The expanded capacity operations were again unable to supply all requirements for this product by a wide margin. Demand for titanium pigments, although rising on the product's own merits, has been accentuated in recent years by inadequate supplies of competitive lead- and zinc-paint pigments. According to information from a leading manufacturer, the use pattern for titanium pigments in 1947 was as follows: 75 percent was for paint, varnish, and

[2] Spencer, Robt. V., Titanium Minerals in Trail Ridge, Fla.: Bureau of Mines Rept. of Investigations 4208, 1948, 21 pp.

Consumption of ilmenite and rutile in the United States, 1943–45 (total) and 1946–47, by products, in short tons

Product	Ilmenite		Rutile	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content
1943	302,822	142,868	17,634	16,451
1944	360,941	175,475	14,813	13,837
1945	381,178	187,580	9,791	9,144
1946				
Pigments (manufactured titanium dioxide)[1]	399,042	200,352		
Welding-rod coatings[1]	105	57	5,990	5,600
Alloys and carbide	4,685	2,025	1,035	966
Ceramics			75	72
Miscellaneous[2]	451	229	34	32
Total 1946	404,283	202,663	7,134	6,670
1947				
Pigments (manufactured titanium dioxide)[1]	473,154	248,231		
Welding-rod coatings[1]	144	74	6,425	5,907
Alloys and carbide	5,972	2,431	1,131	1,050
Ceramics			102	95
Miscellaneous[2]	254	123	34	31
Total 1947	479,524	250,859	7,692	7,083

[1] "Pigments" include all manufactured titanium dioxide, consumption of which in welding-rod coatings was 938 tons in 1946 and 1,257 tons in 1947.
[2] Consists of ilmenite used as a steel flux and rutile used in lamp-electrode coatings and as a steel deoxidizer.

lacquer, 8 percent for paper, 6 percent for rubber, 2 percent each for floor coverings and welding rods, and 7 percent for other uses.

Welding-Rod Coatings.—Production of titanium-coated welding rods was 153,000 short tons in 1947, a gain of 15 percent over 1946 and the first increase since 1943. In 1946, 133,000 short tons were coated and in 1943, 481,000 tons. Of the rods in 1947, 54 percent were coated with natural rutile, 33 percent with manufactured titanium dioxide (extracted from ilmenite), 7 percent with both varieties of dioxide, and 6 percent with ilmenite.

Titanium Alloys and Other Uses.—New acid-resistant, highly opaque sheet-metal cover-coat enamels made from relatively high percentages of titanium dioxide have come to the fore[3] because of their many advantages in covering power and acid resistance. A steel has been developed[4] to withstand very high temperature of enameling furnaces so that a special tough porcelain enamel can be applied to the metal. The single porcelain enamel finish on the titanium steel has production advantages over the two-coat finish.

Synthetic rutile gems have been developed at the titanium division

[3] Steel Enameling Industry Limited by Raw Material Shortages: Vol. 122, No. 1, Jan. 5, 1948, p. 239.
[4] The Iron Age, Titanium Iron for Vitreous Enameling (Advertisement): Vol. 158, No. 24, Dec. 12, 1946, p. 149.
Daily Metal Reporter, Westinghouse Offers Range With Titanium Steel Tap: Vol. 48, No. 61, Apr. 2, 1948, p. 9.

of the National Lead Co. research laboratories. A descriptive article[5] states:

Pure rutile crystals may have other uses in addition to that of gems. Industrial uses have not yet been investigated due to the present limited laboratory production. The atomic structure of the mineral indicates the possibility of excellent electrical, optical and sonic properties.

STOCKS

Ilmenite and rutile industry stocks increased 19 and 28 percent, respectively, during 1947.

Stocks of titanium concentrates in the United States at end of year, 1946–47, in short tons

Stocks	1946				1947			
	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	1,309	613	533	501	1,706	776	3,953	3,687
Distributors [1]	3,919	2,155	8,488	7,979	5,684	3,126	8,642	8,123
Consumers	375,998	195,541	1,896	1,521	[2] 446,052	[2] 229,128	1,342	1,232
Government [3]			3,891	3,658				
Total stocks	381,226	198,309	14,808	13,659	[2] 453,442	[2] 233,030	13,937	13,042

[1] Includes ilmenite and rutile content of mixed zirconium-titanium concentrates.
[2] A large quantity previously counted as stocks was written off company books in 1947.
[3] Excludes stocks in Government strategic stock pile.

PRICES

Ilmenite, 57–60 percent TiO_2, was quoted in E & M J Metal and Mineral Markets nominally at \$19–\$20 a long ton, f. o. b. Atlantic seaboard, according to grade and impurities, at the beginning and at the end of the year, but slumped to a low of \$17–\$19 for a limited period in late spring. Rutile, 94 percent TiO_2 guaranteed minimum, remained nominally at 8–10 cents a pound throughout the year. 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, continued to be quoted at \$5–\$5.50 a pound until May when the quotation was advanced to \$8–\$9 a pound, where it remained until reduced in September, to \$6–\$7 a pound, at which level it continued through the remainder of the year. Manufactured titanium dioxide (anatase), chalk-resistant, plain and nonchalking, in bags, carlots, delivered—quoted in Oil, Paint, and Drug Reporter at 15½ and 15½ to 17½ cents a pound, respectively, at the beginning of the year—was raised 1 cent a pound in the spring and an additional 1 cent at the end of December.

[5] Science News Letter, New Synthetic Gems Made: Vol. 52, No. 16, Oct. 18, 1947, p. 243.

FOREIGN TRADE [6]

Imports.—Receipts of ilmenite from abroad in 1947 were larger than ever before, being 24 percent above 1946 and 5 percent higher than the previous record established in 1939, before the war had cut off normal trade movements. India was by far the largest source, furnishing 87 percent of total entries in establishing new record quantities in 1947. Norwegian ilmenite came into the country again in larger quantities following the resumption of shipments to the United States in 1945. Imports of rutile, much of it in the form of mixed zircon-rutile-ilmenite concentrates from Australia, more than doubled

Titanium concentrates [1] imported for consumption in the United States, 1943–47, by countries, in short tons

[U. S. Department of Commerce]

Country of origin	1943	1944	1945	1946	1947
ILMENITE					
Australia [2]	390	79	1,753		[3] 1,659
Brazil		5,511	10,508	2	1
Canada	65,437	32,580	6,987	1,250	7,122
Ceylon		4,648			
India	8,960	62,066	179,693	218,623	262,503
Norway			9,895	21,077	30,026
Total as reported	74,787	104,884	208,836	240,952	301,311
Australia: In "zirconium ore" [2]	3,306	4,064	[4] 1,236	1,388	
Grand total	78,093	108,948	210,072	242,340	301,311
Value of "As reported"	$380,161	$596,034	$1,217,339	$1,440,112	$1,791,020
RUTILE					
Australia [2]	2,802	1,896	3,070	4,377	7,460
Brazil	4,920	1,669	234	31	
Cameroun (French) [5]	1,095				3
India	818	134			113
Total as reported	9,635	3,699	3,304	4,408	7,576
Australia: In "zirconium ore" [2]	4,703	6,320	7,298	1,456	
In "ilmenite"					[3] 5,061
Grand total	14,338	10,019	10,602	5,864	12,637
Value of "As reported"	$823,624	$272,283	$98,170	$213,795	$468,810

[1] Classified as "ore" by the U. S. Department of Commerce.
[2] Most of the imports of titanium from Australia in 1943–47 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] Most of the ilmenite, rutile, and zircon from Australia in 1947 was imported in the form of zircon-rutile or zircon-rutile-ilmenite mixed concentrates. These concentrates (including separated concentrates of a single mineral) totaled 36,074 short tons, of which 1,659 were ilmenite, 12,521 rutile, and 21,894 zircon. For statistical convenience, it can be assumed that 5,061 tons of the material reported by the Department of Commerce as ilmenite was actually rutile; the value of this 5,061 tons of rutile, however, is inseparable from the value of ilmenite as reported.
[4] Includes 309 tons not recovered from mixed concentrates.
[5] Includes quantities reported by the U. S. Department of Commerce as originating in French Equatorial Africa, from which no rutile production has been recorded.

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

in 1947 and were the largest since 1943. Australia was the only important foreign source of rutile in 1947. Imports of ferrotitanium for consumption totaled 45 short tons in 1947, all from the United Kingdom.

Exports.—Of the concentrates exported in 1947, 31 percent went to the Netherlands, 30 percent to Canada, 17 percent to Sweden, 6 percent to the Union of South Africa, and 5 percent each to Belgium and France. Of the pigments, 63 percent went to Canada and 9 percent to Belgium-Luxembourg; Norway was the only other country out of the 44 remaining destinations that received as much as 5 percent. South America as a whole received nearly 9 percent and Europe, including Belgium-Luxembourg and Norway, received 22 percent. Total titanium products exported in 1947 were valued at about $5,500,000.

Exports of titanium products from the United States, 1943–47, by classes

[U. S. Department of Commerce]

Year	Concentrates		Ferro-alloys [1]		Dioxide and pigments		Tetrachloride and other compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	1,385	200,866	550	63,723	16,314	3,092,607	(2)	(2)
1947	1,266	192,703	509	80,590	21,171	5,183,936	(2)	(2)

1 Includes metal and nonferrous alloys, 1943–44.
2 Beginning Jan. 1, 1946, not separately classified.

TECHNOLOGY

Bureau of Mines' pilot-plant production of ductile metallic titanium was discussed in the report of this series for 1946. Practice of the method used, a modification of the Kroll process, requires large amounts of pure titanium tetrachloride. About 30,000 pounds of commercial titanium tetrachloride have been successfully purified through a distillation process developed by the Bureau of Mines. A report,[7] recently issued, gives detailed information on the equipment and tests.

German research in connection with the melting of ilmenite in a MgO-lined batch rotary kiln in the presence of both carbon and a sodiumhydroxide flux is discussed in the World Review section of this chapter. German methods of producing titanium metal are also referred to.

An article [8] recently published states it is believed that at the present time titanium can be produced on a small scale for $3 to $4 a

7 Stoddard, C. Kerby, and Pietz, Emil, Pilot-Plant Distillation and Purification of Titanium Tetrachloride; Bureau of Mines Rept. of Investigations 4153, 1947, 40 pp.
8 Gee, E. A., and Waggaman, W. H., Metallic Titanium is Light, Strong, Durable, and Corrosion Resistant: Materials and Methods, vol. 27, No. 1, January 1948, pp. 75–78.

pound, and estimates of large-scale production have been as low as 50 cents a pound. The article says:

> Even at the higher prices, the unusual and valuable properties of titanium are such as to amply justify its use for purposes that cannot be adequately fulfilled by other metals. The technology of titanium, however, is only in its infancy, and continued improvement of the preparation and fabrication processes will eventually bring about lower costs.

WORLD REVIEW

Available data on world production of ilmenite and rutile in recent years are shown in the accompanying table. Brief notes on certain important producing and consuming countries follow.

World production of titanium concentrates (ilmenite and rutile), 1940–47, by countries, in metric tons

[Compiled by B. B. Mitchell]

Country	1940	1941	1942	1943	1944	1945	1946	1947
ILMENITE								
Australia:								
New South Wales	1,538	3,521	3,651	3,815	3,590			
Queensland	--------	258	937	1,902	3,697	6,671	5,894	6,449
Tasmania	--------	--------	--------	--------	--------			
Brazil (exports)	12	4,471	--------	--------	3,250	5,000	--------	(1)
Canada	4,114	11,477	9,100	62,992	30,820	12,834	1,275	1,134
Egypt	465	2	[2] 691	--------	9	9	146	(1)
India	267,376	131,111	49,977	38,396	102,412	174,848	187,993	(1)
Malayan Union	[3] 2,596	[4] 44	--------	--------	--------	--------	(1)	(1)
Norway	51,700	61,086	60,713	66,191	63,975	28,312	(1)	(1)
Portugal	899	798	--------	121	--------	301	633	(1)
Senegal [5]	7,082	1,000	4,840	730	--------	3,200	4,310	(1)
Spain	--------	71	85	178	548	216	128	136
United States	18,750	21,135	70,042	184,657	252,749	279,880	256,230	305,296
Total ilmenite	354,532	234,974	200,036	358,982	461,050	511,271	500,000	(1)
RUTILE								
Australia:								
New South Wales	1,641	3,549	4,496	4,828	4,597			
Queensland	--------	267	1,007	1,655	4,246	9,900	8,283	13,406
South Australia	2	(6)	--------	--------	--------			
Brazil (exports)	499	2,369	4,615	4,557	1,564	160	28	[4] 5
Cameroun, French	400	1,800	2,400	2,735	3,320	1,440	1,260	800
India	934	1,891	2,295	2,396	1,672	620	262	(1)
Norway	156	172	77	116	85	76	(1)	(1)
United States	2,620	2,839	2,402	3,617	6,279	6,513	6,761	7,767
Total rutile	6,252	12,887	17,292	19,904	21,763	18,709	16,700	(1)

[1] Data not available. In 1946, estimates by author of chapter included in world total.
[2] Includes 26 tons of garnet-ilmenite.
[3] Exports.
[4] January to September, inclusive.
[5] Approximately 20 percent of ilmenite concentrates is zircon.
[6] Less than 1 ton.

Ceylon.—Investigation was said [9] to be in progress of the desirability of installing a factory for the manufacture of titanium dioxide, from ilmenite to be produced from reportedly extensive beach deposits on the east coast.

Finland.—Finnish press reports in 1947 stated that at least 10,000,000 to 20,000,000 tons of ore, containing 67 percent iron and 2 percent titanium, were discovered to be in deposits at Otanmaki.

Germany.—The report of this series for 1946 outlined some of the data made available recently on titanium in Germany. A subsequent report [10] is abstracted as follows:

> Research is described on the smelting of ilmenite in a MgO lined batch rotary kiln in the presence of both carbon and a sodium hydroxide flux. The products are a high carbon content iron and a sodium titanate slag containing 60–70% titanium dioxide with a TiO_2/Na_2O mol ratio of 4/1. Such slags can be reacted with sulfuric acid and subsequently processed to titanium dioxide pigment. The research had not progressed far enough to evaluate reliably the yields and economics of the process, or to establish definitely the probable life of the magnesia refractory lining.

Three methods employed by German technicians for the production of titanium metal were described [11] in 1947.

India.—Descriptions of the discovery and nature of beach deposits of mineral sands in Travancore, and of the separation of the minerals present, were recently published.[12] The titanium-pigment plant, mentioned in the report of this series for 1946 as scheduled for construction in Travancore, is expected [13] to require 2 years for completion, to cost about $1,250,000, and to have a capacity of 5 tons of pigment a day. British interests, headed by British Titan Products, Ltd., were said to have agreed to assist in setting up the plant.

Malaya.—Resumption of the exportation of ilmenite, a byproduct of tin mining, was expected [14] in 1947. Exports reached a peak of 11,098 long (11,276 metric) tons in 1939.

Mexico.—A large deposit of ilmenite was said [15] to have been discovered recently west of Victoria, capital of the State of Tamaulipas. The Instituto de Geologia de la Universidad Autónoma Nacional (Geological Institute of the National Autonomous University) of Mexico was reported [16] recently to have been investigating what were said to be large deposits of rutile near the Pacific coast of the State of Oaxaca, near the village of Pluma Hidalgo.

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9 Metal Industry (London), vol. 71, No. 12, Sept. 19, 1947, p. 253.
10 Kramer, Edw. N., and others, The Smelting of Ilmenite in Germany: Off. Military Govt. for Germany (U. S.) FIAT Final Rept. 1061, Mar. 5, 1947, 53 pp. (Published by U. S. Department of Commerce.)
11 Titanium, Three German Methods of Production: Metal Industry, vol. 70, No. 20, May 16, 1947 (abs. from B. I. O. S. report), pp. 363–364.
12 Viswanathan, P., Beach Minerals of Travancore: Science and Culture (Calcutta), vol. 12, No. 1, July, 1946, pp. 22–29.
13 Indian Monazite Exports Restricted by Government: E&MJ Metal and Mineral Markets, vol. 18, No. 25, June 19, 1947, p. 3.
14 Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 4, October 1947, p. 16.
15 Bureau of Mines, Mineral Trade Notes: Spec. Suppl. 18, vol. 25, No. 3, September 1947, p. 21.
16 Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 1, July 1947, p. 22.

New Zealand.—Titanium mineral resources on the West Coast of Wanganui are said [17] to have been examined and reported on for E. I. du Pont de Nemours & Co., Inc. Some 22,000,000 tons of titaniferous magnetite ore are estimated [18] to be present.

Norway.- Second only to India in the output of ilmenite before World War II, Norway's production was subsequently surpassed by the United States. Expansion of capacity for output at the mine of the National Lead Co. at Fredrikstad was announced late in 1947, the second since the end of the war.

United Kingdom.—The 1947 annual report of the National Lead Co. indicated the disposal of stock interest in British Titan Products Co., Ltd., early in 1948 in conformance with the United States Supreme Court ruling mentioned in the opening section of this report.

[17] South African Min. & Engr. Journal, vol. 58, pt. I, No. 2831, May 17, 1947, p. 371.
[18] Chemical Age (London), vol. 56, No. 1447, Apr. 5, 1947, p. 422.

Tungsten

By HUBERT W. DAVIS

GENERAL SUMMARY

LACK of offerings of tungsten concentrates of suitable quality in the first half of 1947, increased world demand, speculation, and much higher prices were features of the tungsten industry in 1947. To ease the shortage that existed in the United States, some members of the tool-steel industry made an unsuccessful attempt to release some of the tungsten in the Government strategic stock pile to consumers. Owing largely to a shortage of supplies, European competition for South American tungsten, and increased domestic demand, the price of imported tungsten concentrates advanced to a peak of $33 a short-ton unit of WO_3, duty paid, by mid-July; and domestic scheelite, delivered, reached $32 a unit. After an improvement in the supply position and buyer resistance, the price of both imported and domestic concentrates dropped to $30 a unit by the end of year.

Salient statistics of tungsten ores and concentrates in the United States, 1943–47, in pounds of tungsten

Year	Production	Shipments from mines	Imports for consumption	Consumption	Industry stocks at end of year		
					Consumers and dealers	Producers	Total
1943	11,472,985	11,368,295	19,445,017	19,313,000	2,459,246	458,586	2,917,832
1944	9,764,647	9,786,537	18,396,277	19,165,000	1,510,419	435,634	1,946,053
1945	5,388,639	5,266,818	4,773,861	14,146,000	3,784,429	557,042	4,341,471
1946	4,671,042	4,942,282	6,869,438	6,458,000	3,694,256	285,865	3,980,121
1947	3,026,470	2,944,622	6,018,005	7,812,000	3,343,360	368,316	3,711,676

Despite much higher prices and substantially greater demand in 1947, domestic production and shipments of tungsten concentrates declined for the fourth successive year. Production and shipments of tungsten concentrates (60 percent WO_3 basis), were 3,180 and 3,094 short tons, respectively, in 1947, decreases of 35 and 40 percent from 1946. Nevada again was the premier tungsten-producing State, and North Carolina—where output was double that of 1946—ascended from fourth to second place.

Imports of tungsten ores and concentrates for consumption in the United States were 6,323 short tons (60 percent WO_3 basis) in 1947, a decline of 12 percent from 1946. China (27 percent), Brazil (15 percent), and Bolivia (14 percent), supplied 56 percent of the total. However, important quantities were also contributed by Belgian Congo and Siam.

Consumption of tungsten concentrates in the United States was about 8,200 short tons (60 percent WO_3 basis) in 1947 compared with

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6,800 tons in 1946. The quantity of concentrates converted to ferrotungsten was 58 percent greater in 1947 than in 1946, but this gain was partly offset by a 26-percent decline in the quantity charged directly to the steel bath. Use of concentrates in tungsten-metal powder and other tungsten products was 20 percent more in 1947 than in 1946.

Industry stocks of tungsten concentrates were 3,900 short tons (60 percent WO_3 basis) on December 31, 1947, compared with 4,182 tons at the end of 1946.

Under the International Trade Agreement, signed at Geneva on October 30, 1947, the rate of duty on tungsten ores and concentrates was lowered to $6.03 a short-ton unit of WO_3, a reduction of $1.90 a unit. However, the effective date of the new rate of duty was May 22, 1948. The rates of duty on ferrotungsten, metal and carbide, and tungstic acid and compounds were also reduced, effective January 1, 1948.

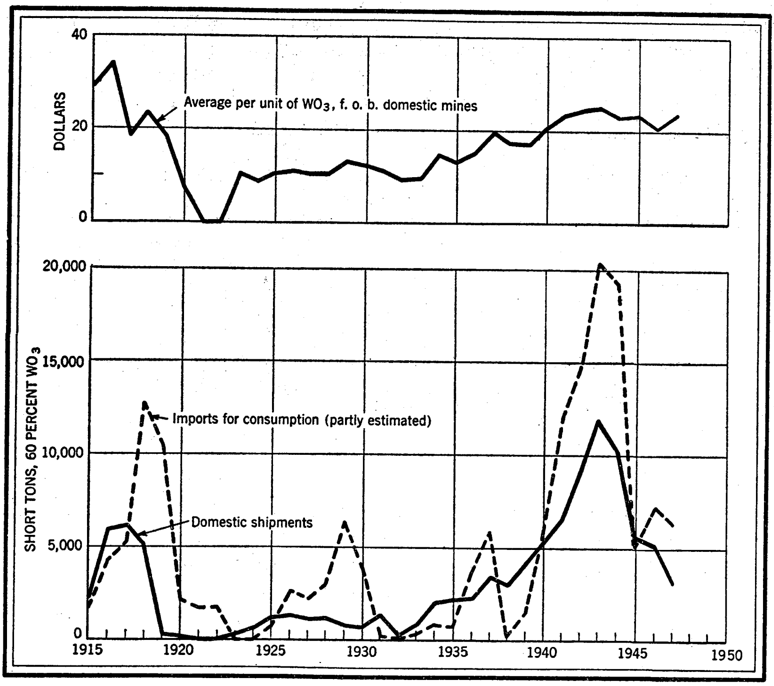

FIGURE 1.—Trends in domestic shipments, imports, and average price of tungsten ores and concentrates, 1915–47.

RESERVES

The following information on reserves of tungsten ore in the United States was prepared by the Bureau of Mines and Geological Survey and is quoted from a report on Mineral Position of the United States, published in the Hearings before a Subcommittee of the Committee on Public Lands, United States Senate, Eightieth Congress, First Session, 1947. It should be emphasized that the reserves were calculated on the basis of material that would be commercially profitable at costs prevailing as of 1943; consequently, allowance should be made for inflation, tariff changes, and other factors that have followed since the estimates were prepared.

Reserves of tungsten-bearing material estimated to be present in known deposits or districts in the continental United States are shown in the accompanying table. The reserves have been calculated on the basis of material that would be commercially profitable at $30, $24, and $16 per short-ton unit. The $30 price was the maximum premium price allowed by the Metals Reserve Company during the war to certain producers; $16 is a representative prewar price.

In the United States the price of tungsten ore is based upon the units of tungstic oxide (WO_3) per short ton. A "short-ton unit" is equivalent to 20 pounds of WO_3; ore containing 1 percent of WO_3 contains one unit to the ton. National statistics are often expressed in terms of pounds of contained metallic tungsten, 15.86 pounds being equivalent to one short-ton unit. Reserve estimates are given here in short-ton units of WO_3, with the approximate equivalent in pounds of contained metallic tungsten; gross and recoverable contents of the reserves are shown also.

In addition to the reserves shown in the table, residual or placer-type deposits may contain about 500,000 units of WO_3 (about 7,900,000 pounds of contained tungsten), which probably cannot be recovered profitably even at a price of $30 per unit of WO_3. Furthermore, 1,000,000 units of WO_3 are estimated to be contained in large, low-grade deposits and might be made available at a price somewhat above $30 per unit under conditions of large-scale operation.

Estimated tungsten reserves of the United States as of 1943, at $30 or less per short-ton unit of WO_3

Price per short-ton unit	Measured		Indicated	
	Gross	Recoverable [1]	Gross	Recoverable [1]
In short-ton units of WO_3:				
$16 or less [2]	300,000	216,000	800,000	576,000
$16 to $24 [3]	500,000	360,000	1,300,000	936,000
$24 to $30 [4]	600,000	432,000	2,000,000	1,440,000
Total	1,400,000	1,008,000	4,100,000	2,952,000
In pounds of contained tungsten:				
$16 or less [2]	4,758,000	3,425,800	12,688,000	9,135,300
$16 to $24 [3]	7,930,000	5,709,600	20,618,000	14,844,900
$24 to $30 [4]	9,516,000	6,851,500	31,720,000	22,838,400
Total	22,204,000	15,986,900	65,026,000	46,818,600

Price per short-ton unit	Inferred		Total	
	Gross	Recoverable [1]	Gross	Recoverable [1]
In short-ton units of WO_3:				
$16 or less [2]	1,400,000	1,008,000	2,500,000	1,800,000
$16 to $24 [3]	900,000	648,000	2,700,000	1,944,000
$24 to $30 [4]	2,500,000	1,800,000	5,100,000	3,672,000
Total	4,800,000	3,456,000	10,300,000	7,416,000
In pounds of contained tungsten:				
$16 or less [2]	22,204,000	15,986,800	39,650,000	28,547,900
$16 to $24 [3]	14,274,000	10,277,300	42,822,000	30,831,800
$24 to $30 [4]	39,650,000	28,548,000	80,886,000	58,237,900
Total	76,128,000	54,812,100	163,358,000	117,617,600

[1] Mining recovery estimated at 90 percent; milling recovery estimated at 80 percent.
[2] Lowest tungsten content of crude ore included in estimates, 0.8 percent of WO_3; average grade, 1.5 percent; minimum size of deposit considered, 10,000 units of WO_3.
[3] Lowest tungsten content of crude ore included in estimates, 0.6 percent of WO_3; average grade, 1.2 percent; minimum size of deposit considered, 5,000 units of WO_3.
[4] Lowest tungsten content of crude ore included in estimates, 0.5 percent of WO_3; average grade, 0.8 percent; minimum size of deposit considered, 500 units 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), huebnerite (manganese tungstate), and wolframite (iron-manganese tungstate), in the order listed, contribute a comparatively small part of the tungsten in domestic ore. 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 filaments in electric-light bulbs and radio tubes.

Tungsten concentrates shipped from mines in the United States, 1943–47

Year	Quantity		Reported value f. o. b. mines		
	Concentrates, 60 percent WO_3 (short tons)	Tungsten content (pounds)	Total	Average per unit of WO_3	Average per pound of tungsten
1943	11,945	11,368,295	$17,973,685	$25.08	$1.58
1944	10,283	9,786,537	14,407,143	23.35	1.47
1945	5,534	5,266,818	7,692,691	23.17	1.46
1946	5,193	4,942,282	6,283,413	20.17	1.27
1947	3,094	2,944,622	4,349,851	23.43	1.48

Tungsten concentrates produced and shipped in the United States, 1946–47, by States

State	Produced				Shipped from mines			
	1946		1947		1946		1947	
	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	26	1,583	5	326	19	1,129	13	751
Arizona	20	1,211	13	805	20	1,211	13	805
California	1,258	75,467	476	28,535	1,262	75,735	394	23,650
Colorado	208	12,473	61	3,678	213	12,754	68	4,046
Idaho	538	32,310	139	8,356	641	38,458	61	3,656
Montana	55	3,306	1	34	84	5,047	4	244
Nevada	2,475	148,483	1,906	114,383	2,617	157,069	2,002	120,129
North Carolina	298	17,908	578	34,656	307	18,434	538	32,295
South Dakota	1	39			1	39		
Texas	1	45			1	45		
Utah	27	1,636	1	55	27	1,636	1	55
Washington	1	30			1	30		
	4,908	294,491	3,180	190,828	5,193	311,587	3,094	185,631

Despite much higher prices and substantially greater demand in 1947, production of concentrates declined for the fourth successive year to 3,180 short tons (60 percent WO_3 basis), compared with 4,908 tons in 1946. Output in 1947 was obtained from many widely scattered operations in eight States and Alaska, but three States—Nevada, North Carolina, and California—supplied 93 percent of the total; and seven operators—Atolia Mining Co., Bradley Mining Co., Nevada-Massachusetts Co., Surcease Mining Co., Tulare County Tungsten Mines, Tungsten Mining Corp., and United States Vanadium Corp.—produced 92 percent of the United States total. Nevada again was the premier tungsten-producing State, and North Carolina, where output was double that of 1946, ascended from fourth to second place in 1947.

Tungsten ore and concentrates shipped from mines in the United States, by States, with shipments for maximum year and cumulative shipments from 1900 to end of 1947, in short tons of 60 percent WO_3

State	Maximum shipments		Shipments by years										Total shipments 1900–47
	Year	Quantity	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	
Alaska	1916	47	-----	-----	-----	-----	22	10	19	-----	19	13	177
Arizona	1936	489	37	100	349	277	219	62	29	97	20	13	3, 890
California	1943	3, 871	839	1, 263	2, 070	2, 603	3, 483	3, 871	3, 027	1, 073	1, 262	394	34, 685
Colorado	1917	2, 707	240	479	693	631	376	378	296	234	213	68	24, 626
Connecticut	1916	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	11
Idaho	1943	4, 648	154	228	260	656	2, 108	4, 648	4, 005	2, 130	641	61	15, 208
Missouri	1940	13	1	-----	13	3	-----	1	1	-----	-----	-----	31
Montana	1946	84	-----	23	50	7	(1)	-----	25	(1)	84	4	508
Nevada	1942	3, 052	1, 461	2, 091	1, 796	2, 289	3, 052	2, 910	2, 665	1, 857	2, 617	2, 002	35, 754
New Mexico	1915	45	2	-----	(1)	1	-----	-----	9	-----	-----	-----	103
North Carolina	1947	538	-----	-----	-----	-----	-----	40	186	132	307	538	1, 203
Oregon	1917	(1)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	(1)
South Dakota	1917	270	-----	-----	-----	2	-----	-----	7	4	1	-----	1, 296
Texas	1946	1	-----	-----	-----	-----	(1)	-----	-----	-----	1	-----	1
Utah	1917	33	7	3	14	30	29	21	9	5	27	1	235
Washington	1938	303	303	100	74	68	43	4	5	2	1	-----	1, 326
	1943	11, 945	3, 044	4, 287	5, 319	6, 567	9, 333	11, 945	10, 283	5, 534	5, 193	3, 094	119, 054

1 Less than half a ton.

Alaska.—J. H. Scott Co., operating the Riverside mine near Hyder, produced a small quantity of concentrate averaging 55 percent WO_3 and a smaller tonnage averaging 18 percent WO_3 in 1947; these concentrates, together with those produced in 1946, were shipped to the United States. The Big Chief mine of the Yukon Corp. near Fairbanks made no output in 1947.

Arizona.—Production and shipments of tungsten concentrates in Arizona were 16 short tons averaging 50.31 percent WO_3 in 1947, compared with 17 tons averaging 71.24 percent WO_3 in 1946. The 1947 output came from several widely scattered operations.

California.—California dropped from second to third place as a tungsten-producing State in 1947, chiefly because of greatly reduced operations at the Pine Creek mine and concentrator. Output of concentrates was 521 short tons averaging 54.8 percent WO_3 in 1947, compared with 5,607 tons averaging 13.5 percent WO_3 in 1946. Shipments of tungsten concentrates totaled 515 tons averaging 45.9 percent WO_3 in 1947, compared with 5,525 tons averaging 13.7 percent WO_3 in 1946. Although concentrates were produced at a number of widely scattered operations, three producers (Surcease Mining Co., Tulare County Tungsten Mines, and United States Vanadium Corp.) supplied 74 percent of the State total. The bulk of the remainder was contributed by El Diablo Mining Co., Tungstar Corp., Sheridan, Bennett & Kidder, W. C. Thompson, A. E. Beauregard, Hanging

Valley Tungsten Co., Alpine Mining Co., Consolidated Tungsten, V. K. Horton et al., Helm & Green, and Embree & Eliason Mining Co.

The Pine Creek mine and concentrator of United States Vanadium Corp. near Bishop were operated at greatly reduced rates in 1947; consequently, the quantities of ore mined and concentrates produced were 43 and 88 percent, respectively, less than in 1946. The driving of a 7,000-foot low-level adit, which was begun in 1945, was about completed in 1947. The adit intersected ore about 1,600 feet below the workings in the main ore body. A continuous ore shoot is presumed and a three-compartment vertical shaft connection has been projected. This development will eliminate a difficult snow condition that has hampered operations.

The Tulare County Tungsten Mines, operating the Big Jim mine in Tulare County, quadrupled its output of tungsten concentrate in 1947 and was the largest producer in California.

Surcease Mining Co. (formerly Hoefling Bros.) continued to work the Spud Patch and other placers in San Bernardino County; its output of concentrate in 1947 was about the same as in 1946.

The Tungstar Corp. near Bishop milled some ore that had been stocked at the mill site before the destruction of the mine surface installation by fire on October 29, 1946.

The Bishop Concentrate & Cleaning Co. installed a magnetic separator and roasting equipment in the old Bishop tungsten mill near Bishop for upgrading concentrates on a toll basis.

The Black Rock tungsten deposit in Mono County is described in Report of Investigations 4210.[1]

Colorado.—Production and shipments of concentrates (60 percent WO_3 basis) in Colorado were 61 and 68 short tons, respectively, in 1947, compared with 208 and 213 tons, respectively, in 1946. The Firth-Sterling Steel & Carbide Corp. (Wolf Tongue Division) and Tanner & Smith, both in Boulder County, were the chief producers in Colorado in 1947.

The Climax Molybdenum Co., operating the world's largest known molybdenite deposit at Climax, Colo., carried out extensive research with a view to recovering the very small tungsten content of the ore. This work proved that a portion of the tungsten can be recovered at a reasonable cost, and the installation of the necessary equipment to treat the current mill tailings was in progress. This new plant was expected to begin operation in May 1948. So great is the tonnage of ore treated that the recovery of tungsten will be substantial.

Idaho.—The Bradley Mining Co., operating the Ima mine in Lemhi County, produced 117 short tons of huebnerite concentrate averaging 71.65 percent WO_3 and 31 tons of scheelite concentrate averaging 18 percent WO_3 in 1947, compared with 134 tons of huebnerite concentrate averaging 70.72 percent WO_3 and 33 tons of scheelite concentrate averaging 19 percent WO_3 in 1946. The scheelite concentrate produced in 1946 and 1947 has not yet been included in the statistics. The concentrator serving the Ima mine was destroyed by fire December 10, 1947; a new mill will be built.

[1] Dupuy, L. W., Black Rock Tungsten Deposit, Mono County, Calif.: Bureau of Mines Report of Investigations 4210, 1948, 6 pp.

The Yellow Pine mine in Valley County has been described [2] in much detail. Production of tungsten at the Yellow Pine mine was begun in August 1941; between that time and December 31, 1945, when all known ore was virtually exhausted, 611,284 short tons of ore averaging 1.645 percent WO_3 had been produced.

Montana.—The Jardine Mining Co. in Park County recovered a small quantity of high-grade scheelite concentrate in 1947.

Nevada.—Nevada again was the premier tungsten-producing State; nevertheless, output was 23 percent less than in 1946. Production of concentrates was 3,550 short tons averaging 32 percent WO_3 in 1947, compared with 4,034 tons averaging 37 percent WO_3 in 1946. Shipments were also smaller—3,576 tons averaging 34 percent WO_3 in 1947, compared with 4,149 tons averaging 38 percent WO_3 in 1946.

The Nevada-Massachusetts Co. was the largest producer of tungsten concentrates in the United States in 1947; its output was 18 percent greater than in 1946. The mill and the Stank, Humboldt, and Sutton No. 2 mines were worked steadily. Development was continued at the O'Byrne mine, where some ore was mined. Open-pit mining continued to yield a substantial tonnage. Much prospecting was done on the surface, and small deposits were opened. The company purchased 68 Government-owned houses which had been operated by the Federal Housing Authority during World War II.

The second largest producer of tungsten concentrates in Nevada in 1947 was the Riley mine in Humboldt County, operated by United States Vanadium Corp.; output was 26 percent greater than in 1946.

Smaller producers of concentrates in 1947 were the Atolia Mining Co., operating the Lincoln mine in Lincoln County; Nevada Scheelite, Inc., operating a mine of the same name in Mineral County; and Tungstonia Minerals, Inc., operating the Tungstonia mine in White Pine County. The new mill of Nevada Scheelite, Inc., was completed and put into operation in September 1947; it replaced one destroyed by fire June 10, 1946.

North Carolina.—North Carolina displaced California as the second largest tungsten-producing State in 1947. Production of concentrate was 585 short tons averaging 59.2 percent WO_3 in 1947, compared with 349 tons averaging 51.3 percent WO_3 in 1946.

The only producer of tungsten concentrate in North Carolina in 1946 and 1947 was the Tungsten Mining Corp., operating the Hamme mine in Vance County. In June 1947 the company began a major underground development program and concurrently inaugurated a surface and underground diamond-drilling schedule; as a result, two additional ore bodies were being prepared for mining. New equipment was being installed in the mill to increase its capacity.

The Seminole Rock & Sand Co. did surface prospecting at its property in Vance County in 1947.

The tungsten deposits of Vance County, N. C., and Mecklenburg County, Va. have been described by the Federal Geological Survey.[3]

Utah.—A small quantity of concentrate (55 units of WO_3) was recovered by Wilson Explorations from dump ores in 1947.

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[2] Cole, J. W., and Bailey, H. D., Exploration, Development, Mining, and Milling of a Unique Tungsten Ore Body at the Yellow Pine Mine, Stibnite, Idaho: Bureau of Mines Inf. Circ. 7443, 1948, 24 pp.

[3] Espenshade, G. H., Tungsten Deposits of Vance County, N. C., and Mecklenburg County, Va.: Geol. Survey Bull. 948-A, 1947, 17 pp.

CONSUMPTION

Consumption of tungsten concentrates in the United States was about 8,200 short tons (60 percent WO_3 basis) in 1947, compared with 6,800 tons in 1946. Of the total consumed in 1947, about 3,800 tons (46 percent of the total) 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 1,400 tons (17 percent) were so used in 1947. Tungsten-metal powder and other tungsten products, chiefly the former, utilized about 3,000 tons or 37 percent of the total concentrates consumed in 1947.

PRICES

Prices on tungsten concentrates fluctuated substantially in 1947. According to the Engineering and Mining Journal, quotations on Chinese ore ranged from \$24 to \$33 a short-ton unit of WO_3, duty paid, and domestic scheelite of good known analysis, in carlots, delivered, from \$24 to \$32 a unit. Prices on ores and concentrates from Bolivia, Brazil, and other countries fluctuated between \$21 and \$33 a unit, duty paid. The increasing use of high-purity scheelite for direct smelting has placed a premium on this type of concentrate. As reported to the Bureau of Mines, the average price for high-grade domestic concentrates shipped to consumers in 1947 was \$25.77 a short-ton unit of WO_3, and that of low-grade concentrates, \$16.20 a unit.

FOREIGN TRADE [4]

Domestic production is inadequate for requirements, and the United States imports both tungsten concentrates and products, chiefly the former. General imports (receipts) of ores and concentrates into the United States totaled 9,002,115 pounds (tungsten content), equivalent to 9,459 short tons of 60 percent WO_3 in 1947, a 32-percent gain over 1946. This quantity represents the ores and concentrates received into the United States, irrespective of final disposition. Although ores and concentrates were received from 18 foreign countries in 1947, 5—China (26 percent), Brazil (14 percent), Bolivia, (12 percent) and Spain and Korea (11 percent each)—supplied 74 percent of the total.

Imports of ores and concentrates for consumption in the United States were 6,018,005 pounds (tungsten content), equivalent to 6,323 short tons of 60 percent WO_3 in 1947, a decline of 12 percent from 1946. Imports for consumption represent ores and concentrates on which the duty has been paid and which have thereby entered into the domestic commerce of the United States. China (27 percent), Brazil (15 percent), and Bolivia (14 percent) supplied 56 percent of the 1947 total. However, important quantities were also contributed by Belgian Congo and Siam.

In 1947, 954 short tons (60 percent WO_3 basis) of ores and concentrates were withdrawn from warehouses for smelting, refining, and export (1,724 tons in 1946), and 933 tons (gross weight) were reexported (1,517 tons in 1946). Ores and concentrates withdrawn for smelting, refining, and export and for reexport are free of duty.

[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.

Tungsten ores and concentrates imported into the United States, 1946–47, by countries

[U. S. Department of Commerce]

Country	General imports [1]		Imports for consumption [2]		
	Gross weight (pounds)	Tungsten content (pounds)	Gross weight (pounds)	Tungsten content (pounds)	Value
1946					
Argentina	263,118	141,480	265,755	145,178	$120,146
Australia	450,982	253,510	23,677	13,729	10,866
Belgian Congo	589,071	307,591	789,544	426,908	390,023
Bolivia	6,029,435	2,488,924	5,842,279	2,525,312	2,097,988
Brazil	2,319,885	1,253,565	3,297,648	1,816,486	1,567,750
British East Africa	19,139	10,190			
Canada	245,906	111,692			
China	358,255	186,822	162,628	82,514	77,442
Cuba			16,968	8,544	8,657
France	551	37	551	37	91
Mexico	104,966	49,814	66,253	31,976	37,783
Netherlands	54,880	31,386	54,880	31,386	25,174
Netherlands Indies	321,809	178,487	222,525	123,075	107,251
New Zealand	35,640	18,577	301,156	154,366	144,505
Peru	433,348	243,583	552,052	307,158	258,894
Portugal	297,502	150,149			
Siam	220,374	113,596	178,883	92,217	41,529
Southern Rhodesia	967,663	488,701	1,735,472	888,599	838,150
Spain	398,384	194,557	227,784	113,526	107,187
Union of South Africa	249,064	127,820	62,322	33,356	25,755
United Kingdom	893,509	460,618	135,385	75,071	69,938
	14,253,481	6,811,099	13,935,762	6,869,438	5,929,129
1947					
Argentina	624,902	343,952	605,104	306,098	248,209
Australia	61,801	31,521	415,524	222,994	124,114
Belgian Congo	983,357	550,328	956,099	534,343	516,543
Bolivia	2,857,025	1,093,463	2,040,934	829,062	688,069
Brazil	2,163,454	1,225,435	1,584,420	905,704	840,863
British East Africa	50,347	26,686	38,052	19,907	16,575
Canada	717,920	175,679	296,157	150,914	126,901
Chile	106,200	58,613	116,726	63,387	61,590
China	4,287,934	2,313,657	3,019,317	1,650,354	2,563,507
Cuba			100	28	24
Korea	1,921,375	953,711			
Malayan Union			8,649	4,850	4,590
Mexico	326,994	151,926	92,510	48,700	45,240
Netherlands Indies	141,934	80,502	198,057	110,018	109,702
New Zealand	11,200	6,297	11,200	6,297	4,565
Peru	35,274	19,024	199,117	78,610	70,976
Portugal	322,736	154,523	222,018	107,084	104,130
Siam	1,633,692	778,092	947,460	533,827	480,517
Southern Rhodesia			383,572	203,254	193,410
Spain	2,301,519	1,031,076	226,638	114,472	101,987
Union of South Africa	14,800	7,630	203,052	109,869	102,915
United Kingdom			39,034	18,233	17,400
	18,562,464	9,002,115	11,603,740	6,018,005	6,421,827

[1] Comprises ores and concentrates received in the United States; part went into consumption during year, and remainder entered bonded warehouses.
[2] Comprises ores and concentrates withdrawn from bonded warehouses during year (irrespective of time of importation) and receipts during year for consumption.

The duty on tungsten ores and concentrates is 50 cents a pound on the metallic tungsten contained therein. This is equivalent to $7.93 a short-ton unit.[5]

Exports of domestic tungsten ores and concentrates from the United States are small; 310,497 pounds (gross weight) were exported in 1947 (78,473 pounds in 1946).

[5] A unit, as applied to tungsten ores, is 1 percent of a ton of contained tungsten trioxide (WO_3). Thus, a short-ton unit is 20 pounds of WO_3 or 15.86 pounds of tungsten (W).

Imports of tungsten metal were 10,890 pounds in 1947 (11,136 pounds in 1946), and imports of tungstic acid were 4 pounds in 1947 (none in 1946). There were no imports of combinations containing tungsten or tungsten carbide in 1947 (2 pounds in 1946). There were no imports of ferrotungsten or tungsten carbide as such in either year.

Exports of tungsten metal, stellite, wire, shapes, and alloys other than ferrotungsten were 243,741 pounds in 1947 (138,472 pounds in 1946). Exports of ferrotungsten were 81,983 pounds in 1947 (181,445 pounds in 1946).

WORLD REVIEW

Data on world production of tungsten ores are shown in the accompanying table.

Argentina.—Argentina formerly ranked as the second-largest producer of tungsten in South America, but in 1944 it was displaced by Brazil. Output in Argentina comes from the Provinces of Catamarca, Córdoba, Mendoza, San Juan, and San Luis. The San Antonio mine in the Province of Catamarca, the Josefina mine in the Province of Mendoza, and the Cerro Morro and Santo Domingo mines in the Province of San Luis have been described by the Federal Geological Survey.[6] Production of tungsten (60 percent WO_3 basis) in Argentina advanced uninterruptedly from 392 metric tons in 1934 to a peak of 2,390 metric tons in 1943; however, from 1944 through 1946 it declined progressively and markedly. Outputs were 1,067 and 457 tons, respectively, in 1945 and 1946.

Bolivia.—Bolivia continued to be the largest tungsten producer in South America. Most of the deposits are in the Departments of La Paz, Oruro, Potosí, and Cochabamba. Reversing a 2-year downward trend, output (as indicated by exports) was 2,635 metric tons (60 percent WO_3 basis) in 1947, compared with 2,120 tons in 1946. Of the 1947 exports, 2,134 tons went to the United States and 501 tons to Europe, chiefly England and Sweden.

Brazil.—Brazil continued to be the second-largest producer of tungsten in South America. The principal deposits are in the States of Paraîba and Rio Grande do Norte. Exports of tungsten concentrates were 1,226 metric tons (65 percent WO_3) in 1947, compared with 1,476 tons (66 percent WO_3) in 1946.

Canada.—Production of tungsten concentrate was resumed in 1947 at the Emerald mine 6 miles southeast of Solmo in southern British Columbia. This mine was discovered early in 1942, and output from the 300-ton mill was begun in July 1943. However, as a result of the marked improvement in the supply of tungsten, the property was closed in October 1943. During the short period of operation both high-grade (72 percent WO_3) and low-grade (15 percent WO_3) concentrates containing 137 short tons of WO_3 were produced; the ore treated averaged 1.7 percent WO_3. The Emerald mine has been described by Mason.[7] Production of tungsten concentrate in Canada in 1947, presumably all from the Emerald mine, was 288 short tons of WO_3, of which about 80 percent was high grade (73 to 75 percent WO_3) and 20 percent low grade.

[6] Smith, W. C., and Gonzâlez, E. M., Tungsten Investigations in the Republic of Argentina, 1942–43: Geol. Survey Bull. 954–A, 1947, 37 pp.
[7] Mason, E. E., Emerald Tungsten Project: The Miner, vol. 17, No. 6, June 1944, pp. 38–42.

World production of tungsten ores, 1939–47, by countries, in metric tons of concentrates containing 60 percent WO_3[1]

[Compiled by B. B. Mitchell]

Country [1]	1939	1940	1941	1942	1943	1944	1945	1946	1947
North America:									
Canada	4	6	32	244	618	214			435
Cuba (exports)		(2)	(2)	7	7		9		
Mexico	229	216	191	193	516	336	134	95	97
United States (shipments)	3,889	4,825	5,957	8,467	10,836	9,329	5,020	4,711	2,807
	4,122	5,047	6,180	8,911	11,977	9,879	5,163	4,806	3,339
South America:									
Argentina	1,309	1,417	1,720	2,115	2,390	2,043	1,067	457	(2)
Bolivia (exports)	3,337	4,183	4,353	5,606	6,902	7,935	3,851	2,120	2,635
Brazil (exports)	7	9	35	9	1,264	2,221	2,192	1,623	1,328
Chile			1		3	3	(2)	(2)	(2)
Peru	170	290	337	510	722	635	523	510	383
	4,823	5,899	6,446	8,240	11,281	12,837	7,633	4,710	(2)
Europe:									
France	284	138	120	95	126	84	(2)	228	391
Great Britain: Cornwall	188	201	127	198	237	350	120	108	68
Italy	2	2	1	5	(2)	(2)	(2)	(2)	(2)
Norway	31	10	8	7		4	5		(2)
Portugal	3,851	4,858	5,834	5,220	7,477	4,088		630	(2)
Spain	368	393	415	1,462	3,902	2,393	283	363	461
Sweden	158	145	228	267	290	335	413	490	(2)
	4,882	5,747	6,733	7,254	12,032	7,254	(2)	1,819	(2)
Asia:									
Burma	7,824	8,095	(2)	1,346	1,346	1,346	(2)	(2)	(2)
China	12,871	10,141	13,538	12,962	9,734	3,502	2,929	2,691	6,900
India	(2)	44	77	87	85	33	22	3	(2)
Indochina: Tonkin	507	390	333	213	107	83	8		(2)
Japan	[3] 299	[3] 479	[3] 601	[3] 817	[3] 733	[3] 575	[3] 193	[3] 59	19
Korea	3,969	4,525	4,650	6,062	6,932	8,402	1,513	1,180	2,202
Malayan Union	587	522	[4] 56	61	146	217	29	10	50
Netherlands Indies	2	(5)	(5)				(2)	(2)	(2)
Siam	378	400	961	1,653	1,738	1,135	461	201	486
	26,437	24,596	(2)	23,201	20,821	15,293	(2)	(2)	(2)
Africa:									
Belgian Congo		63	123	315	467	433	513	397	(2)
Egypt		15	43	17	42	16			(2)
Morrocco, French	4			(5)		3			(2)
Nigeria	237	131		100	75	30	6	[6] 2	(2)
Southern Rhodesia	270	246	264	504	806	757	287	53	26
South-West Africa	50	24	116	122	174	118	4		11
Tanganyika (exports)	(5)	2	1	2	3				(2)
Uganda	2	(2)		7	33	95	92	102	139
Union of South Africa	100	105	142	400	430	660	452	144	91
	663	586	689	1,467	2,030	2,112	1,354	698	(2)
Oceania:									
Australia:									
New South Wales	117	76	95	52	75	53	53	(2)	(2)
Northern Territory	342	314	333	159	193	102	140	74	103
Queensland	93	129	137	217	177	229	155	75	82
Tasmania	477	607	577	475	463	300	800	850	902
New Zealand	49	88	79	73	121	159	37	30	24
	1,078	1,214	1,221	976	1,029	843	1,185	(2)	(2)
Total (estimate)	42,000	43,000	50,500	52,000	61,200	50,200	23,500	19,300	26,000

1 In addition to countries listed, tungsten ore is produced in U. S. S. R., but data on production are not available; estimate is included in the total beginning in 1941.
2 Data not available; estimate by author of chapter included in total.
3 Preliminary data for the fiscal year ended March 31 of year following that stated.
4 January to September, inclusive.
5 Less than 1 ton.
6 Exports.

China.—Inflation, transportation difficulties, and civil strife combined to reduce greatly the output of tungsten in China during World War II, and production declined progressively from 1942 to 1945; in 1943 China surrendered its position as the premier tungsten-producing country. As a result of more settled conditions, output in 1947 was 2.4 times that of 1946, and production in 1948 was expected to approach the prewar rate. Exports of tungsten from China in 1947 were 6,109 metric tons (65 percent WO_3), comprising 2,350 tons to the U. S. S. R., 1,581 tons to the United States, 1,453 tons to Hong Kong, 400 tons to Burma, and 325 tons to Sweden, compared with exports of 4,933 tons in 1946, of which 4,374 tons went to the U. S. S. R. and 559 tons to the United States.

The following information concerning the tungsten industry of China is quoted from a U. S. Department of State report:[8]

The tungsten reserves so far discovered are found primarily in the Nanling belt, an area spreading across the Kwangtung-Hunan and the Fukien-Kiangsi borders. The southern part of Kiangsi is especially known for its rich reserves, and the largest tungsten mines in China are there. Kwangtung is second to Kiangsi in tungsten reserves and output. Its deposits, however, spread over a wide area of more than forty hsien,[9] making production both difficult and costly. Hunan Province is also a large producer of tungsten and ranks third in importance in this field. Small deposits are located in the provinces of Kwangsi, Yunnan, Sinkiang, and Hopeh and in Hong Kong, but the quality of the tungsten from these areas is said to be considerably below that from Kiangsi, Kwangtung, and Hunan.

During World War I the demand for tungsten reached a high exceeding all previous records, and its peak price was US$34 per short-ton unit in 1916. Top production in China during that time (1914–18) was 10,577 metric tons in 1918. The tungsten price dropped in subsequent years, reaching a low of US$3.15 per short-ton unit in 1921. Its average price was US$28 per short-ton unit in 1947, and this is the prevailing price (all prices quoted are c. i. f. New York) as of March 1948.

Large-scale mining enterprises in China were not begun until 1935, when the Kiangsi Tungsten Mining Bureau was established. In 1936 the NRC, a governmental agency under whose jurisdiction falls complete control of certain national resources, including tungsten and antimony, set up 14 offices in Kiangsi Province to control tungsten production and its collection. At present the NRC has 14 such offices in Kiangsi, 7 in Kwangtung, and 2 in Hunan.

During the period of Sino-Japanese hostilities from July 1937 through August 1945 the peak price of tungsten was US$24 per short-ton unit, duty paid, throughout the period 1942–45. China's top production during that period was 12,556 metric tons in 1938, and her peak export was 14,276 metric tons in 1941.

Production of tungsten was interrupted during 1944 and 1945, but according to Dr. C. H. Wu, Secretary-General of the NRC, the interruption was not caused by enemy occupation of the mines. He stated that the Japanese never occupied any mine in Kiangsi or Hunan Province, and that the only Chinese tungsten mines exploited by the Japanese were the Nanpang Island mine and one mine in northern Hopeh Province. He added that production from both mines was very small.

The NRC estimates that its 1948 production of tungsten (65 percent WO_3) will be 11,300 metric tons and that the output in 1949 will probably reach 15,000 metric tons.

[8] Briskey, C. C., Economic Assistant, American Embassy, Nanking, April 29, 1948.
[9] A hsien is a political division of a province, roughly comparable to a county in the United States.

Opinions vary regarding the probable amount of tungsten being lost to the Government and its records through smuggling—one source suggesting that the official production figure might be doubled to reflect a realistic production figure, whereas Dr. Wu states that any estimate over 500 tons a year would be an exaggeration. At any rate, the Government is at present making serious effort to put a stop to illegal production and marketing of tungsten.

The discovery of an important deposit of tungsten in the Province of Kiangsi in southeast China has been announced.[10] The production of rough concentrate (60± percent WO_3) has reached about 1,200 metric tons since its discovery in August 1947. The comparatively large output was possible not because the veins were unusually rich but rather because the partial weathering of the outcrop made it easy to mine the ore with the most primitive methods and tools. The easily mined ore has been about exhausted, and future production will depend on installation of modern mining machinery and a systematic development program.

Korea.—The following information concerning the tungsten industry in Korea is quoted from a recent report: [11]

Prior to 1933 Korea's total output of tungsten concentrate had been only a few thousand tons, and most of this had been produced during the period 1916–19. The Ungbong-san mine and Sun-gyong-san mine were major contributors to this early output.

Japan's demand for tungsten increased greatly during the 1930's, and in response to this stimulus Korea's output of tungsten concentrate gradually grew from 150 metric tons in 1933 to 11,500 tons in 1944. During 1933–45 Korea's output of tungsten concentrate amounted to 36,000 tons, 60 percent of the total consumed in the Japanese Empire. Mines in southern Korea, the area now occupied by American troops, accounted for about 55 percent of Korea's total output.

Since 1940 approximately 850,000 tons of ore have been mined from the Sangdong deposit. Eighty-five percent of this ore came from the Sangdong mine and 15 percent from the Sun-gyong-san mine. Concentrates containing 7,523 tons of WO_3 were recovered from this 850,000 tons of ore. This is equivalent to 69 percent of southern Korea's total output, or 18 percent of the total consumption of WO_3 in the Japanese Empire from 1938 through 1945.

The reserve of ore to a depth of 60 meters below the deepest workings is estimated to be about 3,000,000 tons containing 51,000 tons of WO_3.

During the period 1941–46 total output of concentrates at the Sangdong mine was 11,974 metric tons averaging 52.4 percent WO_3. From 1940 until August 1945 the Kobayashi Mining Co. exploited the Main bed to a depth of 200 meters below the highest outcrop of the principal ore shoot through four adits at intervals of 50 to 70 meters along the incline (25 to 35 meters vertical) and two winzes below the lowest adit (Main adit). Since August 1945 the mine has been operated intermittently on a small scale by Koreans.

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[10] Briskey, C. C., Economic Assistant, American Embassy, Nanking, January 15, 1948.

[11] Klepper, M. R., The Sangdong Tungsten Deposit, Southern Korea: Econ. Geol., vol. 42, No. 5, August 1947, pp. 465–476.

Southern Rhodesia.[12]—Production of tungsten in Southern Rhodesia was increased substantially during World War II. In 1941 only two producers accounted for the output of 269 short tons. In 1942, however, producers numbered 23, and production totaled 513 tons. Output reached a peak in 1943, when 56 producers contributed 821 tons. Toward the end of 1943, although the supply of tungsten available to the United Nations was on a satisfactory basis, the Ministry of Supply guaranteed the existing price of 100s per unit f. o. r. Beira until the end of 1944 or to the end of hostilities, whichever was earlier. During 1944, however, several mines closed, and as a result there was a decline in output. Coincident with the termination of the guaranteed price, output declined spectacularly to 292 and 54 tons, respectively, in 1945 and 1946 and was only 27 tons in 1947. Tungsten minerals have been found in the Hartley, Mazoe, Bulawayo, Wankie, Umtali, Marandellas, and Melsetter districts. The first production was obtained about 1906 from Essexvale deposits southeast of Bulawayo. Total production of tungsten concentrates in Southern Rhodesia from 1916 through 1947 was 4,516 short tons.

[32] Vanderburg, W. O., Minerals Attaché, Pretoria, Union of South Africa, October 27, 1947.

Uranium, Radium, and Thorium[1]

By ALLAN F. MATTHEWS

GENERAL SUMMARY

ABOUT eight nuclear reactors (chain-reacting atomic piles) were operating in the United States, two in Canada, and one in England during 1947. Others were being designed in the United States, England, New Zealand, France, Norway, and Sweden. The extent of atomic development in the Soviet Union was a paramount enigma. United Nations efforts to plan international control of atomic energy virtually collapsed. Representatives of Canada, United Kingdom, and the United States conferred in Washington, D. C., in November 1947, discussing uniform policies for publishing atomic energy information shared as a result of combined wartime work.

A number of books explaining the nature and significance of nuclear energy, for the general reader, were published.[2]

Administration of atomic energy establishments in the United States passed from military to civilian hands at the beginning of 1947. Employment then was approximately 6,400 by the Atomic Energy Commission and 41,000 (revised figure) by contractors at AEC installations. By the end of 1947 the number of employees was 5,300 (some 500 in the Washington office) and about 55,000, respectively, according to the AEC Third Semiannual Report. The War Department transferred to the AEC $506,000,000 at the end of 1946, and the Congress appropriated $175,000,000 for AEC expenditures and $400,000,000 for AEC contract authorizations during the fiscal year

[1] This chapter is an analysis of information previously published (except the data on radium and the figures on consumption of uranium for nonenergy purposes). In preceding issues of Minerals Yearbook radium was discussed in the Minor Metals chapter.

[2] Andrade, E. N. da C., The Atom and Its Energy: G. Bell & Sons, Ltd., London, 1947, 196 pp.
Campbell, John W., The Atomic Story: Henry Holt & Co., New York, 1947, 297 pp.
Eidinoff, Maxwell L., and Ruchlis, Hyman, Atomics for the Millions: McGraw-Hill Book Co., New York, 1947, 281 pp.
Hecht, Selig, Explaining the Atom: Viking Press, New York, 1947, 205 pp.
Thomson, G., The Atom: Oxford University Press, London, 3rd ed. rev., 1947, 196 pp.

ended June 30, 1948. Actual expenditures on atomic energy by the United States Government were as follows:

Fiscal year ended June 30—	Agency	Millions of dollars	Fiscal year ended June 30—	Agency	Millions of dollars
1943	War Dept	77	1947	War Dept	186
1944	do	730	1947	AEC	146
1945	do	859	1948	do	479
1946	do	366			
					2,843

At the end of 1947 the AEC stated that production operations accounted for about 70 percent of construction expenditures and 80 percent of operating expenditures.

GOVERNMENT ORGANIZATION AND CONTROL

Administration of atomic energy development and production in the United States was transferred January 1, 1947, from the Manhattan District, Corps of Engineers, Army Service Forces, to the United States Atomic Energy Commission, in accordance with Executive Order 9816. Establishment of the AEC was provided for in the Atomic Energy Act of 1946 (Public Law 585, 79th Cong.), approved August 1, 1946. The first five-member Commission was appointed by President Harry S. Truman October 28, 1946, and confirmed by the Senate April 9, 1947.

Government allocation control of uranium, as embodied in Conservation Order M–285, was continued by the Office of Temporary Controls until March 31, 1947. On that date the order lapsed and was superseded by Atomic Energy Commission Control of Source Material Part 40 (Code of Federal Regulations Title II), summarized in Minerals Yearbook, 1946, as follows:

> The new regulation provided that on and after April 1, 1947, no person, unless licensed by the Atomic Energy Commission, may transfer, deliver, receive possession of or title to, or export any source material, after removal from its place of deposit in nature, containing as much as 0.05 percent uranium or thorium in any proportion. The restrictions were stated not to apply to transfers or deliveries in any one month of source material containing less than 10 pounds of uranium or thorium. Nor do they apply to incandescent mantles, ceramic products, refractories, glass products, and vacuum tubes; to photographic film, negatives, and prints; or to rare-earth metals, compounds, mixtures, and products containing not more than 0.25 percent Th or U. All stocks of raw source material that have been removed from their place of deposit in nature and contain 10 pounds or more U or Th and all stocks of refined source material that contain 1 pound or more U or Th must be reported to the United States Atomic Energy Commission, P. O. Box 42, Station F, New York 16, N. Y., where applications for licenses are handled.

International Control.—The United Nations Atomic Energy Commission, established January 24, 1946, continued during 1947 to try to evolve an effective plan, acceptable to all members of the Security Council, for the international control of atomic energy.[3] The discussions, however, did not lead to a reconciliation of the views of the Soviet Union with those of the majority of the UN Commission on major points of principle.

[3] United Nations Atomic Energy Commission to the Security Council, Second Report, September 11, 1947: U. S. and United Nations Rept. 11, U. S. Department of State Pub. 2932, 1947, 106 pp.

EXPLORATION AND MINE PRODUCTION

Statistics showing the quantity and content of uranium-radium ores shipped from mines in the United States in 1932–41 were summarized in the preceding edition of this chapter (Minerals Yearbook, 1946, p. 1207). The entire output during that period was carnotite, a radium-bearing potassium-uranium vanadate, mined in western Colorado and eastern Utah principally for its vanadium content. Corresponding production statistics for 1942–47 are not available for publication.

The only mill treating carnotite in the United States in 1947 was operated by the Vanadium Corp. of America at Naturita, Montrose County, Colo. The plant was supplied with ore principally from company-owned and other mines in Colorado but also with carnotite purchased from mines in Arizona, New Mexico, and Utah. The United States Vanadium Corp. operated its roscoelite mine and mill at Rifle, Garfield County, Colo., throughout 1947.

Little or no thorium ore or concentrate has been produced in the United States since 1917.

Government activity in investigating domestic uranium deposits and its policy in procuring uranium ores were described in the Atomic Energy Commission Third Semiannual Report, covering the second half of 1947, as follows:

> The first appraisal of domestic reserves of uranium ores was undertaken during the war by the Manhattan Engineer District, which carried on a program of exploration in many parts of the United States.
>
> In addition to exploration, the program included purchase and refining of residue products from current operations of vanadium-ore mills as well as of waste tailings which had accumulated. These were treated for the recovery of their uranium content. In that period vanadium-ore mills were operating at Durango, Uravan, and Naturita, Colo., and Monticello, Utah. Following the war, the Government-owned facilities for treating tailings in residues from these mills were dismantled by the Manhattan Engineer District, and Government-owned plants for processing vanadium ores were declared surplus. Privately owned plants in this area also curtailed or suspended operations. The only operations at the present time are those sustained by Government purchases of vanadium and uranium.
>
> As a result of the Manhattan Engineer District program, deposits of very low grade ore were discovered. These are now being studied from the point of view of developing methods for the recovery of their uranium content. Their utilization, however, depends upon the solution of difficult and complex research and industrial problems, which for security reasons cannot be described in detail. Exploration for additional deposits is continuing.
>
> The Commission believes new reserves of source materials can best be developed by competitive private industry, under the stimulus of profits, and the means of accomplishing this are under study.
>
> In general, it will be Commission policy to purchase ores for its program from private sources and limit direct Government production as far as possible. It is desirable, however, for the Commission itself to carry on certain activities for the purpose of determining the most efficient methods of ore extraction and beneficiation. The Commission recently purchased the vanadium plant at Monticello, Utah, from War Assets Administration and plans to put these facilities into operation after necessary repairs and alterations have been made and an ore stock pile has been accumulated. Consideration will be given to operating or encouraging the operation of other plants in the area.

The prewar literature on uranium and thorium deposits in the United States was summarized.[4] The Geological Survey performed

[4] De Ment, Jack, and Dake, H. C., Handbook of Uranium Minerals: Mineralogist Pub. Co., Portland, Oreg., 1947, pp. 10–18.

field work in 32 States in the 1945–46 fiscal year and in 12 States in 1946–47 that disclosed much valuable information on the mode of occurrence and availability of uranium and thorium resources, according to the Director's Annual Report. The Atomic Energy Commission in 1947 formed a Division of Raw Materials to organize exploration, procurement, and processing; headquarters were established at Washington, D. C., a branch office at New York, N. Y., and a field office at Grand Junction, Colo. A group of eight prominent mining men was appointed as an Advisory Committee for Exploration and Mining.

REFINERY AND REACTOR PRODUCTION

Uranium.—Uranium ores and concentrates are refined to yield first dioxide and then tetrafluoride. The tetrafluoride is converted to gaseous hexafluoride, which is passed through a series of porous barriers at Oak Ridge, Tenn., to separate from natural uranium (U–238) the 1 part in 140 that is fissionable (U–235). The Oak Ridge plant is operated by the Carbide & Carbon Chemical Corp., subsidiary of Union Carbide & Carbon Corp. Some of the tetrafluoride produced in the United States is refined to pure metal and shipped to Hanford, Wash. There the uranium metal is embedded in graphite to form nuclear reactors (atomic piles) that transmute the natural uranium (U–238) into fissionable plutonium (Pu–239). The Hanford plant, operated by the General Electric Co., was being expanded on a scale requiring greater expenditure than that of the original construction ($350,000,000), according to the Atomic Energy Commission.

Isotopes.—Government sale of radioisotopes was inaugurated by a shipment August 2, 1946. The number of shipments from Oak Ridge in 1946–47 is shown in an accompanying table, but the weight and radioactivity of such shipments are not generally published.

Isotopes shipped by the U. S. Atomic Energy Commission, by kinds, 1946–47, in number of shipments

Kind of isotope	1946 [1]	1947		Total
	Second half	First half	Second half	
Phosphorus-32	48	212	325	585
Iodine-131	68	208	287	563
Carbon-14	47	41	67	155
Sodium-24	1	31	49	81
Gold-198	17	46	6	69
Sulfur-35	12	19	20	51
Calcium-45	5	17	25	47
Iron-55 and -59	5	21	20	46
Potassium-42	6	17	14	37
Cobalt-60	4	20	12	36
Strontium-87 and -90	3	4	5	12
Others (49)	30	63	123	216
Total radioactive isotopes	246	699	953	1,898
Deuterium oxide (heavy water)		31	60	91
Deuterium		22	58	80
Boron-10		2	22	24
Oxygen-18			14	14
Total stable isotopes		55	154	209
Total isotopes	246	754	1,107	2,107

[1] Shipped by Manhattan District, Corps of Engineers, U. S. Army Service Forces.

Radium and Polonium.—The principal producer of refined radium in the United States is International Rare Metals Refinery, Inc., Mount Kisco, N. Y. Construction of the refinery was initiated in late spring 1943, and operations were begun during the middle of October 1943. Small quantities of refined radium have been produced in recent years by Vitro Manufacturing Co., Pittsburgh, Pa., and S. W. Shattuck Chemical Co., Denver, Colo. The International Rare Metals Refinery, Inc., also shipped several thousand millicuries of polonium annually in 1945–47 and several hundred millicuries of radium D in 1947 (none in 1944–46).

Shipments of radium refined in the United States, 1943–47 [1]

Year	From domestic ores		From Canadian ores		Total	
	Milligrams	Estimated value	Milligrams	Estimated value	Milligrams	Estimated value
1943	200	$3,700			200	$3,700
1944	200	3,700	21,800	$403,300	22,000	407,000
1945	200	3,700	31,400	580,900	31,600	584,600
1946	200	3,700	17,400	321,900	17,600	325,600
1947	16,400	303,400			16,400	303,400

[1] Excludes confidential figures representing certain shipments in October 1943 to May 1944.

Thorium.—Thorium compounds are produced from monazite by Lindsay Light & Chemical Co., West Chicago, Ill., and Wollf-Alport, Brooklyn, N. Y. Thorium metal is produced by Westinghouse Electric Corp., Pittsburgh, Pa., and by Metal Hydrides, Inc., Beverly, Mass. (subsidiary of Ventures, Ltd.).

CONSUMPTION AND USES

URANIUM

Weapons.—Research, development, and production of atomic weapons are conducted by the Atomic Energy Commission, principally at Los Alamos, N. Mex. Much of the technical talent assembled there during the war had departed from weapons work in 1946, but some returned during 1947. The AEC announced December 22, 1947, the staffing of its proving ground on Eniwetok Atoll, Marshall Islands. Studies of nuclear reactors for military power applications were carried out during 1947 by the Department of the Air Force and by the Department of the Navy. An official report [5] of the atomic bomb tests at Bikini was published. The consequences to survivors of the Hiroshima and Nagasaki explosions were described,[6] and the factors involved in reducing vulnerability to atomic bombs were analyzed by a committee of the Social Science Research Council.[7]

[5] Shurcliff, W. A., Bombs at Bikini—the Official Report of Operations Crossroads: Wm. H. Wise & Co., Inc., New York, N. Y., 1947, 212 pp.
Shurcliff, W. A., Operation Crossroads—Official Pictorial Record: Wm. H. Wise & Co., Inc., New York, N. Y., 1946, 224 pp.
[6] Atomic Bomb Casualty Commission, General Report: National Research Council, Washington, D. C., 1947, 112 pp.
Hersey, John R., Hiroshima: A. A. Knopf Co., New York, N. Y., 1946, 117 pp.
National Research Council Committee on Atomic Casualties, Genetic Effects of the Atomic Bombs in Hiroshima and Nagasaki: Science, vol. 106, No. 2754, Oct. 10, 1947, pp. 331-333.
United States Strategic Bombing Survey, The Effects of Atomic Bombs on Health and Medical Services in Hiroshima and Nagasaki: U. S. Gov't. Printing Office, Washington, D. C., 1947, 91 pp.
[7] Coale, Ansley J., The Problem of Reducing Vulnerability to Atomic Bombs: Princeton University Press, Princeton, N. J., 1947, 116 pp.

The armed forces in 1946 began instructing personnel in radiological defense measures.

Industrial Power.—The AEC began construction in August 1947 of the Knolls Atomic Power Laboratory, Schenectady, N. Y., to cost $15,000,000 and be operated by the General Electric Co. An experimental atomic power plant was being built also at Oak Ridge, Tenn. Some of the problems involved in commercial production of power from nuclear reactors were described.[8]

Nonenergy Uses.—Consumption of uranium compounds for purposes unrelated to atomic energy continued to be further restricted and in 1947 totaled 1.7 short tons of contained metal. All essential industrial uses were provided for, however, according to the AEC. These included analytical reagents, glass for glass-to-metal contacts in vacuum tubes, amber signal glass, and negative-temperature-coefficient resistors. Use of uranium in toning motion-picture film was no longer authorized.

Consumption of uranium compounds for nonenergy purposes in the United States, 1943–47, in pounds of contained U_3O_8

[Atomic Energy Commission]

Industry	1943	1944	1945	1946	1947
Chemical (including catalytic)	[1] 4,000	[1] 6,700	[1] 3,800	2,500	2,400
Ceramic (including glass)	7,500	100	150	1,000	825
Electrical	250	800	1,000	300	150
Photographic	(1)	(1)	(1)	360	----------
	11,750	7,600	4,950	4,160	3,375

[1] Photographic included with chemical.

RADIOISOTOPES

The leading use of radioactive isotopes is medical therapy, particularly iodine–131 for treating hyperthyroidism (overactivity of the thyroid gland) and phosphorus–32 for polycythemia (overactive formation of red blood corpuscles). Most of the other shipments of isotopes are for research purposes. The tagging of ferrous metals with carbon–14 and sulfur–35 is revealing information about the form and diffusion of carbon and sulfur in iron, steel, and slag.[9] Radioisotopes are also used in oil-well logging and in studying friction, corrosion resistance, and absorption of gases in metals.[10]

[8] Colborn, Robert, Industry's Stake in Atomic Energy: Chem. Eng., vol. 54, No. 3, March 1947, pp. 96–100, 113.

Goodman, Clark (ed.), The Science and Engineering of Nuclear Power: Addison-Wesley Press, Inc., Cambridge, Mass., 1947, 536 pp.

Lum, James H., Engineering and Economics of Atomic Power: Chem. Eng., vol. 54, No. 10, October 1947, pp. 122–125.

Wiggins, E. J., Power Production from Nuclear Reactors: Eng. Jour. (Montreal), vol. 30, No. 6, June 1947, pp. 268–275.

Winne, H. A., and Prentice, B. R., Application of Atomic Energy to Industry: Am. Inst. Min. and Met. Eng. anniversary vol., Seventy-Five Years of Progress in the Mineral Industry, 1871–1946, 1948, pp. 706–721.

[9] Hardy, Gene, Metalworking Industry Gets Real Benefit From Atomic Pile: Iron Age, vol. 160, No. 2, July 10, 1947, pp. 108–110.

Kopecki, E. S., Radioactive Tracers in Metallurgical Work: Iron Age, vol. 160, No. 10, Sept. 4, 1947, pp. 60–64.

[10] U. S. Atomic Energy Commission, Background Material on Activity in First Year of Distribution of Pile-Produced Radioisotopes: U. S. Govt. Printing Office, Washington, D. C., 1948, 24 pp.

Burwell, J. T., Jr., Radioactive Tracers in Friction Studies: Nucleonics, vol. 1, No. 4, December 1947, pp. 38–50.

Stanley, J. K., Tracer Isotopes in Metallurgy: Nucleonics, vol. 1, No. 2, October 1947, pp. 70–77.

Isotopes shipped by the U. S. Atomic Energy Commission by uses, 1946–47, in number of shipments

Use	1946 [1]		1947		Total		
	Radio-active	Stable	Radio-active	Stable	Radio-active	Stable	Grand total
Medical therapy	88	----------	716	----------	804	----------	804
Animal physiology	78	----------	508	35	586	35	621
Physics	17	----------	134	104	151	104	255
Chemistry	27	----------	138	57	165	57	222
Plant physiology	16	----------	62	5	78	5	83
Industrial research	14	----------	51	7	65	7	72
Bacteriology	4	----------	33	1	37	1	38
Metallurgy	2	----------	10	----------	12	----------	12
	246	----------	1,652	209	1,898	209	2,107

[1] Shipped by Manhattan District, Corps of Engineers, U. S. Army Service Forces.

RADIUM AND POLONIUM

Of the 88 grams of radium refined in the United States (from domestic and Canadian ores) and shipped commercially in 1943–47, 52 percent was used in medical therapy, 45 percent in luminous compounds, 2 percent in industrial radiography, and 1 percent in oil-well logging. By 1947 the demand for radium in luminous compounds had declined very considerably, but that for treatment of cancer and skin diseases remained fairly constant. Of the polonium refined in the United States and shipped in 1945–47, 41 percent was used for scientific purposes, 31 percent in luminous compounds, and 28 percent in static eliminators and other industrial applications.

THORIUM

Consumption of monazite was 2,494 short tons in 1947 compared with 2,655 tons in 1946. The chief products are rare-earth alloys and compounds; the thorium recovered is used for research on atomic energy and for gas mantles and refractories.

STOCKS

Monazite stocks held by industry were 3,289 short tons at the beginning of 1947 and 3,192 tons at the end of the year. Data on stocks of uranium and radium are not available for publication. Monazite, radium, and uranium were classified by the Munitions Board as strategic materials, but only monazite was subject to procurement by the Bureau of Federal Supply for addition to the National Stock Pile. Radium was judged to be among the strategic materials "posing problems of storage such as to outweigh the advantages of stock-piling them." Government inventories of uranium were under the jurisdiction of the Atomic Energy Commission.

PRICES

Uranium Ore.—The first postwar prices on uranium in ores or concentrates—effective April 12, 1947, to April 30, 1948—were quoted by the Vanadium Corp. of America, f. o. b. Naturita, Colo., as follows:

U_3O_8 contained (percent):	*Per pound of U_3O_8 contained*	*U_3O_8 contained (percent):—Continued*	*Per pound of U_3O_8 contained*
0.20–0.30	$0.35	1.26–1.50	$0.80
0.31–0.40	.40	1.51–1.75	.90
0.41–0.50	.50	1.76–2.00	1.00
0.51–1.00	.60	2.01 and over	1.10
1.01–1.25	.70		

In addition to the above payment for uranium, 31 cents was paid for each pound of V_2O_5 contained in ores or concentrates averaging at least 2 percent V_2O_5. No payment was made for uranium in grades under 0.20 percent U_3O_8, and the corporation reserved the right to reject ore containing more than 6 percent lime ($CaCO_3$). In instances where the corporation hauled the ore, it charged 5 cents per ton-mile.

Uranium Metal and Compounds.—No price on uranium metal has been quoted in recent years, but the Northern California Association of Scientists assumed in 1946 that refined uranium was worth about $10 a pound and plutonium $20 a gram. Black uranium oxide was quoted by Oil, Paint and Drug Reporter at $2.55 a pound and uranium yellow (sodium uranate) at $1.65 a pound throughout 1947. Canadian Chemistry and Process Industries listed black uranium oxide at $3.35 a pound and uranium nitrate at $2.85 a pound January through September 1947, after which these compounds were not reported; the journal quoted throughout 1947, however, sodium uranate (yellow or orange) at $2.20 a pound.

Radium and Polonium.—The principal domestic refiner quoted radium at $18.50 a milligram, radium D at $50 a millicurie, and polonium at $3 a millicurie in 1947. Canadian Metals and Metallurgical Industries listed radium nominally at $25–$30 a milligram in January–September 1947 and then discontinued quotations.

Radioisotopes.—The Isotopes Branch, United States Atomic Energy Commission, Oak Ridge, Tenn., approved June 28, 1946, its first public price list of radioisotopes. Catalog and Price List 2 became effective March 1, 1947, and was revised September 1947. Quotations for the radioisotopes shipped in largest quantities are shown in the accompanying table.

Stable Isotopes.—The Atomic Energy Commission announced April 30, 1947, that the stable isotope (not radioactive) hydrogen-2 (deuterium or heavy hydrogen) had become available at the following prices, which prevailed during the remainder of 1947: Heavy hydrogen gas (normal temperature and pressure), $1.00 per liter for the first 100 liters, $0.80 per liter thereafter; heavy water (deuterium oxide), $0.50 per gram for the first 100 grams, $0.30 per gram thereafter.

Thorium.—Monazite concentrates, 70-percent rare-earth oxides, c. i. f. Atlantic ports, were quoted by E&MJ Metal and Mineral Markets at $65 a short ton in December 1946, $100 in January 1947, $120 in February through April, $80–$100 in May, $100–$125 in June, $135–$145 in July and August, and $140–$150 in the last 4 months of 1947. These quotations apply to Brazilian concentrates, believed

Prices of radioisotopes quoted by the Atomic Energy Commission, 1946–47, in dollars per millicurie

Radioisotope	Separated from carrier		Unseparated	
	June 1946 to February 1947	March to December 1947	June 1946 to February 1947	March to December 1947
Carbon-14	$367.00	$50.00		
Gold-198			$0.07	$0.15
Iodine-131	1.69	1.70	.55	.33
Phosphorus-32	1.09	1.10	[1] .51	[1] .65
Sodium-24			.07	.24
Sulfur-35	36.56	[2] 2.40	[3] 4.49	([3])

[1] With sulfur-35. With potassium-42, $0.04 June 1946–February 1947 and $0.09 March to December 1947.
[2] September to December; not quoted in March to August 1947.
[3] Not quoted. With potassium chloride. With phosphorus-32, $1.31 June 1946–February 1947 and $33.00 March to December 1947.

to average about 6 percent ThO_2. During 1947 thorium metal, 98–99 percent, pound lots, was listed at 3½ d. a gram (no quotation in last 2 weeks of the year) by the Metal Bulletin (London), and the refractory-grade oxide was selling in the United States for $7 a pound.[11] The price of thorium nitrate, according to Oil, Paint and Drug Reporter, was $2 a pound in first half 1947, $3 in July to late December, and $3.50 in the closing days of 1947.

FOREIGN TRADE [12]

United States imports of uranium in recent years have come principally from the Belgian Congo and Canada, radium from Canada and Belgium, and monazite from Brazil and India. Foreign trade statistics on uranium and thorium in 1937–46, insofar as data are available, are tabulated in Minerals Yearbook, 1946 (pp. 1224–1225). Corresponding data for 1947 may not be published. However, Bureau of Mines records show that imports of monazite totaled 2,397 short tons valued at $277,327 (at Atlantic coast port of destination) in 1947 compared with 3,686 tons valued at $218,705 in 1946. Exports of uranium and thorium were controlled during 1947 by the Atomic Energy Commission, and exports of radium, polonium, actinium, and a number of other metals useful in nuclear-energy work were controlled by the Office of International Trade, United States Department of Commerce.

Exports of radioisotopes, produced by the Atomic Energy Commission at Oak Ridge, Tenn., were begun in 1947. The first shipment, consisting of 20 millicuries of phosphorus–32, left Oak Ridge by air September 5 en route to the Commonwealth X-Ray and Radium Laboratory, Melbourne, Australia, for treatment of an urgent case of polycythemia.[13] Exports of radioisotopes in 1947, according to the AEC, totaled 20 shipments—17 to Australia and 1 each to Argentina, Denmark, and United Kingdom.

[11] Birch, R. E., Am. Ceram. Soc. Refractories Div. Symposium, Bradford, Pa., October 10, 1947; abs. Metal Progress, vol. 53, No. 3, March 1948, p. 418.
[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.
[13] Chemical and Engineering News, vol. 25, No. 38, September 22, 1947, pp. 2754–2755.

Radium salts and mesothorium salts imported for consumption and exported from the United States, 1943–47

[U. S. Department of Commerce]

Year	Imports: Radium salts: Grams	Imports: Radium salts: Value: Total	Imports: Radium salts: Value: Average per gram	Imports: Radioactive substitutes (value)	Exports: Radium salts: Grams	Exports: Radium salts: Value: Total	Exports: Radium salts: Value: Average per gram	Exports: Mesothorium salts: Milligrams	Exports: Mesothorium salts: Value
1943	90.755	$1,366,538	$15,100	$35,589	5.697	$134,496	$23,600	865	$20,758
1944	101.290	1,374,933	13,600	128,010	4.752	120,086	25,300		
1945	67.342	991,979	14,700	122,178	10.774	229,632	21,300	(1)	(1)
1946	17.229	326,450	18,900		(1)	(1)	(1)	(1)	(1)
1947	76.681	1,504,814	19,600		(1)	(1)	(1)	(1)	(1)

1 Not separately classified.

The AEC and the United States Department of Commerce drew up regulations, announced October 1947, to provide more effective control over export of specific classes of declassified equipment such as radiation detectors, mass spectrometers, high-vacuum apparatus, and particle accelerators.

TECHNOLOGY

The characteristics and mode of occurrence of uranium and thorium minerals were described,[14] and prospecting methods were detailed.[15] The Atomic Energy Commission sponsored considerable metallurgical research on the properties of materials constituting reactors—fuels, moderators, coolants, structural supports, shielding, and auxiliaries such as pipes, valves, pumps, and control instruments. The materials must be of a purity never before achieved outside the laboratory and meet rigid specifications for neutron absorption, corrosion resistance, stability under high temperature and intense radiation, and strength under great pressures.

14 DeMent, Jack, and Dake, H. C., work cited in footnote 4, pp. 59–73.
Spence, Hugh S., Information on Uranium and Thorium Minerals for the Use of Prospectors: Canadian Bureau of Mines, Ottawa, June 1947, 21 pp. (mimeographed); Canadian Min. Jour., vol. 68, No. 9, September 1947, pp. 636–642.

15 DeMent, Jack, Uranium and Thorium Prospecting with the Geiger Counter: Min. Cong. Jour., vol. 33, No. 8, August 1947, pp. 30–32, 37–38.
DeMent, Jack, and Dake, H. C., work cited in footnote 4, pp. 31–50.
Knoerr, A. W., Geiger-Mueller Counters Applied to Mining: Eng. and Min. Jour., vol. 148, No. 7, July 1947, pp. 92–95, 123.

WORLD REVIEW

It is believed that the principal producers of uranium-radium ore in 1947 were Belgian Congo and Canada, but that there was some output also in Czechoslovakia, France, Germany, Portugal, U. S. S. R., and United States. Uranium-radium refineries were active in Belgium, Canada, United Kingdom (plant under construction), United States, and probably U. S. S. R. Monazite is mined chiefly in Brazil and India, and refined in Canada, France, United Kingdom, and United States.

Known deposits, throughout the world, of ore averaging at least 0.1 percent uranium contain scarcely 50,000 tons of uranium, states Josef Eklund, Swedish Geological Survey.[16] However, the geologist estimates that oil shales (0.02 percent uranium) in Sweden contain 1,000,000 tons of uranium and that oil shales and vanadiferous shales in the United States and U. S. S. R. have contents of that general magnitude. He calculates that uranium can be extracted from shale at a cost approximating $50 a kilogram ($23 a pound). The principal known occurrences of uranium and thorium in the world were described.[17]

NORTH AND SOUTH AMERICA

Brazil.—Exports of monazite from Brazil in 1939–47 were as follows:

Year:	*Metric tons*	Year—Continued	*Metric tons*
1939	48	1944	3
1940	180	1945	1,030
1941	854	1946	1,250
1942	1,430	1947	1,751
1943	1,550		

Except for 1 ton to Canada, all of the 1947 exports were to the United States. The monazite was derived from the beach sands of Esperito Santo.

Canada.—Eldorado Mining & Refining (1944), Ltd., a Crown corporation, operated at Port Radium, on the east shore of Great Bear Lake, Northwest Territories, one of the largest uranium mines in the world, and at Port Hope, Ontario, a uranium-radium refinery. Its working capital was $5,052,568 as of March 31, 1948, compared with $4,203,795 March 31, 1947, and $794,951 December 31, 1945; and its net operating profit was $1,087,319 in the year ended March 31, 1948, compared with $952,752 in the 15 months ended March 31, 1947, and a net loss of $338,965 in the calendar year 1945.[18] The Eldorado mine has been developed to a depth of 1,350 feet;[19] the mill treated an average of 120 tons of ore per day, according to K. J. Christie, Inspector of Mines, Bureau of Northwest Territories and

16 Echo des mines et de la mètallurgie (Paris), No. 3385, June 1947, p. 89.
17 DeMent, Jack, and Dake, H. C. Work cited in footnote 4, pp. 9–30.
18 Precambrian (Winnipeg), vol. 20, No. 8, August 1947, p. 42; vol. 21, No. 8, August 1948, p. 23.
19 Precambrian (Winnipeg), vol. 20, No. 8, August 1947, p. 8.

Yukon Affairs.[20] Employment early in 1947 totaled 478, of whom 264 were at the mine, 173 at the refinery, and 41 elsewhere. Eldorado expenditures for exploration aggregated $394,469 in 1944–46 and $246,552 in 1947; 60 men were afield in summer 1946 and 70 in 1947, principally in Northwest Territories but also in the Goldfields (Lake Athabaska) area, northern Saskatchewan. A few field parties of the Canadian Bureau of Mines also were exploring Northwest Territories (Camsell River area between Yellowknife and Great Bear Lake) for uranium. The International Uranium Mining Co., Ltd., during 1947 developed its uranium-silver mine at Contact Lake, 8½ miles southeast [21] of the Eldorado mine,[22] and rebuilt the power plant that had been destroyed by fire the preceding fall.

Under authority of the Atomic Energy Control Act of 1946, the Canadian Atomic Energy Control Board April 1, 1947, issued regulations controlling the sale or transfer of uranium, thorium, transuranium metals, radioactive isotopes, and deuterium (heavy hydrogen). The regulations require that discoverers of uranium and thorium deposits notify the Board of their finds and that assayers report details of any determinations showing 0.05 percent or more uranium or thorium; such assays may be disclosed only to the Board unless otherwise authorized. The Orders in Council, which since 1943 reserved to the Crown discoveries of radioactive minerals in the Northwest Territories and Yukon and limited the mining of such deposits to Government agencies, were revoked December 30, 1947, and similar action had been taken or was impending in the Provinces.[23] The Atomic Energy Control Board during 1947 was under the direction of C. D. Howe, Minister of Reconstruction and Supply, and chairman of the Committee of the Privy Council on Scientific and Industrial Research. Gen. A. G. L. McNaughton was president and chairman of the Control Board and was Canadian member of the United Nations Atomic Energy Commission.

Atomic Energy appropriations by the Canadian Parliament for the 1947–48 fiscal year totaled $5,838,000, comprising $3,400,000 for operating expenses at the National Institute for Nuclear Research, Chalk River, near Pembroke, Ontario, $2,173,000 for capital expenditures at Chalk River, $150,000 for atomic research at universities, and $115,000 for administrative expenses of the Atomic Energy Control Board.[24] The research grants involved $87,500 to McGill University to help construct a cyclotron (100 million electron-volts), $32,500 to the University of British Columbia to assist in providing a Van de Graaff generator and linear accelerator, and $30,000 to the University of Saskatchewan toward the purchase of a betatron (20 million electron-volts).[25]

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[20] Christie, K. J., Mining Progress in the Northwest Territories: Western Miner (Vancouver, B. C.) vol. 20, No. 11, November 1947, p. 108.
[21] Not southwest, as erroneously reported in Minerals Yearbook, 1946, p. 1227.
[22] Northern Miner (Toronto), vol. 33, No. 35, November 20, 1947, p. 3.
[23] Canadian Mining and Metallurgical Bulletin (Montreal), vol. 41, No. 434, June 1948, p. 382.
[24] Precambrian (Winnipeg), vol. 20, No. 8, August 1947, p. 15.
[25] McNaughton, Gen. A. G. L., The Development and Control of Atomic Energy: Eng. Jour. (Montreal), vol. 30, No. 6, June 1947, pp. 254–257.

The first chain-reacting atomic pile outside the United States was designed by the National Research Council of Canada and Defence Industries Ltd. and constructed by Fraser Brace Ltd. at Chalk River. It first operated September 5, 1945. The moderator is heavy water (10 tons), control rods and plates are cadmium-plated steel, the reflectors are graphite, and the cooling mediums are air and water. The pile can be operated continuously at 3.5 watts and flashed to 30 watts.[26] A second heavy-water pile, several thousand times more powerful than the first Canadian one, was placed in operation in 1947, according to an announcement by Minister Howe. The Chalk River establishment produced and prepared to distribute at least 14 useful radioactive isotopes.[27] Plutonium-uranium mixtures from the piles were treated in a chemical separation plant to yield plutonium. Working at Chalk River in 1947 were 1,000 skilled workers, half of them scientists.[28] Project expenditures, including capital and operating costs, have been as follows:[29]

Fiscal year:	*Expenditures*
1944–45	C$2, 830, 107
1945–46	14, 202, 467
1946–47	7, 171, 067
1947–48 (appropriation)	5, 573, 000
	29, 776, 641

Canada was still exporting uranium to the United States from time to time, stated Minister Howe in 1947,[30] but no plutonium or radioactive isotopes were leaving the country. During 1947 efforts were made to reestablish Canada's position in the world radium market.

AFRICA

Belgian Congo.—Exports of uranium ore and concentrates from the Belgian Congo were 9,769 metric tons valued at $1,900,000 in 1945 and 6,253 tons valued at $9,582,000 in 1946, according to press reports[31] that were neither confirmed nor denied officially. Of those exports, all the 1945 shipments and 3,654 metric tons valued at $5,332,000 in 1946 reportedly went to the United States; 2,599 tons valued at $4,250,000 (£1,060,000) in 1946 were said to have been exported to Great Britain. A special customs tax of 60 francs per kilogram of uranium oxide contained in ore exported from the Belgian Congo was decreed June 9, 1947, effective retroactively January 1, 1944. The special customs tax is in addition to the ordinary export tax, but exports of uranium ore destined for industrial uses other

[26] Sargent, B. W., Low-Energy Pile at Chalk River: Nat. Res. Council of Canad., Atomic Energy Res. Div. Rept. 1685, 1946, 10 pp.; abs. in Nuclear Science Abs., vol. 1, No. 9, November 15, 1948, p. 404.
[27] Chemistry and Industry (London), No. 45, November 8, 1947, p. 690.
[28] Canadian Metals & Metallurgical Industries (Toronto), vol. 11, No. 1, January 1948, p. 36.
[29] Jackson, C. H., The Chalk River Atomic Energy Project: Eng. Jour. (Montreal), vol. 30, No. 6, June 1947, pp. 262-267.
[30] Mining Journal (London), vol. 229, No. 5849, September 27, 1947, p. 622.
[31] Newspaper report of January 3, 1948, from Brussels quoted in Bull. Atomic Scientists, vol. 4, No. 3, March 1948, p. 76.
Business Week, No. 953, December 6, 1947, p. 120.

than nuclear fission are exempt within the limits of 200 tons annually.[32] The principal producer of uranium ore is Union Minière du Haut Katanga, operating the Chinkolobwe and other mines. The wartime agreement placing the uranium output at the disposal of the Allies [33] was still in force at the middle of 1947, Premier Paul-Henri Spaak told the Belgian Senate; he added, however, that the agreement was about to be reviewed.[34]

EUROPE

Belgium.—A radium refinery at Oolen, near Antwerp, is operated by Société Générale Métallurgique de Hoboken, subsidiary of Union Minière du Haut Katanga, which owns the uranium-radium mines in the Belgian Congo. Antwerp imports on August 8, 1946, included 206 metric tons of radium waste from the United States; [35] this suggests that the radium content of Congo ores, sent to the United States for extraction of uranium, are returned to Belgium in the form of residues. Trade agreements concluded in 1946–47 provided for export of refined radium to several countries, including France and Spain. Belgium presented Switzerland with 3 grams of radium November 21, 1947, in recognition of aid to Belgium during World War II.[36]

Czechoslovakia.—Persistent reports indicate that the pitchblende mines at Jachymov (Joachimsthal), the most important in Europe, and at other localities in Bohemia are being worked rigorously under Russian domination.

France.—Sixty-eight prospectors were employed to explore uranium deposits in France and its colonies; half of them were at work by July 1947, according to Frederic Joliot-Curie, High Commissioner of Atomic Energy. The deposit at Grury, Saône-et-Loire, was being mined; and those near Autun, Saône-et-Loire, and in Madagascar were being prospected. A decree of August 23, 1947, authorized the Commissariat of Atomic Energy to acquire the uranium concession (assigned October 22, 1929, and worked until 1932) in the Departments of Allier and Puy-de-Dôme, near the town of Lachaux. A plant for refining uranium ores was being built by the Commissariat of Atomic Energy, with the cooperation of Sté. des Terres Rares, at the Bouchet powder works near Paris. Chemical and mineralogical laboratories have been established at the Fort de Châtillon. Research and development work at the Collège de France, l'Institut du Radium, and Centre National de la Recherche Scientifique are directed toward the erection of two chain-reacting atomic piles at the Saclay Research Center, near Orsay, west of Paris. One of the piles is planned to use heavy water as the moderator and operate at 300 to 1,000 kilowatts; the other will be a 10,000-kilowatt graphite pile.[37]

[32] Metal Bulletin (London), No. 3209, July 22, 1947, p. 7.
[33] Presumably the United States and United Kingdom only.
[34] Daily Metal Reporter, vol. 47, No. 133, July 11, 1947, p. 3.
[35] Metal Bulletin (London), No. 3121, August 23, 1946, p. 6.
[36] Chimie et Industrie (Paris), vol. 57, No. 2, February 1947, p. 192; vol. 59, No. 1, January 1948, p.97.
[37] Echo des Mines et de la Métallurgie (Paris), No. 3388, September 1947, pp. 141, 149.

Germany.—Postwar production of radioactive materials and beryllium was prohibited, according to an Allied Control Authority statement in February 1946. During 1947, however, thousands of people were said to have been bribed with food or forced by Russian officials, in the Soviet-occupied zone, to work by primitive methods the lean pitchblende deposits near Annaberg, Schneeberg, and Johanngeorgenstadt—all in southern Saxony.[38]

Norway.—In 1947 the Norwegian Parliament appropriated the equivalent of $1,000,000 for atomic research.[39] The work will be coordinated by a 14-man committee headed by Prof. Svein Rosseland and including representatives of the University of Oslo, the Norwegian Institute of Technology at Trondheim, and private industry.[40] Plans call for early construction of a chain-reacting atomic pile approximately the same size as the first one at Chalk River, Canada. The principal materials to be used—uranium and heavy water—are both available in Norway.[41] A small uranium mine was opened in 1946 at Evje in Setesdal.[42]

Sweden.—Limited quantities of uranium have been produced in Sweden;[43] an annual output of 9 tons is planned to be recovered from 3,000 tons of oil shale, but plans were only in the laboratory stage.[44] Ultimately a much greater production seems assured, for the plants at Kvarntorp, Department of Örebro (formerly Narke), treat for extraction of oil about 3,450 metric tons [45] daily of shale, which contains 220 grams of uranium oxide per ton.[46] A million tons of uranium are contained in Swedish shales—principally in oil shales averaging 0.02 percent U—according to Joseph Eklund, of the Swedish Geological Survey.[47] Formation of a company, AB Atomenergi, with a capital of 3,500,000 kronor ($973,000), was proposed in 1947 by the Swedish Atomic Committee, of which Malte Jacobsson is president. It is planned that the Government would provide 57 percent of the capital. The first task of the new company would be to design and build an experimental plant for the liberation of atomic energy. Later a plant for production of atomic power and radioactive isotopes on an industrial scale would be erected.[48] A modern cyclotron lab-

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38 Mining and Metallurgy, vol. 28, No. 490, October 1947, p. 521.
39 Chemical Age (London), vol. 58, No. 1490, January 31, 1948, p. 187.
40 Chemical Engineering, vol. 54, No. 5, May 1947, p. 236.
41 Chemical Age (London), vol. 58, No. 1494, February 28, 1947, p. 307.
42 Chemical Age (London), vol. 59, No. 1535, December 11, 1948, p. 781.
43 Oil, Paint and Drug Reporter, vol. 151, No. 19, May 12, 1947, p. 43.
44 Mining Journal (London), vol. 229, No. 5858, November 29, 1947, p. 797.
45 Schjanberg, E., before the Fuel Economy Conference, The Hague, 1947: Mining Jour. (London), vol. 230, No. 5870, February 21, 1948, p. 132.
46 Chemical Engineering, vol. 54, No. 5, May 1947, p. 294.
47 Cadman, W. H., The Oil-Shale Deposits of the World and Recent Developments in Their Exploitation and Utilization, Reviewed to May 1947: Jour. Inst. Petrol. (London), vol. 34, No. 290, February 1948, p. 112.
48 Metallurgia (London), vol. 36, No. 212, June 1947, p. 84.

oratory is being constructed by the Physico-Chemical Institute, headed by Prof. The Svedberg, at the University of Upsala. The plant, expected to be completed in 1948, will cost about 2,500,000 kronor ($694,000), of which 2,000,000 kronor has been granted by the Werner textile concern, of Gothenburg; the Government is also assisting in the financing.[49]

United Kingdom.—British organization for national security, as it existed in 1947, was directed by the Defense Committee, of which Prime Minister Clement R. Attlee was chairman. One of six subcommittees was the Ministerial Committee on Atomic Energy; this subcommittee was assisted by the Advisory Committee on Atomic Energy (Sir John Anderson, Chairman) from August 1945 to January 7, 1948, when its dissolution, on the grounds that other bodies had assumed its functions, was announced.[50] The Defense Committee included the Minister of Supply (John Wilmot), to whom were responsible the Controller of Production of Atomic Energy (Lord Portal of Hungerford) and the Director of the Atomic Energy Research Establishment (Prof. Sir John D. Crockcroft).

About 900 men were employed in the spring 1947, at Springfields, near Preston, Lancashire, adapting a chemical factory to a plant for refining pitchblende concentrates and machining the resultant uranium metal into rods for use in atomic piles. Production was scheduled to begin in the fall 1947, and at peak operation 1,000 workers will be needed.[51] Pitchblende concentrates totaling 2,599 metric tons (£1,060,000) were exported from the Belgian Congo to Great Britain in 1946 (none in 1945), according to press reports [52] lacking official confirmation or denial.

Construction of Britain's first chain-reacting atomic pile—begun in 1946 at the Atomic Energy Research Establishment, Harwell, near Didcot, Berkshire—was hindered seriously by shortages of materials, fuel, and power and by prolonged bad weather,[53] yet it began operation in the middle of August 1947. Known as "Gleep" (graphite low-energy experimental pile), the 100-kilowatt pile consists of several hundred tons of very pure graphite into which are inserted several tons of uranium metal.[54] It was designed largely by a group of New Zealand scientists working at Harwell; scientists of Great Britain were responsible for the production of pure graphite, uranium, and control instruments, and those of Canada rendered considerable assistance, particularly in testing the graphite. Engineering and constructional work was accomplished in 15 months by the British Ministry of Works and its contractors—W. E. Chivers & Sons, Ltd., and Mathew Hall & Co., Ltd. "Gleep" is to be used primarily for investigations in nuclear physics, but small quantities of radioisotopes were to be produced for biological research until the more powerful Harwell pile, under construction in 1947, came into operation in

[49] Chemical Engineering, vol. 54, No. 5, May 1947, p. 232.
[50] Records and Statistics (supplement to the Economist (London), vol. 3, No. 53, Jan. 17, 1948, p. 42.
[51] Iron Age, vol. 159, No. 18, May 1, 1947, p. 152.
[52] Works cited in footnote 31.
[53] Mining Journal (London), vol. 229, No. 5843, August 16, 1947, p. 508.
[54] Chemical Age (London), vol. 57, No. 1465, August 9, 1947, p. 183.

1948.[55] Plans were made for building several large atomic piles at Windscale Works, Sellafield, in the Lake district of West Cumberland. Construction of the first of these piles began in the latter part of 1947 and is scheduled for completion in 1952; it is expected to cost £7,000,000 and to have a power output of 75,000 kilowatts.[56]

Estimates of the time to elapse before electricity generated by atomic energy will be available for public distribution were made in 1947 by several British scientists, including Sir Wallace Akers,[57] research director of Imperial Chemical Industries; Prof. P. M. S. Blackett,[58] Manchester University; Prof. N. F. Mott,[59] Bristol University; and Prof. H. L. Pryce,[59] Oxford University. It is believed that a demonstration atomic plant for generating electricity can be operating in the United Kingdom within 5 years, that power stations of this type will begin to come into commercial use in 5 to 10 years, and that they will make a marked contribution to the power resources of the country within 20 years.

A national radiochemical center was being operated at Amersham, Buckinghamshire, by Thorium, Ltd., acting as agent for the Ministry of Supply. The center processes, packages, and distributes radium, other natural radioactive substances, and artificial radioisotopes.

The English Electric Co., Ltd., opened its Nelson Research Laboratories November 5, 1947. Atomic research equipment installed at the Blackheathlane branch of the laboratory includes two Van de Graaff electrostatic generators (2 million and 5 million electron-volts, respectively) and a synchrotron (30 million electron-volts). Three similar-size synchrotrons were being built for the Atomic Energy Research Establishment and for the British Medical Research Council, and a 140-million-electron-volt synchrotron for the Clarendon Laboratory, Oxford University.[60]

ASIA

U. S. S. R.—Soviet work on atomic energy is probably centered in the Tuvinian Autonomous Region, according to one writer acquainted with the country.[61]

[55] Chemical Age (London), vol. 57, No. 1467, August 23, 1947, p. 254.
[56] Chemical Age (London), vol. 56, No. 1454, May 24, 1947, p. 690.
Chemistry and Industry (London), No. 31, August 2, 1947, p. 480.
[57] Chemical Age (London), vol. 57, No. 1463, July 26, 1947, p. 126.
[58] Mining Journal (London), vol. 229, No. 5845, August 30, 1947, p. 542.
[59] Chemical Age (London), vol. 57, No. 1479, November 15, 1947, p. 657.
[60] Chemical and Engineering News, vol. 26, No. 4, January 26, 1948, p. 272.
[61] Mansvetov, Fedor S., Tannu-Tuva—the Soviet "Atom City"?: The Russian Review (New York), vol. 6, No. 2, Spring 1947, pp. 9–19.

AUSTRALIA AND NEW ZEALAND

Australia.—New discoveries near the known autunite-torbernite deposits in the Mount Painter area, South Australia, some 400 miles north of Adelaide, appear to be highly promising.[62] Other uranium reserves were uncovered by drilling and trenching at Radium Hill, near Olary, South Australia, about 70 miles west of Broken Hill.[63] Two parties of the Geological Survey of Western Australia, in cooperation with the Commonwealth Bureau of Mineral Resources, sampled potential sources of radioactive minerals in 1947. The Council for Scientific and Industrial Research continued its work on the treatment of Mount Painter ore; the process developed involves acid-leaching torbernite from a manganiferous ironstone matrix and recovering the dissolved uranium by selective precipitation. The Council plans to collaborate with the University of Melbourne in conducting investigations of nuclear physics,[64] and with the New Zealand Department of Scientific and Industrial Research in constructing a low-energy chain-reacting pile in Australia or New Zealand.

New Zealand.—Equipment was being assembled in New Zealand to develop methods of recovering uranium and thorium minerals as byproducts of gold dredging on the west coast of South Island. Small-scale production appeared to be possible but to be uneconomic unless the atomic-energy source metals attain higher commercial value, according to the annual report of the Department of Scientific and Industrial Research published August 27, 1947. Official consideration was given the possibility of erecting in New Zealand a small atomic pile, with a power level of 10 to 20 watts, to supply radioactive isotopes. The proposal was prompted partly by the fact that certain useful isotopes are so short-lived that they can be employed only in or near the country of production.[65]

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[62] Mining Journal (London), vol. 228, No. 5835, June 21, 1947, p. 367.
[63] Metal Industry (London), vol. 71, No. 14, 1947, p. 413.
[64] Chemical Engineering and Mining Review (Melbourne), vol. 40, No. 1, October 10, 1947, pp. 8, 9, 22–23.
[65] Beverstock, Roswell C., American Legation, Rept. 211, Wellington, Aug. 15, 1947; Rept. 298, November 21, 1947.

Vanadium

By HUBERT W. DAVIS

GENERAL SUMMARY

BOTH output and consumption of domestic vanadium ore turned upward in 1947, after having declined for three consecutive years. Imports of vanadium concentrates and vanadium-bearing flue dust were also greater than in 1946. The higher level of operation in the steel industry, coupled with purchases of vanadium oxide for the Government strategic stock pile, was chiefly responsible for the greatly accelerated activity in vanadium in 1947.

Production of vanadium ore was 2,117,962 pounds (contained vanadium) in 1947, a gain of 66 percent over 1946. Colorado supplied 1,912,158 pounds, or 90 percent of the total in 1947.

Imports of vanadium concentrates (all from Peru) were 983,869 pounds (contained vanadium) in 1947, a gain of 24 percent over 1946.

Consumption of domestic vanadium ore was 2,236,315 pounds (contained vanadium) in 1947, an increase of 50 percent over 1946.

Salient statistics of the vanadium industry in the United States, 1943–47

	Pounds of vanadium contained				
	1943	1944	1945	1946	1947
Mine shipments of ores and concentrates [1]	5,586,492	3,527,054	2,963,913	1,272,148	2,117,962
Imports:					
Ore or concentrates	2,052,620	1,284,603	1,550,479	791,057	983,869
Vanadium-bearing flue dust	64,393	40,171	26,293	20,931	71,819
Exports of ore, concentrates, and vanadium oxide	38,180	6,254	113,927	6,051	7,661
Consumption (domestic ores only)	5,179,290	4,113,309	3,821,419	1,495,839	2,236,315

[1] Measured by receipts at mills and Government purchasing depots.

DOMESTIC PRODUCTION

The center of domestic vanadium-ore mining in the United States is the Colorado-Utah region. Small outputs are made in Arizona, Nevada, and New Mexico, and vanadium-bearing phosphate rock is mined in Idaho. The total output of vanadium in ore in the United States from 1910—the year of first commercial production—through 1947 has been 46,533,000 pounds.

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Vanadium in ores and concentrates produced in the United States, 1938–47 [1]

Year	Vanadium, pounds	Year	Vanadium, pounds
1938	1,613,155	1943	5,586,492
1939	1,984,068	1944	3,527,054
1940	2,162,916	1945	2,963,913
1941	2,513,051	1946	1,272,148
1942	4,439,130	1947	2,117,962

[1] Data for 1940–47 are receipts at mills and Government purchasing depots.

REVIEW BY STATES

The accompanying table shows production of vanadium ore (including the vanadium recovered as a byproduct of phosphate-rock mining), by States, measured in terms of receipts at mills.

Vanadium in ores and concentrates produced in the United States, 1943–47, by States

State	Pounds of vanadium contained				
	1943	1944	1945	1946	1947
Colorado	4,159,830	3,058,727	2,701,103	1,036,050	1,912,158
Utah	833,680	287,045	97,572	63,188	48,949
Arizona, Idaho, and other States [1]	592,982	181,282	165,238	172,910	156,855
	5,586,492	3,527,054	2,963,913	1,272,148	2,117,962

[1] Includes Nevada, 1943; and New Mexico, 1943–44 and 1947.

Arizona.—A small quantity of vanadium ore from Arizona was shipped to the mill of Vanadium Corp. of America at Naturita, Colo., in 1947.

Colorado.—Colorado maintained the position it has held for several years as the largest vanadium-producing State. Production was 1,912,158 pounds (contained vanadium) in 1947, a gain of 85 percent over 1946. The United States Vanadium Corp. operated its mill and mine at Rifle throughout 1947. The Vanadium Corp. of America operated its mill at Naturita; the plant was supplied with ore from company mines and by purchases from producers in Arizona, Colorado, New Mexico, and Utah.

Idaho.—The Anaconda Copper Mining Co. continued to recover vanadium in the form of "red cake" (vanadium oxide containing about 88 percent V_2O_5) from phosphate rock mined at Conda, Idaho, and treated at Anaconda, Mont. Production was 6 percent less in 1947 than in 1946.

New Mexico.—A small shipment of vanadium ore from New Mexico was made to the mill of Vanadium Corp. of America at Naturita, Colo., in 1947.

Utah.—A number of mine operators delivered vanadium ore to the mill of Vanadium Corp. of America, Naturita, Colo., in 1947.

CONSUMPTION AND USES

Consumption of domestic vanadium ore was 2,236,315 pounds (contained vanadium) in 1947 compared with 1,495,839 pounds in 1946.

Vanadium is used in various forms; but about 90 percent is consumed as ferrovanadium in the manufacture of tool steels, engineering steels, high-strength structural steels, nonaging rimming steels, and special wear-resistant cast irons. Some ferrovanadium is used in welding-electrode coatings and as a deoxidizer, and some metal is utilized in magnets. Some vanadium oxide is also used in the production of tool steel. The largest uses for vanadium oxide and ammonium metavanadate are as catalysts, in glass and ceramic glazes, for driers in paints and inks, and for laboratory research.

Complete data are not available on consumption of ferrovanadium and chemical compounds; but based on information furnished by identical companies believed to consume about 85 percent of the total, it is apparent that usage was about 25 percent greater in 1947 than in 1946. Consumption of vanadium in steel, which accounted for about 95 percent of the reported total, was 25 percent larger, and usage for other purposes was up 23 percent.

Distribution of vanadium consumption by type of use, 1946–47, in percent

Use	1946 [1]	1947	Use	1946 [1]	1947
Steel:			Nonsteel:		
High-speed steel	55.3	45.7	Alloy cast iron	.1	(2)
Other tool steel	13.1	12.7	Catalysts	3.3	3.5
Other alloy steel	26.7	36.9	Total nonsteel	3.4	3.5
Deoxidation and degasification	.4	.2	Undistributed	1.1	1.0
Total steel	95.5	95.5	Grand total	100.0	100.0

[1] Revised figures.
[2] 0.04 percent.

PRICES

For many years vanadium ore has been quoted at 27½ cents a pound of V_2O_5. This quotation, however, is without regard to the grade of the ore or the presence or absence of objectionable impurities—matters of importance to the refiners, inasmuch as they vitally affect recovery. Vanadium pentoxide (technical grade) was quoted at \$1.10 a pound of V_2O_5 until late October, when it was raised to \$1.20. Ferrovanadium was quoted at \$2.70–\$2.90 a pound of contained vanadium (depending upon the grade of the alloy) from January 1 to September 4, when it was advanced to \$2.90–\$3.10.

FOREIGN TRADE [1]

Inports of vanadium concentrates (all from Peru) were 983,869 pounds (contained vanadium) in 1947, a gain of 24 percent over

[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.

1946. Flue dust containing 71,819 pounds of vanadium was received from Curaçao in 1947, compared with 20,931 pounds in 1946. There were no imports of ferrovanadium or vanadium oxide in 1947. Vanadium ore and concentrates enter the United States free of duty. However, the rate of duty on ferrovanadium is 12½ percent ad valorem and on vanadic oxide, anhydride, salts, and compounds and mixtures of vanadium 40 percent ad valorem.

Vanadium ore or concentrates and vanadium-bearing flue dust imported for consumption in the United States, 1946–47, by countries

Class of material and country	1946			1947		
	Pounds		Value	Pounds		Value
	Gross weight	Vanadium content		Gross weight	Vanadium content	
Ore or concentrates: Peru	2, 784, 349	791, 057	$390, 077	3, 274, 548	983, 869	$448, 076
Vanadium-bearing flue dust: Curaçao (N. W. I.)	97, 750	20, 931	13, 480	143, 124	71, 819	15, 483

Vanadium ore or concentrates imported for consumption in the United States, 1938–47

Year	Pounds		Value	Year	Pounds		Value
	Gross weight	Vanadium content			Gross weight	Vanadium content	
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, 776, 328	1, 550, 479	725, 362
1941	24, 645, 686	2, 138, 608	1, 012, 991	1946	2, 784, 349	791, 057	390, 077
1942	36, 492, 268	2, 422, 376	1, 274, 483	1947	3, 274, 548	983, 869	448, 076

Exports of vanadium ore and concentrates were 7,661 pounds (contained vanadium) valued at $15,788 in 1947, compared with 6,051 pounds valued at $40,541 in 1946. The 1947 exports comprised 7,168 pounds to Canada, 487 pounds to Hong Kong, and 6 pounds to India. Exports of ferrovanadium were 178,198 pounds (gross weight) valued at $266,040 in 1947 compared with 113,058 pounds valued at $161,289 in 1946.

WORLD REVIEW

World production of vanadium ores is limited almost entirely to four countries—Northern Rhodesia, Peru, South-West Africa, and the United States. Since 1938, output from these sources has ranged from 1,400 to 4,400 metric tons, and since 1941 the United States has been the leading producer.

Vanadium has also been recovered commercially from phosphate rock, iron ore, chrome ore, magnetite beach sands, caustic-soda solution employed in Bayer process of refining bauxite, naphtha soot collected from the smokestacks of ships and industrial plants, and vanadiferous ashes derived from asphaltites. Complete information on vanadium production from these sources is lacking; however, undoubtedly large quantities were recovered, especially during World War II.

Vanadium was one alloying element produced in Germany in sufficient quantity for its needs in World War II. A wartime regulation required that vanadium be recovered from iron ores; and, chiefly as a consequence, the production of vanadium in Germany was reported to have risen from about 1,400 metric tons a year at the beginning of the war to 2,916 and 3,233 tons, respectively, in 1943 and 1944. The vanadium is recovered from the slag by special methods that undoubtedly must make the metal expensive in man-hours.

During World War II the beach sands of Japan were processed by concentration and chemical treatment to recover vanadium. The quantity of vanadium so recovered has not been reported.

Appreciable quantities of vanadium are recovered from naphtha soot collected from the smokestacks of ships and industrial plants. The exact quantity recovered from this source is not known, but 377,635 pounds (contained vanadium) were imported into the United States during the 6 years 1942–47.

Comparatively small quantities of vanadium in the form of vanadium pentoxide are recovered in the United States as byproducts of phosphate rock mined in Idaho and imported chrome ore. Some vanadium is also recovered in the United States from flue dust and boiler scale.

Because complete information on the quantity of vanadium recovered as byproducts of iron ore and other raw materials is lacking, it is not possible to determine the world production of vanadium from all sources. Consequently, the accompanying table reflects only the production of vanadium in ores and concentrates for the countries listed, plus the quantity recovered in the United States as a byproduct of phosphate rock.

World production of vanadium in ores and concentrates, 1938–47, in metric tons

[Compiled by B. B. Mitchell]

Country	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
Argentina	------	15	1	6	------	------	(1)	(1)	(1)	(1)
Mexico	101	80	32	(2)	------	------	------	------	------	------
Northern Rhodesia	374	384	368	342	388	426	254	219	68	56
Peru	826	1,016	1,214	1,017	1,010	847	514	688	322	437
South-West Africa	557	514	428	269	453	577	385	420	419	275
United States (shipments)[3]	732	900	981	1,140	2,014	2,534	1,600	1,344	577	961
Total[4]	2,590	2,909	3,024	2,774	3,865	4,384	2,753	2,671	1,386	1,729

1 Figure not available.
2 Less than 1 ton.
3 Includes also vanadium recovered as a byproduct of phosphate-rock mining.
4 Total represents data only for countries shown in table and excludes vanadium in ores produced in French Morocco, Spain, U. S. S. R., and Argentina (1944–47), for which figures are not available; also excluded from the total are the quantities of vanadium recovered as byproducts from other ores and raw materials.

Northern Rhodesia.—The vanadium operations of the Rhodesia Broken Hills Development Co., Ltd., were suspended from March 1946 until the latter part of 1947; as a consequence, production in both years was the smallest since 1934. Outputs were 108 and 131 long tons, respectively, in 1947 and 1946, averaging 91.5 percent V_2O_5, compared with 424 tons averaging 90.65 percent V_2O_5, in 1945. During the period of operation in 1946 the feed to the gravity plant was 8,066 short tons of vanadium-bearing laterites from old dumps; feed to the leach plant was 3,915 short tons assaying 4.40 percent V_2O_5, and the recovery was 77.3 percent and the acid factor 13.2 pounds acid per pound fused vanadium pentoxide produced.

Peru.—The famous Mina Ragra mine of the Vanadium Corp. of America in the Andes near Ricran, Department of Junin, has been an important source of vanadium since 1907, when production was begun. From 1938 to 1940, inclusive, and in several earlier years, Peru produced the most of any country in the world. Since 1941, however, its production has been surpassed by that in the United States. Diminishing supplies of high-grade shipping ore in Peru have been accompanied by substantial declines in output and as a consequence the average annual production dropped from an average of 1,017 metric tons during the 5 years 1938–42 to 562 tons during the 5 years 1943–47. Output in 1947 was 781 tons of V_2O_5 and comprised 776 tons in concentrates and 5 tons in ash. The vanadium deposits of Peru have been described [2] in detail.

South-West Africa.—Several deposits of vanadium have been worked in the Grootfontein district, where the ores occur in pipes or mud pockets in the dolomite. Because of lack of demand, only the Abenab mine of the South-West Africa Co., Ltd., which produces concentrates containing 18 to 20 percent V_2O_5, was worked in 1946 and 1947. Output was 2,613 long tons in 1947 compared with 3,880 tons in 1946.

The former German-owned Tsumeb mine, which produced vanadium for export to Germany before World War II, is reported to have been acquired by the Newmont Mining Corp. of New York, in association with American Metal Co., Ltd.,[3] and others. A shipment of copper-lead ore obtained from surface dumps was made in 1947. It has been announced that £1,000,000 will be spent to dewater the mine and reequip the property.

[2] Larson, C. B., and Welker, K. K., Vanadium Resources of Peru: Bureau of Mines Mineral Trade Notes, vol. 25, No. 1, Special Suppl. 16, July 1947, 58 pp.
[3] Engineering and Mining Journal, vol. 148, No. 9, September 1947, p. 137.

Zinc[1]

By RICHARD H. MOTE AND ESTHER B. MILLER

GENERAL SUMMARY

DESPITE work stoppages due to labor strikes and power difficulties that caused some loss of output, domestic smelters established a peacetime record for the production of slab zinc in 1947. Output from domestic and foreign ores increased 11 and 9 percent, respectively, and the production of redistilled slab zinc rose 34 percent to reach the highest level on record. Domestic mine output of recoverable zinc also increased in 1947, and the production of the combined Western States was at a record high.

A 10-percent gain in imports of zinc in ores and concentrates was more than offset by a 31-percent drop in slab zinc imports. Exports of slab zinc were nearly three times greater than in 1946. Despite the increase in smelter output, the total produced plus net imports was insufficient to balance consumption, with the result that producers' and consumers' stocks were sharply reduced during the year. Galvanizing continued to be the principal use of slab zinc, followed by zinc-base alloys and brass products.

Prime Western grade slab zinc was quoted throughout 1947 at 10.50 cents per pound, f. o. b. East St. Louis, the highest quoted price since 1917.

[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 also the chapter on Lead and Zinc Pigments and Zinc Salts.

The zinc industry operated comparatively free of Government controls in 1947. Priorities Regulation 32, limiting manufacturers' inventories of all grades of slab zinc, ended April 1; regulations requiring a license for the exportation of slab zinc and zinc semimanufactures remained operative throughout the year.

Salient statistics of the zinc industry in the United States, 1938–42 (average) and 1943–47

	1938–42 (average)	1943	1944	1945	1946	1947
Production of primary slab zinc:						
By sources:						
From domestic ores......short tons..	559, 922	594, 250	574, 453	467, 084	459, 205	510, 058
From foreign ores..............do....	108, 627	348, 059	294, 849	297, 477	269, 057	292, 437
	668, 549	942, 309	869, 302	764, 561	728, 262	802, 495
By methods:						
Electrolytic..........percent of total..	26	35	37	35	39	37
Distilled...........................do....	74	65	63	65	61	63
Production of redistilled secondary slab zinc.......................short tons..	48, 731	48, 215	49, 037	49, 242	44, 516	59, 542
Stocks on hand at primary smelters Dec. 31..........................short tons..	73, 432	168, 777	233, 044	254, 692	[1] 175, 513	67, 046
Price:						
Prime Western at St. Louis:						
Average for year....cents per pound..	6. 36	8. 25	8. 25	8. 25	8. 73	10. 50
Highest quotation..............do....	8. 25	8. 25	8. 25	8. 25	10. 50	10. 50
Lowest quotation...............do....	4. 00	8. 25	8. 25	8. 25	8. 25	10. 50
Yearly average at London........do....	3. 97	4. 63	4. 63	5. 18	7. 75	12. 58
Mine production of recoverable zinc short tons..	656, 546	744, 196	718, 642	614, 358	574, 833	637, 608
Tri-State district (Joplin) percent of total..	35	27	26	23	24	17
Western States..................do....	35	43	46	48	48	54
Other..............................do....	30	30	28	29	28	29
World smelter production of zinc short tons..	1, 848, 800	2, 028, 300	1, 791, 500	1, 404, 300	1, 549, 600	1, 741, 900

[1] Revised figure.

RESERVES

The following information on reserves of zinc in the United States was prepared by the Bureau of Mines and Geological Survey and published in hearings before a Subcommittee of the Committee on Public Lands, United States Senate, Eightieth Congress, first session 1947 (pp. 308–310).

Few reliable figures are available on the total reserves of zinc in different zinc districts in the United States. The largest mining companies for the most part keep their figures confidential, and because of inherent complexities in the form and grade of the ore bodies the reserves cannot be even roughly approximated by anyone who does not have access to company maps and assay data. Furthermore the usual practices of developing ore only 1 to 5 years ahead means that the company figures, even when available, generally show only the measured and indicated ore, making no reference to ore that may be inferred in geologically favorable but unexplored ground.

The following table summarizes the estimated reserves of known zinc-bearing areas of the United States in two classes, depending on whether the material can be mined (a) under technologic conditions similar to those in 1944; and (b) under possible future conditions. Reserves that could be mined under technologic conditions obtaining in 1944 are subdivided into (1) reserves that could be mined under normal economic conditions as reflected in the price of zinc in relation to production costs (6-cent zinc in the 20-year period from 1921 to 1940); (2) additional reserves that could be mined only under more favorable economic conditions, assuming a cost-price spread somewhat better than normal; and (3) additional reserves that become available only under abnormal conditions similar to those of 1942–44, wherein prices of 13¾ to 16½ cents for zinc and 9¼ to 12 cents for associated lead were received by operators of deposits of this class.

Estimated zinc reserves of the United States as of January 1944

[In short tons of metallic zinc]

	Measured and indicated [1]		Inferred [2]		Total [2]	
	Gross content in ground	Recoverable content [3]	Gross content in ground	Recoverable content [3]	Gross content in ground	Recoverable content [3]
Zinc in deposits that could be worked under technologic conditions similar to those in 1944:						
1. Under normal economic conditions [4]	6, 957, 000	5, 400, 000	7, 500, 000	5, 800, 000	14, 400, 000	11, 200, 000
2. Additional, under somewhat more favorable economic conditions	1, 961, 000	1, 500, 000	3, 300, 000	2, 500, 000	5, 300, 000	4, 000, 000
3. Additional, under emergency prices	1, 295, 000	1, 000, 000	900, 000	700, 000	2, 200, 000	1, 700, 000
Total	10, 213, 000	7, 900, 000	11, 700, 000	9, 000, 000	21, 900, 000	16, 900, 000
Zinc in deposits workable under possible future technologic or industrial conditions	3, 721, 000	------------	400, 000	------------	4, 100, 000	------------

[1] This includes individual estimates of measured and indicated ore in some properties where such ore is known, but for which the tonnage figures are unavailable.
[2] Figures rounded.
[3] Milling and smelting losses are considered to be roughly 23 percent.
[4] Price equivalent to 6 cents per pound and prewar costs.

About 14,400,000 short tons of zinc—measured, indicated, and inferred—is in ore or tailings that can be worked under normal economic conditions; about 77 percent of this zinc (11,200,000 tons) is recoverable. This zinc must compete with imports of foreign ores, but all of it probably will be available in time. About 5,300,000 tons more is in ore that should be workable under more favorable economic conditions. The zinc in high-cost camps and in some slag piles at lead smelters, considered available only at the higher wartime premium prices, is believed to be only slightly more than 2,000,000 tons. Zinc in pyritic deposits and in most slag piles constitutes the material that would be available only under improved technologic conditions.

The estimate of reserves includes a considerable tonnage of low-grade ore in the Tri-State region that can be mined under the premium prices of 1944; but because of underground water, parts of this reserve may be lost forever if the district remains idle for any appreciable time before this ore is extracted.

DOMESTIC PRODUCTION

Statistics on zinc production are compiled both on a mine basis and on a smelter basis. The mine-output data, based upon the zinc content of ores and concentrates produced (adjusted to account for average smelting losses), are the most precise measure of zinc output from year to year. Smelter production of slab zinc presents a more accurate figure of actual zinc recovery but usually differs from the mine figure owing to overlap or lag between mine shipments and smelter receipts and treatment of ores and concentrates. Over a period of years, however, these variations tend to balance within the limits of statistical error.

MINE PRODUCTION

The general absence of labor strikes in 1947 as compared with 1946, an improved mine and mill labor supply, and the highest annual price for Prime Western grade zinc since 1917 combined to boost domestic mine production of recoverable zinc (including that recovered as zinc pigments and salts directly from ore) 11 percent over the 1946 output.

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, Arizona, Montana, New Mexico, Utah, Colorado, Nevada, and Washington, in descending order of productivity in 1947).

Mine production in the combined Western States gained 27 percent over 1946 to reach the highest point in mining history. About 54 percent of the total domestic mine output of zinc in 1947 (48 percent in 1946) was produced in the Western States. Idaho continued to be the largest producer of zinc in the United States. More than 95 percent of the Idaho zinc output in 1947 came from the Coeur d'Alene region; zinc-lead ores and old tailings concentrated yielded 92 percent of the total zinc. Among the Western States, Arizona continued in second place, as zinc production reached a new record high for the eighth consecutive year. About 60 percent of the Arizona total zinc came from the Warren (Bisbee) district, in Cochise County; zinc-lead ore represented 89 percent of the total production. New Mexico output, the highest since 1944, increased 22 percent in 1947. Nearly 87 percent of the total production came from mines in the Central district, Grant County; zinc ore yielded 90 percent of the total zinc produced. The mine output of zinc in Montana increased 172 percent in 1947 and was the largest in any year since 1942. Zinc-lead ore comprised 96 percent of Montana's zinc in 1947 and 2 percent was from zinc ore and old slag. Utah zinc output rose to the highest level since 1943. Zinc-lead ore concentrated supplied 87 percent of the total zinc in 1947 and zinc slag fumed most of remainder. Zinc production in Colorado increased 7 percent in 1947; zinc ore yielded 62 percent of the State total zinc and zinc-lead ore, 28 percent. Nevada zinc output declined 25 percent. About 85 percent of the 1947 total production was mined in the Pioche district, Lincoln County; over 98 percent of the zinc recovered was from zinc and zinc-lead ore.

Mine production of recoverable zinc in Arkansas, Kansas, Missouri, and Oklahoma decreased 21 percent. Output in the Tri-State district, which totaled 109,338 tons in 1947, dropped precipitously after the Premium Price Plan expired June 30. Production from July through December represented only 32 percent of the total 1947 Tri-State output.

The total production in States east of the Mississippi River increased 12 percent in 1947; zinc output from this region accounted for 29 percent of the total domestic output.

Mine production of recoverable zinc in the United States, 1938–42 (average) and 1943–47, by States, in short tons

State	1938–42 (average)	1943	1944	1945	1946	1947
Western States and Alaska:						
Alaska						25
Arizona	12, 599	19, 677	29, 077	40, 226	43, 665	54, 644
California	228	1, 856	8, 455	9, 923	6, 877	5, 415
Colorado	11, 876	44, 094	39, 955	35, 773	36, 147	38, 745
Idaho	65, 704	86, 707	91, 372	83, 463	71, 507	83, 069
Montana	42, 331	37, 606	36, 127	17, 403	16, 770	45, 679
Nevada	10, 466	13, 647	20, 699	21, 457	22, 649	16, 970
New Mexico	34, 446	59, 524	50, 727	40, 295	36, 103	44, 103
Oregon				1		1
South Dakota	23	46	56			19
Texas					44	22
Utah	39, 913	46, 896	38, 994	33, 630	28, 292	43, 673
Washington	12, 362	12, 203	11, 904	11, 693	11, 329	13, 800
	229, 948	322, 256	327, 366	293, 864	273, 383	346, 165
West Central States:						
Arkansas	220	96	19	303	85	18
Kansas	65, 261	56, 944	63, 703	48, 394	47, 703	41, 497
Missouri	19, 270	30, 413	36, 626	22, 175	22, 234	17, 074
Oklahoma	145, 870	114, 085	91, 449	69, 300	69, 552	51, 062
	230, 621	201, 538	191, 797	140, 172	139, 574	109, 651
States east of the Mississippi River:						
Illinois	4, 748	5, 851	7, 262	8, 310	8, 798	10, 073
Kentucky	669	931	341	182	314	508
New Jersey	90, 757	92, 864	80, 288	81, 392	64, 454	76, 871
New York	37, 170	46, 000	35, 541	24, 978	32, 515	34, 116
Tennessee	35, 424	41, 766	40, 831	33, 824	24, 614	31, 212
Virginia	21, 327	18, 603	19, 667	16, 075	16, 905	16, 788
Wisconsin	5, 882	14, 387	15, 549	15, 561	14, 276	12, 224
	195, 977	220, 402	199, 479	180, 322	161, 876	181, 792
	656, 546	744, 196	718, 642	614, 358	574, 833	637, 608

Mine production[1] of recoverable zinc in the United States, 1941–47, by months, in short tons

Month	1941	1942	1943	1944	1945	1946	1947
January	60, 833	67, 289	58, 798	66, 304	56, 745	51, 870	55, 036
February	55, 627	63, 684	55, 634	65, 253	50, 901	47, 968	51, 770
March	61, 184	69, 415	62, 540	68, 219	56, 344	51, 177	55, 874
April	62, 555	68, 521	66, 072	64, 496	51, 663	47, 972	58, 447
May	61, 852	68, 871	59, 620	63, 292	54, 084	48, 655	59, 098
June	64, 030	64, 540	60, 626	59, 648	52, 429	42, 966	62, 121
July	60, 950	63, 253	60, 036	56, 710	47, 686	33, 737	47, 719
August	63, 973	61, 671	61, 423	60, 259	46, 694	46, 567	48, 855
September	63, 453	57, 702	63, 621	53, 362	47, 664	49, 030	47, 608
October	65, 284	61, 164	64, 999	54, 293	52, 029	52, 191	51, 506
November	62, 038	58, 892	66, 652	54, 527	51, 515	50, 574	48, 976
December	67, 346	63, 023	64, 175	52, 279	46, 604	52, 126	50, 598
	749, 125	768, 025	744, 196	718, 642	614, 358	574, 833	637, 608

[1] Monthly data for 1941–44 are based largely on smelter receipts, whereas those for 1945–47 represent actual mine output. Monthly figures have been adjusted to final annual mine-production totals.

The 25 leading zinc-producing mines in the United States in 1947, listed in the following table, yielded 55 percent of the total domestic zinc output.

Twenty five leading zinc-producing mines in the United States in 1947, in order of output

Rank	Mine	District	State	Operator	Type of ore
1	Franklin and Sterling Hill	New Jersey	New Jersey	The New Jersey Zinc Co	Zinc.
2	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp	Zinc-lead.
3	Butte Mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Do.
4	Balmat	St. Lawrence County	New York	St. Joseph Lead Co	Do.
5	United States and Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co	Do.
6	Eagle	Red Cliff	Colorado	Empire Zinc Division, New Jersey Zinc Co	Zinc.
7	Austinville	Austinville	Virginia	The New Jersey Zinc Co	Zinc-lead.
8	Star	Hunter	Idaho	Sullivan Mining Co	Do.
9	Ground Hog group	Central	New Mexico	American Smelting & Refining Co	Zinc.
10	Oswaldo	do	do	Kennecott Copper Corp	Do.
11	Bayard Mine group	do	do	U. S. Smelting, Refining & Mining Co	Do.
12	Mascot No. 2	Eastern Tennessee	Tennessee	American Zinc Co. of Tennessee	Do.
13	Edwards	St. Lawrence County	New York	St. Joseph Lead Co	Do.
14	Combined Metals group	Pioche	Nevada	Combined Metals Reduction Co., & R. E. West Mining Co.	Zinc-lead.
15	Page	Yreka	Idaho	Federal Mining & Smelting Co	Do.
16	Sidney	do	do	Sidney Mining Co	Do.
17	Grasselli	Eastern Tennessee	Tennessee	American Zinc Co. of Tennessee	Zinc.
18	Davis-Bible group	do	do	Universal Exploration Co	Do.
19	Emma	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Zinc-lead.
20	Bunker Hill Smelter Slag Dump	Yreka	Idaho	Bunker Hill & Sullivan Mining & Concentrating Co	Zinc slag.
21	Grandview	Metaline	Washington	American Zinc, Lead & Smelting Co	Zinc-lead.
22	Hanover Mine group	Central	New Mexico	Empire Zinc Division, New Jersey Zinc Co	Zinc.
23	Ely Valley	Pioche	Nevada	Ely Valley Mine	Zinc-lead.
24	Iron King	Big Bug	Arizona	Shattuck Denn Mining Corp	Do.
25	Walter Hartley	Tri-State	Kansas	St. Louis Smelting & Refining Co	Zinc.

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, 1943–47, in short tons

District	State	1943	1944	1945	1946	1947
Tri-State (Joplin region)	Kansas, southwestern Missouri, Oklahoma.	200,514	190,270	139,274	139,038	109,338
Coeur d'Alene region	Idaho	79,634	85,227	78,030	67,429	79,251
New Jersey	New Jersey	92,864	80,288	81,392	64,454	76,871
Summit Valley (Butte)	Montana	7,877	7,874	8,364	7,108	40,712
Central	New Mexico	52,215	44,648	36,245	32,279	38,155
St. Lawrence County	New York	46,000	35,541	24,978	32,515	34,116
Warren (Bisbee)	Arizona	1,020	8,070	18,078	22,374	32,546
Eastern Tennessee [1]	Tennessee	41,766	40,831	33,824	24,614	31,212
West Mountain (Bingham)	Utah	23,405	19,151	14,670	7,593	20,446
Red Cliff	Colorado	28,854	20,492	15,805	16,437	17,375
Upper Mississippi Valley	Northern Illinois, Iowa,[2] Wisconsin.	15,539	17,242	19,318	18,344	17,077
Austinville	Virginia	17,139	18,257	16,000	16,905	16,788
Pioche	Nevada	11,991	17,983	16,575	15,764	14,362
Park City region	Utah	11,487	9,556	7,435	8,876	10,956
Metaline	Washington	9,292	9,236	7,794	7,685	9,754
Kentucky-Southern Illinois	Kentucky, southern Illinois	5,630	5,910	4,735	5,044	5,728
Rush Valley and Smelter (Tooele County).	Utah	8,880	6,224	7,720	6,365	5,642
Madgalena	New Mexico	5,290	4,474	3,044	3,474	5,013
Big Bug	Arizona	3,009	3,794	4,922	5,234	4,991
California (Leadville)	Colorado	5,512	7,984	7,419	5,996	4,809
Pima (Sierritas, Papago, Twin Buttes).	Arizona	1,390	5,170	3,697	3,948	4,727
Ten Mile	Colorado	971	1,483	2,142	2,490	4,587
Tintic	Utah	2,330	3,450	2,928	3,710	3,969
Pioneer (Rico)	Colorado	3,652	4,557	3,920	3,435	3,433
Old Hat (Oracle)	Arizona	2,450	2,521	4,750	4,235	3,427
Cochise	do		46	1,300	2,877	3,143
Warm Springs	Idaho	4,740	4,000	2,797	2,161	2,791
Northport	Washington	914	1,438	1,410	1,790	2,788
Campo Seco	California		712	2,134	3,301	2,350
Upper San Miguel	Colorado	1,213	828	1,458	1,963	2,067
Harshaw	Arizona	3,398	2,051	1,666	1,128	2,006
Flat Creek	California	229	1,532	1,714	1,926	1,707
Tomichi	Colorado	343	431	430	440	1,684
Heddleston	Montana	953	1,529	1,878	1,516	1,482
Animas	Colorado	474	577	795	1,590	1,310
Breckenridge	do	231	318	723	1,110	1,279
Chelan Lake	Washington	1,930	1,074	2,419	1,730	1,000
Eureka	Nevada	40	195	1,204	3,705	897
Wallapai	Arizona	1,542	1,046	684	486	857
Smelter (Lewis and Clark County).	Montana	24,165	20,623	2,235	4,995	748
Sheridan	do	519	1,053	861	785	527
Patagonia	Arizona	1,931	1,261	683	833	314
Packer Creek	Montana	1,001	1,389	254		83
Hunter Valley	California		3,346	3,311		
Pioneer (Superior)	Arizona	4,072	3,850	2,297		
Yankee Hill	California	407	1,444	1,251		
Livingston	Virginia	1,456	1,410	75		

[1] Includes very small quantity produced elsewhere in State.
[2] No production in Iowa since 1917.

SMELTER PRODUCTION

During 1947, 21 primary zinc-reduction plants were in operation, of which 12 operated with horizontal retorts exclusively, 1 with both horizontal and vertical retorts, 3 with vertical retorts exclusively (1 electrothermic), and 5 with electrolytic methods.

Horizontal-Retort Plants.—The total number of retorts reported at active horizontal-retort primary plants in 1947 was 69,950, a 4-percent decrease from the 73,240 retorts on December 31, 1946, at plants which operated during that year. Of the total retorts reported, 51,668 (74 percent) were in use at the close of 1947, compared with 54,272 (74 percent) in operation at the end of 1946.

Vertical-Retort Plants.—Four vertical-retort continuous distilling plants operated during 1947. The St. Joseph Lead Co. operated its 10 electrothermic units at Josephtown, Pa., at about 90 percent capacity throughout the year. Of the 66 vertical retorts at the remaining 3 plants, 64 were in operation on December 31, 1947.

Electrolytic Plants.—Five electrolytic plants were in operation during 1947, as in 1946. There were 3,210 cells at the plants on December 31, 1947, of which 3,176 (99 percent) were in operation; the number of cells at the end of 1946 was 3,210 (revised figure), of which 2,668 (83 percent) were operating.

Smelting Capacity.—Irrespective of additions or subtractions of smelter recovery units, statistics on domestic smelting capacity vary from year to year owing 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, 1947, had a stated annual capacity to produce 998,087 tons of slab zinc under normal operating conditions, allowing for necessary shut-downs for repairs. This figure, which compares with a 1,067,800-ton reported capacity at the end of 1946, indicates that the 1947 output was 86 percent of the capacity as compared with 72 percent in 1946. Horizontal- and vertical-retort plants operated at 88 percent of a stated 599,502-ton capacity (73 percent of a 641,000-ton capacity in 1946), electrolytic plants at 86 percent of a 341,701-ton capacity (74 percent in 1946), and secondary smelters at 66 percent of a 56,884-ton capacity (59 percent of a 44,400-ton capacity in 1946).

New Construction.—During the latter part of 1947 additions to the capacity of two smelters were under construction. At the St. Joseph Lead Co. electrothermic plant at Josephtown, Pa., a project for expansion of capacity to approximately 65,000 tons of slab zinc annually was scheduled for completion in the third quarter of 1948. In Idaho, the Sullivan Mining Co. installed an additional roaster and expects to install additional electrolytic cells during 1948 that will permit a capacity expansion of about 7,200 tons of slab zinc per year.

Waelz Kilns.—The same companies listed as operating Waelz kilns in the 1946 chapter of this series, continued to do so in 1947.

Slag-Fuming Plants.—The following companies operated slag-fuming plants in 1947 and produced impure zinc oxide which was further treated for the recovery of slab zinc:

Idaho:
- Bradley—Bunker Hill & Sullivan Mining & Concentrating Co.

Montana:
- East Helena—Anaconda Copper Mining Co.

Utah:
- Tooele—International Smelting & Refining Co.

In 1947, these three plants treated 587,364 tons of hot and cold slag, which yielded 94,996 tons of oxide fume containing 56,025 tons of recoverable zinc. Corresponding figures for 1946 were 486,428, 75,385, and 41,566 tons, respectively.

The St. Joseph Lead Co. continued experimental operation of its slag-fuming plant at Herculaneum, Mo., in 1947 and recovered a small tonnage of slab zinc as a direct product of the operation that treats lead blast-furnace slag containing 12 to 16 percent zinc.

Retreatment of old slag accumulated at the El Paso (Tex.) smelter of the American Smelting & Refining Co. is scheduled to begin the later part of 1948, upon completion of the slag-fuming plant under construction during 1947. The plant, similar to those operating in Idaho, Montana, and Utah, is expected to produce monthly about 2,000 tons of zinc oxide, which will be shipped to a horizontal retort plant for conversion into Prime Western-grade zinc.

Active Zinc-Reduction Plants.—Except for the Hegler Zinc Co. smelter at Danville, Ill., and the American Zinc & Chemical plant at Langeloth, Pa., which were closed in November and December, respectively, the list of primary zinc distillers as given in the 1946 chapter of this series remained unchanged in 1947.

PRIMARY AND REDISTILLED SECONDARY SLAB ZINC

The output of primary slab zinc in 1947, the greatest since 1944, increased 10 percent over the 1946 production. Although the use of foreign concentrates gained and the slab zinc produced from this source increased 9 percent, the ratio of zinc recovery from foreign concentrates to total primary zinc output remained virtually unchanged. Production from domestic ores and concentrates rose 11 percent, thus terminating the downward trend in evidence since 1941.

Production of redistilled slab zinc from zinc scrap increased 34 percent in 1947 to the highest level on record. Of the 59,542 short tons of redistilled secondary slab zinc produced, 22,093 tons (37 percent) were derived from primary smelters and 37,449 tons (63 percent) were produced at secondary plants. Data on output of remelted secondary slab zinc are not included with those for redistilled metal. In 1947 the production of slab zinc recovered by remelting purchased scrap was 7,443 tons (8,212 tons in 1946). Zinc rolling mills and other large consumers of slab zinc recover large quantities of zinc from their own plant scrap; but such metal is not measured statistically, for it seldom enters the market as scrap.

Primary and redistilled secondary slab zinc produced in the United States, 1943–47, in short tons

Year	Primary			Redistilled secondary	Total (excludes zinc recovered by remelting)
	Domestic	Foreign	Total		
1943	594,250	[1] 348,059	942,309	48,215	990,524
1944	574,453	[1] 294,849	869,302	49,037	918,339
1945	467,084	[1] 297,477	764,561	49,242	813,803
1946	459,205	269,057	728,262	44,516	772,778
1947	510,058	292,437	802,495	59,542	862,037

[1] Includes a small tonnage of foreign slab zinc further refined into high-grade metal in the United States.

DISTILLED AND ELECTROLYTIC ZINC

Of the 1947 output of primary zinc, 63 percent was distilled, and 37 percent was produced electrolytically compared with 61 and 39 percent, respectively, in 1946.

The output of Prime Western-grade zinc increased 37 percent in 1947 and was the largest since 1941. Production of Intermediate grade and Regular High Grade rose 14 percent and 6 percent, respectively. Output of Special High Grade increased for the second consecutive year and was slightly more than 1 percent above the 1946 production. Output of Selected grade dropped 6 percent to the lowest level since 1941. Owing to the large supply of brass scrap available for the manufacture of brass products and a drop in demand for Brass Special-grade zinc, smelter output declined 19 percent. Of the total 1947 production (comparable 1946 figures in parentheses), 37 percent (30 percent) was Prime Western, 28 percent (31 percent) Special High Grade, 22 percent (23 percent) Regular High Grade, 7 percent (10 percent) Brass Special, 4 percent (4 percent) Intermediate, and 2 percent (2 percent) Selected.

Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1943–47, in short tons

CLASSIFIED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled	Redistilled secondary [1]		Total
			At primary smelters	At secondary smelters	
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
1946	281,295	446,967	18,408	26,108	772,778
1947	295,520	506,975	22,093	37,449	862,037

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		
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
1946	236,184	180,366	32,294	75,296	13,697	234,941	772,778
1947	239,274	190,429	36,812	61,104	12,844	321,574	862,037

[1] For total production of secondary zinc see chapter on Secondary Metals—Nonferrous.

PRIMARY SLAB ZINC, BY STATES

Montana continued to be the leading producer of primary slab zinc in 1947; Pennsylvania and Oklahoma remained in second and third places, respectively. Of the States for which production figures may be released, Illinois, Idaho, and Arkansas occupied the next three positions, in order of decreasing importance. 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.

Some indication of the movement of foreign ores and concentrates within the United States is revealed when a break-down of the production of primary slab zinc from this source is considered. Of the 292,437 tons of primary slab zinc of foreign origin recovered in 1947, smelters in Oklahoma accounted for 30 percent, Pennsylvania 25 percent, Montana 13 percent, Illinois 13 percent, Texas 11 percent, and West Virginia, Arkansas, and Idaho combined 8 percent. Of the total slab zinc produced from foreign ores and concentrates, 75 percent was recovered by distillation and 25 percent by electrolytic methods, compared with 54 percent and 46 percent, respectively, in 1946.

Primary slab zinc produced in the United States, by States where smelted, 1943–47, in short tons

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania	Texas and West Virginia[1]	Total	
								Short tons	Value
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	107,364	206,315	107,958	869,302	149,520,000
1945	29,391	33,110	124,904	179,251	106,115	200,709	91,081	764,561	131,504,492
1946	18,720	34,832	104,002	186,662	104,125	178,811	101,110	728,262	129,630,636
1947	17,158	41,801	113,192	197,453	128,398	193,524	110,969	802,495	171,894,429

[1] Includes Missouri 1943–44 and 1947.

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 the Secondary Metals—Nonferrous chapter of this volume.

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 native sulfur. The production of sulfuric acid at zinc-blende roasting plants increased 23 percent in 1947.

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Sulfuric acid (basis, 100 percent) made at zinc-blende roasting plants in the United States, 1943–47

Year	Made from zinc blende[1]		Made from native sulfur		Total[1]		
	Short tons	Value[2]	Short tons	Value[2]	Short tons	Value[2]	
						Total	Average per ton
1943	682,926	$8,687,148	120,552	$1,533,475	803,478	$10,220,623	$9.88
1944	652,001	8,344,143	201,109	2,573,734	853,110	10,917,877	9.94
1945	610,938	7,944,478	235,594	3,063,603	846,532	11,008,081	10.10
1946	544,529	6,842,541	160,886	2,021,696	705,415	8,864,237	9.76
1947	598,703	8,001,205	266,104	3,556,281	864,807	11,557,486	10.38

[1] Includes acid from foreign blende.
[2] At average of sales of 60° B. acid.

ZINC DUST

All previous records for production of zinc dust were broken in 1947, the total output being 7 percent above the former high point reached in 1946. 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 particles. The zinc content of the dust produced in 1947 ranged from 95.00 to 99.70 percent and averaged 97.66 percent. Shipments of zinc dust, which totaled 29,986 tons—5 percent of which went to foreign countries—were slightly lower than production; but as the difference was more than compensated by the quantity consumed at manufacturers' plants (3 percent of output), producers' stocks decreased from 1,384 tons (corrected figure) at the beginning to 1,156 tons at the close of the year.

The average price of zinc dust shipped to domestic consumers in 1947 was 12.4 cents a pound compared with 10.6 cents in 1946. The raw materials used to manufacture zinc dust are reviewed in the Secondary Metals—Nonferrous chapter of this volume. 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, 1943–47

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per pound			Total	Average per pound
1943	25,990	$5,249,980	$0.101	1946	28,574	$6,057,688	$0.106
1944	26,511	5,408,244	.102	1947	30,602	7,589,296	.124
1945	25,877	5,227,154	.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 the Lead and Zinc Pigments and Zinc Salts chapter of this volume.

DOMESTIC CONSUMPTION

According to reports from 670 plants, representing an estimated 99 percent of the consuming industry in the United States, 786,360 tons of slab zinc were put in process in 1947, a 2-percent decline from the 1946 total and 12 percent below the record level of 888,626 tons in 1944. Receipts at consumers' plants in 1947 were 774,718 tons.

Galvanizing continued as the principal use of slab zinc, and the quantity consumed for this purpose in 1947 was the greatest in the history of the zinc industry. Consumption of slab zinc for the manufacture of brass products dropped sharply owing to an abundance of brass scrap, which was used by the industry in lieu of new metal. The quantity of zinc used for zinc-base alloys reached an all-time high of 214,469 tons, a slight gain over the previous record of 212,211 tons in 1946.

Consumption of slab zinc in the United States, 1943–47, by industries, in short tons [1]

Industry and product	1943	1944	1945	1946	1947
Galvanizing: [2]					
Sheet and strip	72, 233	119, 381	135, 383	113, 816	115, 147
Wire and wire rope	37, 391	44, 350	46, 083	43, 667	49, 726
Tubes and pipe	51, 023	50, 472	63, 163	62, 460	77, 238
Fittings	14, 549	14, 113	10, 014	10, 593	10, 467
Other	78, 005	87, 675	82, 538	89, 223	108, 749
	253, 201	315, 991	337, 181	319, 759	361, 327
Brass products:					
Sheet, strip, and plate	287, 962	246, 402	146, 375	66, 125	50, 212
Rod and wire	66, 538	70, 970	67, 299	53, 387	34, 653
Tube	24, 456	27, 725	21, 507	19, 173	15, 488
Castings and billets	16, 851	16, 703	12, 942	4, 776	3, 155
Copper-base ingots	20, 384	17, 174	9, 893	4, 379	7, 299
Other copper-base products	2, 888	2, 953	1, 361	1, 262	1, 540
	419, 079	381, 927	259, 377	149, 102	112, 347
Zinc-base alloy:					
Die castings	60, 115	76, 201	121, 966	206, 237	210, 214
Alloy dies and rod	16, 067	8, 245	8, 286	5, 313	3, 802
Slush and sand castings	143	75	584	661	453
	76, 325	84, 521	130, 836	212, 211	214, 469
Rolled zinc	48, 529	76, 524	97, 589	92, 397	70, 680
Zinc oxide	11, 496	20, 198	18, 113	19, 170	18, 376
Other uses:					
Wet batteries	1, 807	2, 174	1, 790	1, 635	1, 462
Desilverizing lead	2, 178	2, 051	2, 095	1, 781	2, 687
Light-metal alloys	1, 074	2, 047	1, 469	545	607
Other [3]	3, 088	3, 193	3, 861	4, 642	4, 405
	8, 147	9, 465	9, 215	8, 603	9, 161
Total consumption [4]	816, 777	[4] 888, 626	[4] 852, 311	[4] 801, 242	786, 360

[1] Excludes some small consumers, but coverage is estimated at 97 percent in 1943, 98 percent in 1944–45, and 99 percent in 1946–47.
[2] Includes zinc used in electrogalvanizing, but excludes sherardizing.
[3] Includes zinc used in making zinc dust, bronze powder, alloys, chemicals, castings, and miscellaneous uses not elsewhere mentioned.
[4] Includes 6,982 tons of remelt zinc in 1944, 5,111 tons in 1945, 3,912 tons in 1946, and 3,577 tons in 1947.

The quantity of slab zinc consumed for rolled products in 1947 dropped 24 percent below the 1946 figure. In addition to slab zinc, the rolling mills remelt and reroll the metallic scrap produced from their fabricating operations. The scrap so treated in 1947 amounted to 14,952 tons—a 20-percent decrease from the 18,670 tons processed in 1946. Purchased zinc scrap in the form of zinc clippings, old zinc scrap, and engravers' plates totaling 3,050 tons were melted and rolled in 1947 (3,313 tons in 1946). Production of rolled zinc from slab zinc and purchased scrap was 71,197 tons, a decrease of 23 percent below the 1946 total, and the lowest output since 1943. Inventories of rolled zinc were 1,852 tons on December 31, 1947, compared with 2,588 tons (revised figure) on the same date in 1946. In addition to the actual shipments of 51,533 tons of rolled zinc in 1947, the rolling mills processed 35,354 tons of rolled zinc (including that which was remelted and rerolled) in manufacturing 20,753 tons of semifabricated and finished products.

Rolled zinc produced and quantity available for consumption in the United States, 1946–47

	1946			1947		
	Short tons	Value		Short tons	Value	
		Total	Average per pound		Total	Average per pound
Production:						
Sheet zinc not over 0.1 inch thick	27,088	$8,581,082	$0.158	20,598	$7,357,171	$0.180
Boiler plate and sheets over 0.1 inch thick	1,615	389,904	.121	1,624	578,853	.148
Strip and ribbon zinc [1]	62,350	16,460,388	.132	47,837	15,253,466	.164
Foil, rod, and wire	1,595	624,508	.196	1,138	540,770	.238
Total rolled zinc	92,648	26,055,882	.141	71,197	23,730,260	.167
Imports	(2)			1	457	.229
Exports	11,957	3,693,009	.154	7,590	3,089,848	.204
Available for consumption	[3][4] 80,601			[3] 64,344		
Value of slab zinc (all grades)			.089			.107
Value added by rolling			.052			.060

[1] Figures represent net production. In addition, 18,670 tons of strip and ribbon zinc in 1946 and 14,952 tons in 1947 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.
[4] Revised figure.

The following table shows the six commercial grades of refined slab zinc and purchased remelt spelter consumed by the various industries in 1947. Of the 786,360 tons of domestic and foreign zinc consumed, 42 percent was Prime Western, 31 percent Special High Grade, and 15 percent Regular High Grade, compared with 37, 32, and 17 percent, respectively, in 1946. All grades of zinc were used for galvanizing and in the manufacture of brass. 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, 70 percent of the total used in this industry being of the two highest grades.

Consumption of slab zinc in the United States in 1947, by grade and industry, in short tons

Industry	Special High Grade	Regular High Grade	Intermediate	Brass Special	Selected	Prime Western	Remelt	Total
Galvanizers	12,501	11,993	13,845	16,319	1,981	301,894	2,794	361,327
Brass products	21,978	57,136	6,163	11,444	2,092	13,184	350	112,347
Zinc-base alloys	202,081	4,153	15	0	0	8,185	35	214,469
Rolled zinc	2,065	24,961	18,740	23,803	0	1,111	0	70,680
Zinc oxide	4,211	13,655	0	510	0	0	0	18,376
Other	1,242	3,365	1,118	500	0	2,538	398	9,161
	244,078	115,263	39,881	52,576	4,073	326,912	3,577	786,360

STOCKS

Producers' Stocks.—Inventories of slab zinc at producers' plants, representing combined Reconstruction Finance Corporation and producer-owned stocks, fell 61 percent in 1947 to the lowest year-end level since 1941, owing mainly to substantial quantities transferred for shipment to Government account.

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 7,229 tons on January 4, 1947. Inventories increased to 11,475 tons, high point of the year, on February 22 but declined generally thereafter to a low of 1,242 tons on January 3, 1948.

Stocks of zinc at zinc-reduction plants in the United States at end of year, 1943–47, in short tons

	1943	1944	1945	1946	1947
At primary reduction plants	168,777	233,044	[1] 254,692	[1] 175,513	67,046
At secondary distilling plants	1,829	652	1,451	756	1,601
	170,606	233,696	[1] 256,143	[1] 176,269	68,647

[1] Revised figure.

Consumers' Stocks.—Consumers' stocks on December 31, 1947, were 11,642 tons (13 percent) less than at the beginning of the year. At the average monthly rate of consumption in 1947, consumers' stocks on hand on December 31 were slightly more than 1 month's requirements.

Consumers' stocks of slab zinc at plants at the beginning and end of 1947, by industries, in short tons

	Galvanizers	Brass mills [1]	Die casters [2]	Zinc rolling mills	Oxide plants	Others	Total
Dec. 31, 1946	[3] 42,387	[3] 19,604	[3] 22,153	6,548	346	[3] 1,219	[3] [4] 92,257
Dec. 31, 1947	39,733	12,911	19,281	6,590	1,096	1,088	80,699

[1] Includes brass mills, brass ingot makers, and brass products.
[2] Includes producers of zinc-base die castings, zinc-alloy dies, and zinc-alloy rods.
[3] Revised figure.
[4] Stocks on Dec. 31, 1946 and 1947, exclude 399 tons and 315 tons, respectively, of remelt spelter.

Reconstruction Finance Corporation Stocks.—In January 1948 the RFC reported stocks of 12,140 short tons of Grade A and 17,306 tons of Grade B slab zinc on hand on December 31, 1947. Stocks of zinc concentrates totaling 65,851 tons of recoverable zinc were also reported on hand at the end of the year.

PRICES

The price of slab zinc throughout 1947 was quoted at 10.50 cents per pound for Prime Western grade, f. o. b. East St. Louis. The weighted average price received by the producers for all grades of zinc sold in 1947 was 10.7 cents a pound, f. o. b. plants, compared with 8.9 cents in 1946. The 1947 price of 12.1 cents for zinc, which appears in the State chapters of this volume, represents the weighted average price received for all grades of slab zinc (10.7 cents) plus the increment—in terms of cents per pound based upon the total mine output of recoverable zinc—of $17,707,736 in subsidies for overquota production and special mine and smelter contracts paid by the Office of Metals Reserve.

The official London maximum price of £70 0s. per long ton for foreign zinc delivered to consumers, duty paid, fixed by the British Ministry of Supply on January 2, 1947, remained unchanged throughout the year.

Average price received by producers of zinc, 1943–47, by grades, in cents per pound [1]

	1943	1944	1945	1946	1947
Grade A: [2]					
Special High Grade	8.91	8.90	8.89	9.18	11.10
Regular High Grade	8.74	8.62	8.60	8.81	10.76
Grade B: Intermediate	8.71	8.74	8.66	9.08	11.19
Grades C and D: [2]					
Brass Special	8.46	8.48	8.48	9.00	10.67
Selected	7.95	8.27	8.32	8.89	10.26
Grade E: Prime Western	8.31	8.24	8.24	8.60	10.39
All grades	8.6	8.6	8.6	8.88	10.71
Prime Western; spot quotation at St. Louis	8.25	8.25	8.25	8.73	10.50

[1] Does not include overquota premium payments made by Office of Metals Reserve.
[2] American Metal Market quotes average prices (delivered) of High Grade and Brass Special as follows: High Grade (f. o. b. New York)—1943-45, 9.25 cents; 1946, 9.73 cents; and 1947, 11.50 cents, Brass Special (f. o. b. East St. Louis)—1943-45, 8.50 cents; 1946, 8.98 cents; and 1947, 10.75 cents.

Average monthly quoted prices of 60-percent zinc concentrates at Joplin, and of common zinc (prompt delivery or spot) St. Louis and London, 1946–47 [1]

Month	1946			1947		
	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	50.00	8.25	5.62	64.00	10.50	12.58
February	50.00	8.25	5.62	64.00	10.50	12.58
March	50.00	8.25	5.62	64.00	10.50	12.58
April	50.00	8.25	6.72	64.00	10.50	12.58
May	50.00	8.25	7.05	64.00	10.50	12.58
June	50.00	8.25	7.05	64.00	10.50	12.58
July	(4)	9.24	8.98	64.00	10.50	12.58
August	50.00	8.25	8.98	64.00	10.50	12.58
September	50.00	8.25	8.98	70.35	10.50	12.58
October	50.00	8.87	8.98	70.35	10.50	12.58
November	60.00	10.12	9.52	70.35	10.50	12.58
December	64.00	10.50	9.88	70.35	10.50	12.58
Average for year	51.12	8.73	7.75	66.20	10.50	12.58

1 Joplin: Metal Statistics, 1948, p. 579. St. Louis: Metal Statistics, 1948, p. 575. London: E&MJ Metal and Mineral Markets.
2 Does not include Government premium of $29.70 a ton on zinc concentrates payable for overquota production. Premium ended June 30, 1947.
3 Average price for foreign zinc converted to cents per pound with the pound sterling at $4.02½.
4 No market due to uncertainty of Premium Price Plan subsidies.

Price of zinc concentrates and zinc, 1943–47

	1943	1944	1945	1946	1947
Joplin 60-percent zinc concentrates:					
Price per short ton ... dollars	55.28	55.28	55.28	51.12	66.20
Average price common zinc at—					
St. Louis (spot) ... cents per pound	8.25	8.25	8.25	8.73	10.50
New York ... do	8.66	8.65	8.65	9.15	11.01
London [1] ... do	4.63	4.63	5.18	7.75	12.58
Price indexes (1925–29 average=100):					
Zinc (New York)	122	122	122	128	155
Lead (New York)	87	87	87	109	196
Copper (New York)	80	80	80	93	143
Nonferrous metals [2]	87	87	87	100	142
All commodities [2]	105	106	108	121	155

1 Average price for foreign zinc, converted to cents per pound with the pound sterling at $4.02¼.
2 Based upon price indexes of U. S. Department of Labor.

HISTORY OF PREMIUM PRICE PLAN

The Premium Price Plan, which involved a 5⅓-year period of unprecedented entry through legislation of Government into the economics of mining, got underway in 1942. Although the necessity for increased domestic zinc output to meet national security needs was a matter of concern to Government and industry following the outbreak of war in Europe, the gravity of the domestic supply situation was not seriously considered until the Japanese attack on Pearl Harbor.

In an effort to expand domestic mine output of zinc for the war program, the Office of Production Management and the Office of Price Administration jointly announced on January 13, 1942, the details of a plan whereby producers (miners) of zinc (copper and lead

Salient statistics on zinc with regard to operation of Premium Price Plan, 1942–47 [1]

TRI-STATE DISTRICT

	1942 [2]	1943	1944	1945	1946	1947 [3]
Total production of recoverable zinc [4] .... short tons	216, 367	200, 103	200, 341	140, 181	137, 858	75, 548
Ceiling production at 8.25 cents a pound .... do	95, 050	11, 930	20, 911	5, 672	2, 253	1, 403
Ceiling production, proportion of total .... percent	43. 93	5. 96	10. 44	4. 05	1. 63	1. 86
Overceiling production under Premium Price Plan:						
A quota only (11 cents a pound) .... short tons	120, 681	92, 650	65, 714	41, 388	[5] 15, 594	(6)
B quota (13.75 cents a pound) .... do	573	58, 243	65, 779	52, 135	[5] 35, 082	
C quota (16.50 cents a pound) .... do	63	34, 803	42, 080	35, 192	[5] 56, 956	
					[7] 22, 262	
Total premium production .... do	121, 317	185, 696	173, 573	128, 715	129, 894	71, 053
Metals Reserve mine contracts .... do	-----	2, 477	5, 857	5, 794	5, 711	3, 092
Total overceiling production .... do	121, 317	188, 173	179, 430	134, 509	135, 605	74. 145
Overceiling production, proportion of total:						
Production under Premium Price Plan:						
A quota only .... percent	55. 78	46. 30	32. 80	29. 53	[5] 11. 31	(6)
B quota (also received A) .... do	. 26	29. 11	32. 83	37. 19	[5] 25. 45	
C quota (also received A and B) .... do	. 03	17. 39	21. 01	25. 10	[5] 41. 31	
					[7] 16. 15	
Total premium production .... do	56. 07	92. 80	86. 64	91. 82	94. 22	94. 05
Metals Reserve mine contracts .... do	-----	1. 24	2. 92	4. 13	4. 15	4. 09
Total overceiling production .... do	56. 07	94. 04	89. 56	95. 95	98. 37	98. 14
Payments under Premium Price Plan: [8]						
A premium .... dollars	6, 672, 409	10, 213, 269	9, 546, 487	7, 079, 337	[5] 5, 802. 964	(6)
B premium .... do	34, 936	5, 117, 544	5, 932, 208	4, 802, 986	[5] 5, 081, 379	
C premium .... do	3, 446	1, 914, 183	2, 314, 401	1, 935, 543	[5] 3, 153, 057	
					[7] 2, 411. 597	
Total premium production .... do	6, 710, 791	17, 244, 996	17, 793, 096	13, 817, 866	16, 448, 997	7, 625, 107
Metals Reserve payments to smelters [8] .... do	-----	-----	402, 580	875, 247	-----	-----
Metals Reserve mine contracts [8] .... do	-----	225, 005	578, 737	550, 979	698, 862	301, 007
Total overceiling payments .... do	6, 710, 791	17, 470, 001	18, 774, 413	15, 244, 092	17, 147, 859	7, 926, 114
Average prices per pound of zinc: [9]						
Average premium production .... cents	11. 016	12. 893	13, 376	13. 618	15. 218	15. 866
Metals Reserve mine contracts .... do	-----	12. 791	13. 190	13. 005	15. 005	15. 368
Total overceiling production .... do	11. 016	12. 892	13. 482	13. 917	15. 210	15. 845
Total production .... do	9. 801	12. 615	12. 936	13. 687	15. 106	15. 746

OTHER DISTRICTS

Total production of recoverable zinc [4] ... short tons	479,881	540,565	515,465	474,177	427,929	261,761
Ceiling production at 8.25 cents a pound ... do	400,984	326,251	251,105	204,633	165,896	92,974
Ceiling production, proportion of total ... percent	83.56	60.35	48.71	43.16	38.77	35.52
Overceiling production under Premium Price Plan:						
A quota only (11 cents a pound) ... short tons	75,617	146,639	171,328	191,328	[5] 132,861	
B quota (13.75 cents a pound) ... do	1,923	40,045	56,015	39,444	[5] 36,152	(6)
C quota (16.50 cents a pound) ... do	734	22,778	31,421	36,009	[5] 44,861	
					[7] 47,136	
Total premium production ... do	78,274	209,462	258,764	266,781	261,010	168,787
Metals Reserve mine contracts ... do	623	4,852	5,596	2,763	1,023	----
Total overceiling production ... do	78,897	214,314	264,360	269,544	262,033	168,787
Overceiling production, proportion of total:						
Production under Premium Price Plan:						
A quota only ... percent	15.76	27.13	33.24	40.35	[5] 31.05	
B quota (also received A) ... do	.40	7.41	10.87	8.32	[5] 8.45	(6)
C quota (also received A and B) ... do	.15	4.21	6.09	7.59	[5] 10.48	
					[7] 11.01	
Total premium production ... do	16.31	38.75	50.20	56.26	60.99	64.48
Metals Reserve mine contracts ... do	.13	.90	1.09	.58	.24	----
Total overceiling production ... do	16.44	39.65	51.29	56.84	61.23	64.48
Payments under Premium Price Plan: [8]						
A premium ... dollars	4,305,059	11,520,444	14,283,080	14,672,969	[5] 11,490,232	
B premium ... do	146,141	3,455,281	4,809,086	4,149,882	[5] 4,296,471	(6)
C premium ... do	40,394	1,252,814	1,728,271	1,980,489	[5] 2,383,854	
					[7] 2,576,074	
Total premium production ... do	4,491,594	16,228,539	20,820,437	20,803,340	20,746,631	9,781,622
Metals Reserve payments to smelters [8] ... do	----	----	----	----	----	----
Metals Reserve mine contracts [8] ... do	36,501	280,353	313,792	157,745	60,352	----
Total overceiling payments ... do	4,528,095	16,508,892	21,134,229	20,961,085	20,806,983	9,781,622
Average prices per pound of zinc: [9]						
Average premium production ... cents	11.119	12.124	12.273	12.150	12.861	13.398
Metals Reserve mine contracts ... do	11.179	11.139	11.054	11.105	11.837	----
Total overceiling production ... do	11.120	12.102	12.247	12.138	12.857	13.398
Total production ... do	8.722	9.777	10.300	10.460	11.318	12.368

See footnotes at end of table.

Salient statistics on zinc with regard to operation of Premium Price Plan, 1942–47—Continued

TOTAL UNITED STATES

	1942 [2]	1943	1944	1945	1946	1947 [3]
Total production of recoverable zinc [4] ....short tons..	696, 248	740, 668	715, 806	614, 358	565, 787	337, 309
Ceiling production at 8.25 cents a pound........do....	496, 034	338, 181	272, 016	210, 305	168, 149	94, 377
Ceiling production, proportion of total........percent..	71. 24	45. 66	38. 00	34. 23	29. 72	27. 98
Overceiling production under Premium Price Plan:						
A quota only (11 cents a pound)........short tons..	196, 298	239, 289	237, 042	232, 716	[5] 148, 455	([6])
B quota (13.75 cents a pound)........do....	2, 496	98, 288	121, 794	91, 579	[5] 71, 234	
C quota (16.50 cents a pound)........do....	797	57, 581	73, 501	71, 201	[5] 101, 817	
					[7] 69, 398	
Total premium production........do....	199, 591	395, 158	432, 337	395, 496	390, 904	239, 840
Metals Reserve mine contracts........do....	623	7, 329	11, 453	8, 557	6, 734	3, 092
Total overceiling production........do....	200, 214	402, 487	443, 790	404, 053	397, 638	242, 932
Overceiling production, proportion of total:						
Production under Premium Price Plan:						
A quota only........percent..	28. 19	32. 31	33. 12	37. 88	[5] 26. 24	([6])
B quota (also received A)........do....	. 36	13. 27	17. 01	14. 91	[5] 12. 59	
C quota (also received A and B)........do....	. 12	7. 77	10. 27	11. 59	[5] 17. 99	
					[7] 12. 27	
Total premium production........do....	28. 67	53. 35	60. 40	64. 38	69. 09	71. 10
Metals Reserve mine contracts........do....	. 09	. 99	1. 60	1. 39	1. 19	0. 92
Total overceiling production........do....	28. 76	54. 34	62. 00	65. 77	70. 28	72. 02
Payments under Premium Price Plan: [8]						
A premium........dollars..	10, 977, 468	21, 733, 713	23, 829, 567	21, 752, 306	[5] 17, 293, 196	([6])
B premium........do....	181, 077	8, 572, 825	10, 741, 294	8, 952, 868	[5] 9, 377, 850	
C premium........do....	43, 840	3, 166, 997	4, 042, 672	3, 916, 032	[5] 5, 536, 911	
					[7] 4, 987, 671	
Total premium production........do....	11, 202, 385	33, 473, 535	38, 613, 533	34, 621, 206	37, 195, 628	17, 406, 729
Metals Reserve payments to smelters [8]........do....	----------	----------	402, 580	875, 247	----------	----------
Metals Reserve mine contracts [8]........do....	36, 501	505, 358	892, 529	708, 724	759, 214	301, 007
Total overceiling payments........do....	11, 238, 886	33, 978, 893	39, 908, 642	36, 205, 177	37, 954, 842	17, 707, 736

Average prices per pound of zinc: [9]						
Average premium production ..... cents..	11.056	12.485	12.716	12.627	13.645	14.129
Metals Reserve mine contracts ..... do....	11.179	11.698	12.146	12.391	14.524	15.368
Total overceiling production ..... do....	11.057	12.471	12.746	12.730	13.660	14.145
Total production ..... do....	9.057	10.544	11.038	11.197	12.241	13.125

[1] From published and unpublished reports of the Office of Price Administration and the Office of Premium Price Plan for Copper, Lead and Zinc. Excludes exploration premiums totaling $6,213,545 paid from July 1, 1946, through Dec. 31, 1947, to encourage exploration and development of copper, lead and zinc deposits; this total cannot be broken down by metals.
[2] Premium Price Plan effective Feb. 1, 1942; data refer to February–December, inclusive.
[3] Premium Price Plan effective until June 30, 1947; data refer to January–June, inclusive.
[4] 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.
[5] January–October. A, B, and C quotas and premium payments for November and December are not separable and are shown with footnote 7.
[6] A, B, and C quotas and premium payments unavailable separately.
[7] Total A, B, and C quotas and premium payments for November and December; separation by kinds not available.
[8] Data on premium payments, payments to smelters, and Metals Reserve mine-contract payments from Office of Metals Reserve.
[9] All average prices shown include OPA ceiling price.

were also included in the plan) received through the Metals Reserve Company 11 cents a pound for zinc produced over quotas based upon 1941 output as against the regular ceiling price of 8.25 cents per pound for Prime Western grade zinc, East St. Louis, established on October 10, 1941. This plan originally scheduled for 2½ years' duration, became effective February 1, 1942. In the Tri-State district the miner was paid an extra $28.05 a ton for 60-percent concentrates, this being declared the equivalent of 2.75 cents a pound premium. Later in 1942 the figure was adjusted to $29.70. The Premium Price Plan was continued without further change in 1942, and although the expected increase in the rate of production did not materialize, the maintenance of past production was in itself an accomplishment.

The record of zinc output under the Premium Price Plan in 1942 indicated the need for materially higher prices if wartime production objectives were to be achieved. New premiums were approved by the Metals Reserve Company on December 23, 1942, in a revision of the plan whereby second and third levels of premium prices for zinc above the existing subsidy of 2.75 cents were established. In accordance with this scheme the quotas were designated A quotas, B quotas, or C quotas. An A quota was defined as the ore tonnage for which a mine received the ceiling price of 8.25 cents. A mine with an A quota would thus receive the first premium price of 2.75 cents per pound for zinc produced over the A quota. Similarly, a B quota was the tonnage for which a mine received the first premium price, and all production over the B quota received the second premium price of 2.75 cents. A mine with the third or C quota would receive the second premium price for tonnage on its C quota and the third premium price of 2.75 cents for output over its C quota. Thus it was possible to secure up to 16½ cents a pound for mine production of zinc. Under the revised plan, which became effective January 1, 1943, the period of premium prices was extended until July 31, 1945, and provision was made for increase or revocation of the B or C quotas upon 30 days' notice.

During the later part of 1943, the supply of zinc (and lead) was considered adequate by the War Production Board in view of increased production, revised military requirements, and labor supply. Accordingly, on October 27, this agency issued a statement denying further premiums in the B and C range to zinc mines not already operating on that date and to zinc mines having a low labor productivity and located in areas of serious labor shortage.

The Premium Price Plan functioned without further change through 1944 and 1945. Prior to expiration of the original plan on July 31, 1945, Congress voted the Hayden-McFarland bill, S. 502, into Public Law 88 on June 14, extending the plan until June 30, 1946.

A bill to extend the OPA and ceiling prices, with which the structure and operation of the Premium Price Plan were intimately related, was vetoed by President Truman on June 29, 1946. Thus on June 30, without legislative approval for continuation and without fixed prices upon which to base subsidy payments, the Premium Price Plan ceased to exist. Reestablishment of the OPA on July 25 provided for retroactive premium payments to cover the period when no plan was in effect, and the Premium Price Plan was extended until June 30, 1947, under the same terms as in the past, except that incorporated in the subsidy section of the bill extending the OPA was a provision that "adjustments shall be made to encourage exploration and development work and adequate allowances for depreciation and depletion." The bill further provided that all classes of premiums were noncancelable unless necessary to make individual adjustments of income to specific mines. With the abandonment of metal price ceilings on November 10, 1946, subsidies to mines financially aided by the Premium Price Plan were computed with average monthly market quotations as a base.

Continuation of the Premium Price Plan for 2 years beyond June 30, 1947, was proposed in the Allen bill (H. R. 1602). This legislation, which was vetoed by President Truman on August 8, included provisions for subsidy payments on domestic mine production of copper, lead, zinc, and manganese at an annual cost of not more than $35,000,000.

FOREIGN TRADE[4]

Imports.—Total imports of zinc in ores and concentrates in 1947 increased 10 percent over 1946. Of the 297,959 tons of contained zinc so imported, 55 percent came from Mexico, 17 percent from Peru, 14 percent from Canada, 6 percent from Bolivia, 4 percent from Italy, 3 percent from Newfoundland, and 1 percent from Spain, Australia, and Union of South Africa.

Zinc imported into the United States in ores, blocks, pigs, or slabs, 1945–47, by countries, in short tons [1]

[U. S. Department of Commerce]

Country	1945	1946	1947
Ores (zinc content):			
Argentina		8, 295	
Australia	15, 377	3, 780	864
Bolivia	5, 771	26, 207	17, 176
Canada	90, 200	57, 298	42, 430
Chile [2]	34, 438		
Italy			11, 613
Mexico	177, 003	127, 685	163, 726
Newfoundland and Labrador	23, 515		8, 873
Peru	35, 415	48, 791	49, 952
Spain			3, 321
Other countries		(3)	4
	381, 719	272, 056	297, 959
Blocks, pigs, or slabs:			
Australia	14, 417	3, 221	3
Canada	46, 594	85, 194	55, 031
India			96
Japan			16, 927
Mexico	36, 105	15, 777	332
Other countries		551	
	97, 116	104, 743	72, 389

[1] Data include zinc 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.

[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.

Zinc imported for consumption in the United States, 1943–47, by classes

[U. S. Department of Commerce]

Year	Ores (zinc content)		Blocks, pigs, 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	
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	331,533	15,021,771	96,760	12,173,525	(3)	2	7,299	476,920	362	39,789	27,712,007
1946	166,885	8,122,471	104,015	16,474,850	(3)	10	4,137	300,429	77	4,942	24,902,702
1947	194,822	12,165,163	72,140	14,826,199	1	457	5,029	435,719	------	------	27,427,538

[1] Includes dross and skimmings as follows—1943: 5,032 tons, $216,425; 1944: 4,694 tons, $224,995; 1945: 4,291 tons, $230,973; 1946: 2,851 tons, $188,972; 1947: 4,315 tons, $349,623.
[2] In addition, manufactures of zinc imported as follows—1943: $35,355; 1944: $14,223; 1945: $8,077; 1946: $1,929; and 1947: $4,429.
[3] Less than 1 ton.

Slab-zinc imports dropped 31 percent in 1947. Canada continued to be the principal foreign source of slab zinc despite a decline of 35 percent in the quantity imported. Imports from Mexico, which totaled 15,777 tons in 1946, dropped to only 332 tons in 1947, but were partly offset by importation of 16,927 tons of slab zinc from Japanese stocks accumulated during the war.

Tariff.—The General Agreement on Tariffs and Trade concluded October 30 at Geneva, Switzerland, bound as of January 1, 1948, the temporary tariff rates established under the Mexican Agreement of January 30, 1943. Thus the tariff on zinc-bearing ores will continue at ¾ cent per pound (zinc content), and on zinc in blocks, pigs, or slabs, and dust at ⅞ cent per pound.

Exports.—The value of exports of zinc ores, concentrates, and manufactured articles containing zinc of foreign and domestic origin (excluding galvanized products, alloys, and pigments) amounted to $27,714,840 in 1947, compared with $12,796,147 (revised figure) in 1946. 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 the Lead and Zinc Pigments and Zinc Salts chapter of this volume. 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. Draw-back refunds were made on 7,274 tons in 1943 and on 29,738 tons in 1944; corresponding 1945–47 data are not yet available.

Zinc ore and manufactures of zinc, exported from the United States, 1943–47

[U. S. Department of Commerce]

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
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
1946	89	15,440	47,224	8,222,940	13,846	4,468,328	366	89,439
1947	1,404	215,123	106,669	22,817,004	10,898	4,234,306	1,646	448,407

[1] Less than 1 ton.

Slab and sheet zinc exported from the United States, 1944–47, by destinations, in short tons

[U. S. Department of Commerce]

Destination	Slabs, plates, and block				Sheets, strips, or other forms, n. e. s.			
	1944	1945	1946	1947	1944	1945	1946	1947
Country:								
Argentina	--------	110	3,811	5,809	146	274	1,353	890
Australia	--------	--------	--------	--------	--------	5	(1)	350
Belgium and Luxembourg	--------	2,060	4,601	7,971	--------	(1)	5	13
Brazil	1,069	441	1,301	1,735	145	321	1,256	628
Canada	4,132	24	1	3	2,704	2,956	2,975	2,579
Chile	17	587	687	600	18	7	322	291
China	--------	--------	1,667	611	5	2	757	431
Colombia	11	1	32	--------	22	62	53	143
Cuba	1	141	67	182	42	67	70	91
Czechoslovakia	--------	--------	1,118	3,347	--------	--------	--------	726
Finland	--------	--------	950	2,330	--------	--------	9	19
France	--------	2,204	(1)	5,253	--------	--------	7	--------
Germany	--------	--------	--------	392	--------	--------	--------	--------
India	--------	--------	7,898	10,748	4	10	324	753
Italy	--------	--------	--------	903	--------	--------	--------	--------
Mexico	473	113	54	54	278	413	460	628
Netherlands	--------	--------	2,491	2,509	--------	--------	72	398
Netherlands Indies	--------	--------	1	--------	--------	--------	12	146
Portugal	--------	17	2	269	--------	277	520	339
Sweden	--------	470	1,293	2,454	--------	94	537	379
Switzerland	--------	1,336	4,205	1,492	--------	110	956	241
Tunisia	--------	--------	--------	--------	44	44	74	119
Turkey	--------	3	213	333	--------	243	2,388	210
Union of South Africa	--------	--------	--------	--------	60	186	38	93
U. S. S. R.	1,151	--------	--------	--------	--------	1	10	--------
United Kingdom	14,669	--------	16,628	59,289	8	4	46	95
Other countries	53	275	204	385	544	1,159	1,602	1,336
	21,576	7,782	47,224	106,669	4,020	6,235	13,846	10,898
Continent:								
North America	4,621	299	136	262	3,095	3,563	3,603	3,441
South America	1,112	1,392	5,902	8,153	438	964	3,254	2,194
Europe	15,820	6,087	31,405	86,561	97	643	2,345	2,333
Asia	22	3	9,781	11,693	10	364	3,919	2,131
Africa	1	1	(1)	--------	379	693	724	446
Oceania	(1)	--------	--------	--------	1	8	1	353

[1] Less than 1 ton.

WORLD PRODUCTION

World production of zinc in recent years, insofar as data are available, is shown in the following table.

World smelter production of zinc, 1940–47, by countries where smelted, in metric tons

Compiled by B. B. Mitchell]

Country	1940	1941	1942	1943	1944	1945	1946	1947
Argentina			410	728	1,200	1,542	1,814	2,631
Australia	77,176	78,945	75,474	76,972	79,979	85,118	77,541	70,535
Belgium	70,410	38,690	28,620	27,770	8,660	11,712	86,224	133,011
Canada	168,486	193,784	195,769	187,342	152,876	166,302	168,431	161,717
China	250	214	396	500	331	328		320
Czechoslovakia	(1)	(1)	(1)	(1)	(1)	(2)	(2)	1,964
France	37,843	25,918	22,829	21,490	8,793	8,414	30,361	46,000
Germany [3]	317,600	317,600	314,100	312,000	259,600	(2)	28,429	[4] 20,827
Indochina, French	6,104	6,251	5,462	4,138	[5] 622			(2)
Italy	39,338	38,800	34,129	25,200		1,565	15,262	25,974
Japan	[6] 59,214	[6] 62,177	[6] 54,730	[6] 60,948	[6] 62,673	[6] 18,553	11,253	14,849
Mexico	33,388	38,678	51,743	54,449	49,248	48,985	41,982	56,749
Netherlands	5,049	3,718	5,153	4,565	2,105		2,011	9,532
Northern Rhodesia	13,402	13,762	13,046	13,620	14,712	15,485	17,466	21,479
Norway	17,229	6,464	7,693	15,376	11,777	9,228	30,210	34,580
Peru	178	752	941	1,225	1,447	1,688	1,473	1,114
Poland	(1)	(1)	(1)	(1)	(1)	36,385	56,614	71,756
Spain	12,322	19,143	19,150	19,200	18,054	17,310	17,568	19,825
Sweden					1,790	2,929		(2)
U. S. S. R.	[5] 85,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United Kingdom [7]	60,025	68,321	72,437	70,345	73,190	63,034	66,405	69,360
United States	612,596	745,720	809,088	854,844	788,613	693,594	660,665	728,007
Yugoslavia	4,989	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Total (estimate)	1,620,600	1,749,200	1,800,000	1,840,000	1,625,200	1,274,000	1,405,800	1,580,200

[1] Included with Germany.
[2] Data not available; estimate by senior author of chapter included in total.
[3] Includes Austria, Czechoslovakia, and Poland in 1940–44.
[4] British zone only.
[5] Estimated.
[6] Preliminary data for fiscal year ended March 31 of year following that stated.
[7] Some secondary metal included.

Minor Metals[1]

By SAMUEL A. GUSTAVSON [2]

BARIUM

A FEW thousand pounds of barium metal are produced annually by the Kemet Laboratories Co., Inc. (unit of Union Carbide & Carbon Corp.), Cleveland, Ohio, and King Laboratories, Inc., Syracuse, N. Y. The total output of these two companies in 1947 was about 15 percent greater than in 1946. Apparent consumption increased about 36 percent. Prices for the metal are not quoted in trade journals but may be obtained direct from the producing companies. The price varies with the quantity and purity desired.

The principal use of barium metal is as a "getter." Barium metal has a high affinity for oxygen and other gases; and, when a small quantity is vaporized in an electronic tube, it absorbs most of the gases remaining in the tube after mechanical means of evacuation have been used. In this application the barium often is alloyed with other alkaline-earth metals and with light metals.

Barium ores and chemicals are discussed in the Barite chapter of this volume.

BERYLLIUM

United States consumption of beryl concentrates in 1947 increased substantially over 1946. Combined domestic production and foreign imports were inadequate to meet refiners' raw-material requirements, the deficit being balanced by the transfer to industry of stocks of beryl concentrates held by the Office of Metals Reserve.

Domestic Mine Production.—South Dakota and New Hampshire were the more important domestic beryl-producing States in 1947. New Hampshire production in 1947 exceeded that of 1946 by over 12 times, whereas South Dakota output declined by 26 percent. The Ashley Mining Corp., operating at West Rumney, N. H., was the

[1] Discussion of radium and mesothorium, formerly included in this chapter, is to be found in the Uranium, Radium, and Thorium chapter of this volume.
[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.

largest individual producer of beryl for the year. Beryl production was recorded from Connecticut, Maine, Colorado, and New Mexico for the first time since 1944. Companies and individuals reporting output numbered 26, 15 of these being in the Black Hills region of South Dakota. Development was reported on beryl properties in the vicinity of Lone Pine, Calif., and Searchlight, Nev.

Beryllium concentrates (beryl) shipped from mines in the United States, by States, 1941–47, in short tons

State	1941	1942	1943	1944	1945	1946	1947
Colorado		3	68	35			(1)
Connecticut				(1)			(1)
Maine	(1)	45	2	2			(1)
Massachusetts			(1)	4			
New Hampshire	(1)	16	42	(1)	1	5	(1)
New Mexico			(1)	29			(1)
South Dakota	151	205	238	306	38	95	70
Other [2]	7		6	12			75
Total: Short tons	158	269	356	388	39	100	145
Value	$7,300	$24,188	$44,407	$56,135	$6,133	$17,787	$25,214
Average value per ton	$46.20	$89.92	$124.74	$144.68	$157.26	$177.87	$173.89

[1] Included with "Other." Bureau of Mines not at liberty to show separately.
[2] Includes States indicated by footnote 1; also, in 1941—Wyoming, and in 1943–44—North Carolina and Virginia.

Domestic Refiners and Fabricators.—Consumers of beryl for processing into metal, alloys, oxide, and other compounds were the Brush Beryllium Co., Cleveland, Ohio; Beryllium Corp., Reading, Pa.; and Clifton Products Inc., Painesville, Ohio. Significant quantities of beryl were used for ceramic applications by the Ferro Enamel Corp., Cleveland, Ohio; for spark-plug insulators by the Champion Spark Plug Co., Detroit, Mich.; and for ceramic material and chemical manufacture by the Harshaw Chemical Co., Cleveland, Ohio.

Fabricators of beryllium metal and beryllium-aluminum alloys included the Machlett Laboratories of Springdale, Conn., and the Aluminum Corp. of America, Pittsburgh, Pa. Beryllium-copper alloys were fabricated by Beryllium Corp., Reading, Pa.; Instrument Specialties Co., Little Falls, N. J.; Riverside Metal Co., Riverside, N. J.; and Slagle Beryllium Co., Upper Darby, Pa.

Government-owned land and buildings of the surplus beryllium oxide and metal plant at Lorain, Ohio, were sold to the Brush Beryllium Co. by the War Assets Administration, in June 1947.

Consumption and Uses.—Domestic consumption of beryl in 1947 for the production of metal, alloys, and compounds rose to 1,735 short tons, thus exceeding by some 722 tons that for 1946 and nearly equaling the 1945 consumption of 1,738 tons. Consumers relied upon stocks of beryl held by OMR as their principal source of supply; beryl transferred to industry from this source amounted to 2,912 tons for the year.

The major portion of beryl ore processed was used for producing beryllium-copper master alloy and beryllium oxide phosphors. There was increasing use of beryllium compounds in the ceramics industry for crucibles. The metal is fabricated into windows for X-ray tubes and used in atomic energy apparatus. Considerable attention was given to the possible health hazards connected with the processing and handling of materials containing beryllium, particularly in the beryllium phosphors used in fluorescent-tube manufacture.

Stocks.—Beryl consumers' stocks decreased from 879 tons at the first of the year to 387 tons at the close. OMR beryl stocks dropped to 1,206 tons by the end of the year as a result of shipments to industry. OMR stocks totaled 4,118 tons at the end of 1946.

Prices.—Domestic beryl prices, f. o. b. mine, rose from $10–$12 per short-ton unit of BeO in January 1947 and $12–$14 in February to $14–$16 in late March through November and $16–$18 in December. This change nearly equalized the prices of domestic and foreign beryl. Imported beryl, f. o. b. Atlantic port, was quoted at $14–$16 per unit in January, $17 in early February, and $18 after mid-February. Beryllium-copper master alloy containing 4 percent Be, was sold at $14.75 per pound of contained beryllium during the first half of the year, $17 from July 7 to October 19, and $20.50 thereafter. Beryllium-aluminum master alloy, 5 percent Be, was quoted in October at $40 per pound of beryllium contained. Beryllium metal was offered in powder form in two grades, Technical and Premium, and priced, respectively, at $95 and $103 per pound; the Premium grade also was available in lump or pebble form at $85 per pound. The oxide was available at $6.50 and $9 per pound, depending upon the purity desired; the prices quoted applied to minimum lots of 100 pounds.

Foreign Trade.—Beryl imports declined for the fourth successive year and were the lowest for any year since 1939, when 459 tons were reported. During 1947, 396 pounds of beryllium ore worth $780 were exported. Exports of beryllium metal, alloys, and scrap totaled 281,369 pounds valued at $259,770; this quantity was distributed as follows: 239,182 pounds to the United Kingdom, 19,409 to Canada, 11,126 to Switzerland, and 11,652 to six other countries. Beryllium exports continued to require licensing. Control was extended to February 28, 1949, by Public Law 395, enacted December 30, 1947.

Beryllium ore (beryl concentrates) imported for consumption in the United States, by countries, 1943–47, in short tons

[U. S. Department of Commerce]

Country	1943	1944	1945	1946	1947
Anglo-Egyptian Sudan		1			
Argentina	1,162	229		53	
Australia	457	518	105	20	45
Brazil	2,551	1,453	572	906	722
British East Africa		15	7		
India	509	892	484	119	
Madagascar	74		11		
Nigeria			22		
Portugal	1				
Southern Rhodesia		7			
Union of South Africa	86	(1)			
Total: Short tons	4,840	3,115	1,201	1,098	767
Value	$377,726	$286,091	$131,841	$105,708	$112,667

[1] Less than 1 ton.

Technology.—Keen interest was evidenced in all phases of the beryllium industry, ranging from exploration for raw materials to new applications for refined products. Reports on beryl resources of

Connecticut [3] and helvite resources of Iron Mountain, N. Mex.,[4] were published. The Bureau of Mines published results of beneficiation tests, principally flotation, carried out on beryl ores from the Western States [5] and from New England.[6] A patent was issued covering a beryllium boro-phosphate glass said to have optical properties in a region outside those occupied by previously known commercial glasses.[7] Several patents were issued covering the use of various beryllium compounds as catalysts for promoting hydrocarbon conversion processes, such as cracking, re-forming, and isomerization.

World Review.—Mining of beryl in Uganda was resumed in 1947. Jooste Lithium Myne in South-West Africa exported 52 metric tons of beryl ore. A beryl occurrence of possible commercial value was reported 80 miles northwest of Winnipeg, Manitoba, and 10 miles east of Lac du Bonnett in the Pointe du Bois quadrangle. Exporters of beryllium ores and beryllium-containing materials in Canada and Australia are required to obtain a special license. India's embargo on beryl exports continued in effect in 1947. Export restrictions in Argentina amounted to a virtual embargo; the principal Argentine beryl mine was reported exhausted. The basic tax value on beryllium mined in Madagascar was increased from 4,000 to 6,000 francs; beryllium-ore output is reserved for France.

World production of beryllium concentrates (beryl), by countries, 1940–47, in metric tons [1]

[Compiled by B. B. Mitchell]

Country	1940	1941	1942	1943	1944	1945	1946	1947
Argentina	520	2,186	925	881	342	190	130	10
Australia	2	3	--------	534	417	47	19	54
Brazil (exports)	1,472	1,703	1,634	2,027	1,185	510	1,294	1,027
India	53	(2)	121	1,486	508	108	112	(3)
Korea	(3)	(3)	(3)	(3)	17	9	(3)	(3)
Madagascar	(3)	(3)	(3)	[4] 67	50	[4] 10	(3)	(2)
Portugal	(3)	35	(3)	14	[5] 60	9	(3)	(3)
Portuguese East Africa	(3)	(3)	8	6	3	2	22	61
Spain	4	(3)	(3)	(3)	(3)	(3)	(3)	(3)
South-West Africa	(3)	20	39	36	1	5	--------	52
Uganda	(3)	(3)	(3)	--------	18	4	--------	18
United States (mine shipments)	110	143	244	323	352	35	91	132
World total (estimate) [6]	2,161	4,090	2,971	5,374	2,953	929	1,700	1,500

[1] In addition to countries listed, beryllium concentrates may also be produced in Finland, France, Kenya, Norway, Rumania, and U. S. S. R. Canada has produced beryl but reported no sales.
[2] Less than 1 ton.
[3] Data not available.
[4] Estimate based on United States imports.
[5] Estimate.
[6] Estimate exclusive of U. S. S. R. Production in other countries for which data are not available is believed to be negligible.

[3] Cameron, Eugene N., and Shainin, Vincent E., The Beryl Resources of Connecticut: Econ. Geol., vol. 42, No. 4, June–July, 1947, pp. 353–367.
[4] Storms, Walter R., Iron Mountain Beryllium Deposits, Sierra and Socorro Counties, N. Mex.: Bureau of Mines Rept. of Investigations 4024, 1947, 13 pp.
[5] Snedden, H. D., and Gibbs, H. L., Beneficiation of Western Beryl Ores: Bureau of Mines Rept. of Investigations 4071, 1947, 18 pp.
[6] Lamb, Frank D., Beneficiation of New England Beryllium Ores: Bureau of Mines Rept. of Investigations 4040, 1947, 9 pp.
[7] Sun, Kuan-Han, and Huggins, M. L. (assignors to Eastman Kodak Co.), Beryllium Boro-Phosphate Glass: U. S. Patent 2,415,661, Feb. 11, 1947.

BORON

Production.—Shipments of boron ferro-alloys in 1947 were 147 short tons containing 13 tons of boron valued at $208,447 compared with 74 short tons containing 11 tons of boron in 1946. Ferroboron contains 10 to 20 percent B and 74 to 78 percent Fe. The shippers were Electro Metallurgical Co., Niagara Falls, N. Y.; Molybdenum Corp. of America, Washington, Pa.; and Ohio Ferro-Alloys Corp., Philo, Ohio. Complex alloys containing 0.2 to 2 percent boron also are produced by these companies.

Uses.—The hardenability of many steels can be increased by additions of 0.001 to 0.003 percent of boron. Several reports have been published in recent years on its use in steel.[8] Boron is an efficient absorber of neutrons, so boron steel has been employed to control the operating rate of the uranium-graphite piles used to produce plutonium. Research in the preparation of boron carbide (B_4C) for use as a partial substitute for industrial diamonds was carried on.

Prices.—According to Iron Age, ferroboron—min. 17.5 percent B., max. 1.5 percent Si, max. 0.50 percent Al, and max. 0.5 percent C—was quoted at $1.30 per pound for less-than-ton lots in the eastern area from January to December 11, 1947, when the price quoted was $1.20 for lots of more than 100 pounds.

CALCIUM

Domestic Production.—Production of calcium metal increased considerably in 1947 over 1946. Two companies—the Electro Metallurgical Co., Sault Ste. Marie, Mich., and the New England Lime Co., Canaan, Conn.—were producers.

Uses.—The metal is used as a deoxidizer and scavenger in ferrous metallurgy and to a small extent as a reducing agent in the preparation of several nonferrous metals. Calcium metal is also alloyed with nonferrous metals, chiefly lead, in which it acts as a substitute for antimony as a permanent hardening agent. Calcium hydride was used extensively during World War II as a convenient portable source of hydrogen.

Prices.—Calcium metal, per pound in ton lots, cast in slabs and small pieces, was quoted at $1.85 from January to early June 1947, at $1.60 from June 12 to mid-September, and again at $1.85 from September 18 through December, according to E&MJ Metal and Mineral Markets. The quotation for calcium silicon (28–35 percent Ca, 60–65 percent Si, 6 percent max. Fe), lump carlots, f. o. b. Welland, Ontario, was quoted at 14½ cents per pound from January to October and at 15½ cents from November to the end of the year, by Canadian Chemical and Process Industries.

Foreign Trade.—During 1947 calcium-metal imports for consumption totaled 354 pounds, all from Canada. There were no imports of calcium-silicon during the year.

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[8] Dean, R. S., and Silkes, B., Boron in Iron and Steel: Bureau of Mines Inf. Circ. 7363, 1946, 56 pp.
Toerge, Walter F., Boron-Treated Steels: Steel, vol. 121, No. 23, Dec. 8, 1947, pp. 93–104.

Calcium metal and calcium-silicon imported for consumption in the United States, 1943–47 [1]

[U. S. Department of Commerce]

Commodity	1945		1946		1947	
	Pounds	Value	Pounds	Value	Pounds	Value
Calcium metal	17,086	$15,845			354	$675
Calcium-silicon	164	22	661,200	$87,647		

[1] No transactions reported during 1943 and 1944.

Canada.—According to preliminary reports, Dominion Magnesium, Ltd., Haley's Station, near Ottawa, Ontario, produced 700,370 pounds of calcium metal valued at $735,282 in 1947, conpared with 53,548 pounds valued at $68,720 in 1946.

CERIUM AND OTHER RARE-EARTH METALS

Cerium, commercially the most important rare-earth element, is produced chiefly from the mineral monazite. There has been virtually no domestic production of monazite since 1917. Between 1887 and 1917 the United States produced 5,456 short tons of monazite concentrates from sands and gravels in North Carolina, South Carolina, Florida, and Idaho. The principal sources since then have been India and Brazil.

Domestic Production.—The principal producers of cerium metal and cerium master alloy (misch metal) in the United States include the Cerium Metals Corp., Niagara Falls, N. Y.; Cooper Metallurgical Laboratory, Cleveland, Ohio; Kent Metal & Chemical Works, Edgewater, N. J.; and New Process Metals Corp., Newark, N. J.

Uses.—The principal commercial product containing cerium is sparking flints for cigarette lighters, miners lamps, and acetylene welding torches. For this purpose, cerium master alloy is treated with iron and other metals to make ferrocerium. The composition of misch metal is about 40–52 percent cerium; 22–30 percent lanthanum; 15–17 percent neodymium; 8–10 percent praseodymium, yttrium, samarium, and other rare-earth metals; and 0–5 percent iron. Cerium metal is used as a getter in electronic tubes, and in nonferrous light-metal (aluminum and magnesium) alloys. Cerium oxide is an excellent abrasive for buffing and polishing metal and glass surfaces.

Technology.—A book on the rare-earth elements and their compounds was published in 1947.[9] The rare mineral fluocerite has been obtained from a small deposit in the Mubende district of Uganda.[10] Papers on developments in separation of the rare-earth elements on the Manhattan Project [11] were presented. During 1947, the United Kingdom and Ireland consumed 9,158 long tons of sulfuric acid (100-

[9] Yost, Don M., Russel, Horace, Jr., and Garner, Clifford S., The Rare Earth Elements and Their Compounds: John Wiley & Sons, Inc., New York, 1947, 92 pp.
[10] Mining Magazine (London), vol. 76, No. 4, April 1947, p. 196.
[11] Johnson, Warren C., Quill, Lawrence L., and Daniels, Farrington, Rare Earths Separation Developed on Manhattan Project: Chem. and Eng. News, vol. 25, No. 35, Sept. 1, 1947, p. 2494.

percent basis) in refining rare earths [12] compared with 8,455 tons in 1946.

Prices.—The Metal Bulletin (London) quoted cerium metal at £7¼ per pound throughout 1947. Cerium alloy (52 percent) was quoted at 36–38 s. in early January, at 42 s. 6 d. from January 10 to mid-November, and 35 s. from November 25 to the end of the year. Lanthanum metal (98–99 percent) remained at 15 s. per gram throughout the year.

Foreign Trade.—Imports of cerium alloys for consumption in the United States totaled 665 pounds valued at $3,708 in 1947. Canada supplied 660 pounds, the United Kingdom 3 pounds, and Switzerland 2 pounds. Imports in 1946, all from Canada, totaled 15,660 pounds valued at $80,276. Exports of cerium metal and alloys during 1947 totaled 182,204 pounds valued at $1,053,936 compared with 39,718 pounds valued at $167,641 in 1946.

Monazite and rare-earth compounds are discussed in the Minor Nonmetals and the Uranium, Radium, and Thorium chapters of this volume.

COLUMBIUM AND TANTALUM

Columbium is a relatively new metal in commercial use. Beginning in about 1935 to the latter part of World War II, virtually all output was as ferrocolumbium and was used as an additive alloy in making stainless steels. With the advent of the jet engine and needs for materials that would withstand high temperatures and corrosive gases, increasing quantities of columbium have been used in newly developed complex alloys to meet these requirements. The present demand for columbium ores is strong; however, supply appears to be adequate for current requirements.

With the end of World War II tantalum requirements decreased, and in 1947 available supply considerably exceeded demand. The principal source of both these metals is a mineral series containing chiefly columbium, tantalum, iron, and manganese oxides. The mineral mixture is called columbite if the columbium content exceeds that of tantalum and conversely tantalite if the tantalum content is in excess. Industrial buyers of columbite concentrates generally specify a minimum content of 60 percent columbium pentoxide (Cb_2O_5) and a maximum ratio of 1 part tantalum pentoxide (Ta_2O_5) to 10 parts Cb_2O_5. Purchasers of tantalite concentrates generally specify a minimum content of 45 percent Ta_2O_5 and a combined oxide content ($Ta_2O_5+Cb_2O_5$) of 60 percent. Grades of ore not meeting these specifications have and are being purchased. However, as the current supply of tantalite exceeds the demand purchasers desire grades containing 60 percent or more Ta_2O_5.

Domestic Production.—During 1947 the Hayden Mining Co. shipped 3,259 pounds of microlite concentrates containing 65.9 percent Ta_2O_5, produced from the Harding mine in New Mexico and the Brown Derby group of claims in Gunnison County, Colo. No other shipments of tantalum concentrates were recorded. No domestic shipments of columbite concentrates have been reported since 1945.

[12] Oil, Paint & Drug Reporter, vol. 153, No. 11, Mar. 15, 1948, p. 42.

Columbium and tantalum concentrates shipped from mines in the United States, 1943–47

[Compiled by R. W. Metcalf]

Year	Columbium concentrates		Tantalum concentrates	
	Pounds	Value	Pounds	Value
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
1946			3,475	8,793
1947			3,259	8,677

Processors of columbium ores in the United States are the Electro Metallurgical Co., Niagara Falls, N. Y., which produces ferrocolumbium, and the Fansteel Metallurgical Corp., North Chicago, Ill., which produces columbium metals and compounds. Tantalum ores are refined only by the Fansteel Metallurgical Corp.

Uses.—The principal use of columbium is as an addition agent to stainless steel. Columbium added in quantities of 0.5–0.8 percent to stainless steels improves weldability, creep strength, impact strength, and corrosion resistance. There is an increasing demand for columbium in complex ferrous and nonferrous alloys having high strength, lightness, and resistance to corrosion when exposed to high temperatures or hot gases. Such alloys are used in jet engine parts and in engine exhaust systems. Columbium nitride is used in the receiver of the bolometer, a very sensitive heat-detecting device.

Tantalum metal is used chiefly in radar and other electronic tubes and tantalum fluoride as a catalyst in synthetic rubber manufacture. Other applications include use as oxides and carbides in high-speed cutting tools and as a metal in corrosion-resistant chemical equipment, skull plates, and surgical wire.

Stocks.—Data on stocks of columbium and tantalum held by industry and in the National Strategic Stock Pile are not available. The 2,179 pounds of columbite held by Office of Metals Reserve at the beginning of 1947 were disposed of during the year. OMR stocks of tantalite and tantalum-columbium slags also were disposed of during the year, chiefly by transfer to the National Strategic Stock Pile.

Prices.—Columbite per pound Cb_2O_5 contained, having a Cb:Ta ratio of 10:1, was about 55 cents per pound, the price decreasing as the ratio of Ta contained increased. The Metal Bulletin (London) quoted columbite, 50–55 percent combined oxides, c. i. f. at 50 s. to 55 s. per unit from January through May, when it increased to 65 s.

Tantalum ore, 60 percent Ta_2O_5, per pound Ta_2O_5 contained, depending on source, was quoted from January to late March at \$3–\$3.50, March 29 to mid-July at \$2–\$3, July 17 to early November at \$2–\$2.75, and November 6 to the close of the year at \$2.50. Tantalum ores, per unit combined oxides, were quoted by Metal Bulletin at £7 January through April and at £12–£15 from May to the end of the year.

Nominal domestic quotations, according to E&MJ Metal and Mineral Markets, for columbium metal per kilogram, were $560 for rod and \$500 for sheet from January to July 17 and thereafter \$280 for rod and \$250 for sheet. Ferrocolumbium 50–55 percent Cb, f. o. b. producers plant per pound Cb contained, was \$2.25–\$2.30 from January to December 11, then increased to \$2.50–\$2.60. Tantalum-metal base price per kilogram (discounts on volume business) was \$160.60 for C. P. rod and \$143 for sheet throughout the year. A kilogram is about 2.2 pounds.

Foreign Trade.—Imports of columbite are principally from Nigeria. Concentrates from this country range from 50–60 percent Cb_2O_5 contained. Imports from other countries usually are lower in grade. Tantalite is imported chiefly from Belgian Congo and Brazil. Concentrates from the Belgian Congo average from 30–45 percent Ta_2O_5, while concentrates from Brazil average over 45 percent. The accompanying table shows gross weights of imports of columbium and tantalum concentrates. Data giving the metal or oxide content are not available.

Columbium and tantalum ores (columbite and tantalite concentrates) imported for consumption in the United States, by countries, 1945–47, in pounds

[U. S. Department of Commerce]

Country	Columbium ore			Tantalum ore		
	1945	1946	1947	1945	1946	1947
Australia				21,125	500	9,468
Belgian Congo			2,734	485,986	263,097	[1] 314,725
Bolivia	1,034	[2] 6,834				
Brazil		7,717		68,229	98,072	71,634
Mozambique	22,046					
Nigeria	4,220,691	2,411,695	2,818,900	31,410		7,998
Southern Rhodesia				9,967		14,928
Uganda [3]	33,381			11,348		
Union of South Africa				2,027	1,884	
Total: Pounds	4,277,152	2,426,246	2,821,634	630,092	363,553	418,753
Value	\$1,312,346	\$742,804	\$857,550	\$453,141	\$302,397	\$386,934

[1] Includes 3,199 pounds classified by U. S. Department of Commerce as from Belgium, which is believed to have been the country of transshipment rather than country of origin.
[2] Classified by U. S. Department of Commerce as from Chile, which is believed to have been the country of transshipment rather than country of origin.
[3] Classified by U. S. Department of Commerce as British East Africa.

During 1947, exports of columbium ore and concentrates totaled 10,511 pounds valued at \$4,720, all to Sweden. Exports of columbium metal and alloys totaled 75 pounds valued at \$869, chiefly to France and the United Kingdom. There were no exports of tantalum ores and concentrates. Tantalum metal and alloys exports totaled 2,622 pounds (gross weight) valued at \$30,872.

World Review.—Virtually all of the world output of columbium concentrates (columbite) in 1947 was from Nigeria, where it is produced as a byproduct of alluvial and eluvial tin operations. Output of columbite concentrates in 1947 was reported at 1,286 long tons, making the total to date 11,032 tons. In 1946, output was 1,550 tons. Exports from Nigeria during 1947 totaled 1,287 tons, of which about 71 percent was shipped to the United States, 21 percent to the United Kingdom, and 8 percent to Norway. The average price realized per ton of concentrates during 1947 was £170 in the first quarter, £195 in the second quarter, and £211 in the third and fourth quarters.

Countries that have produced small quantities of columbium ore include the Belgian Congo, Brazil, India, Mozambique, Uganda, and Argentina.

The largest producer of tantalite in the world and the largest tin producer in the Belgian Congo is the Compagnie Geologique et Minière des Ingenieurs et Industries Belges (Geomines). Tantalite concentrates produced by the company in the early stages of mining averaged about 35 percent Ta_2O_5 and 30 percent Cb_2O_5; however, with depth the grade has changed to about 28 percent Ta_2O_5 and 30 to 35 percent Cb_2O_5. Production of tantalite and columbo-tantalite concentrates in the Belgian Congo totaled 381,465 pounds in 1947 compared with 286,650 pounds in 1946 and 1,170,855 pounds in 1945.

Brazil is the world's largest producer of high-grade tantalite, the concentrates containing 45 to 70 percent Ta_2O_5. The chief source is as a coproduct with beryl. Exports in 1947 were reported at 72,753 pounds compared with 97,003 in 1946.

Australia, the largest producer of high-grade tantalite (45-70 percent) before 1939, produced only 112 pounds in 1947 and 806 pounds in 1946. Other producers included Nigeria, 8,310 pounds of tantalite concentrates in 1947 compared with 2,890 in 1946; Southern Rhodesia, about 27,300 pounds compared with 16,900; Uganda, 7,741 pounds in 1946; and Union of South Africa, about 4,000 pounds in 1946.

GALLIUM

There was increased interest in gallium during 1947. Two companies produced the metal—the Eagle-Picher Lead Co., Joplin, Mo., and the Aluminum Ore Co., East St. Louis, Ill. Gallium was recovered as a byproduct of zinc and alumina production, respectively, by the two companies. The Anaconda Copper Mining Co., Great Falls, Mont., produced several thousand grams during the period 1943–45, but reported no output in 1946 or 1947. Total production for 1947 was several times greater than in 1946.

The Bureau of Mines began a survey of known and possible sources of gallium-rich raw materials and, late in the year, initiated a program of research devoted to the development of reliable analytical techniques and methods of metal recovery.

Gallium has the unusual property of being liquid through a very wide temperature range—from a melting point near room temperature to a boiling point in the neighborhood of 2,000° C. A significant amount of research was conducted during the year in attempting to take advantage of the metal's unusual characteristics in the design of military devices requiring operation at elevated temperatures. Gallium trichloride was suggested as a catalyst in the synthesis of certain organic compounds, notably ketones.[13] Virtually the only commercial use of gallium is in direct reading thermometers for use up to about 1,000° C. (1,832° F.).

Gallium continued to be priced at about $3 per gram. This price

[13] Oil, Paint and Drug Reporter, vol. 152, No. 8, Aug. 25, 1947, p. 7.

reflects the fact that laboratory-scale methods are still employed for recovering gallium.

A license is required for export of the metal.

GERMANIUM

The production level of germanium metal and compounds in the United States continued in 1947 at the 1946 rate of several hundred pounds a year. Eagle-Picher Lead Co., Joplin, Mo., was again the sole producer, recovering the germanium as a byproduct of zinc-smelting operations at Henryetta, Okla. Shipments were mainly in the oxide form.

Prices through 1947 remained at about $180 per pound for the metal and $50 for the oxide. The metal, 99.5 percent pure, was quoted by the Metal Bulletin (London) at 19 s. per gram throughout 1947.

Noteworthy chemical and physical characteristics of germanium are light weight, extreme hardness, resistance to corrosion, expansion on solidification, and high electrical resistance. The major use to date has been in electronic devices required for radar. Germanium-gold alloys show promise for precision casting and as solders for gold articles. The Eastman Kodak Co., Rochester, N. Y., has developed a new glass in which germanium dioxide is substituted for silica, the remaining constituents being titanium dioxide and sodium fluoride; the glass has a high index of refraction which suggests its use in wide-angle camera lenses and microscope objectives.

INDIUM

Indium production during the year was reported by two companies, the American Smelting & Refining Co. at its Perth Amboy, N. J., plant and the American Steel & Wire Co., at Donora, Pa. The latter company was a new producer. Shipments were reported by the two companies mentioned; by the Anaconda Copper Mining Co., Great Falls, Mont.; and by the National Zinc Co., Bartlesville, Okla. Total domestic shipments of indium contained in metal and compounds increased to 13,908 troy ounces compared with 9,667 in 1946 and 57,434 in 1945.

The principal use of indium has been in heavy-duty composite metal bearings. Indium is plated on a lead-coated steel bearing and subsequently diffused into the lead at 350° F. Indium also is used in solder and brazing alloys, alloying with gold and silver for jewelry and plated articles, as a nontarnish coating on silverware, in making low-melting alloys, and in indium-zinc coatings as a noncorrosive plating. A patent was granted on a method for recovering indium from metals or alloys such as lead or zinc.[14] Research was active toward developing significant new uses for the element and its alloys and compounds.

Throughout the year the metal, 99.9 percent pure, was quoted nominally at $2.25 per troy ounce by E&MJ Metal and Mineral Markets.

[14] U. S. Patent 2,433,770, Dec. 30, 1947.

Exports from Peru were about 8,700 troy ounces, approximately doubling that reported for 1946.

LITHIUM

Maywood Chemical Works, Maywood, N. J., and Metalloy Corp., Minneapolis, Minn., produce lithium metal alloys and lithium compounds in the United States. Several thousand pounds of the metal were produced in 1947.

Lithium metal is added as a scavenger in copper-base alloy melts. For this use and for safety and ease in handling, weighed quantities of lithium metal are sealed in copper tubing. Lithium metal also can be purchased sealed in aluminum tubes. Lithium atmospheres in heat-treating furnaces prevent scaling (oxidation) and permit control of both carburizing and decarburizing. Lithium peroxide and lithium borohydride can be used to generate oxygen and hydrogen, respectively. The large military demand for lithium hydride as a lightweight and convenient source of hydrogen ceased with the ending of World War II. Lithium-aluminum hydride reduces organic compounds rapidly at room temperature in ether solutions. Lithium compounds such as lithium aluminate, lithium borate, lithium cobaltite, lithium manganite, lithium molybdate, lithium silicate, lithium titanate, lithium zirconate, and lithium zirconium silicate are finding use in the ceramics industry. Various uses of lithium compounds [15] were listed.

A paper discussing the preparation of lithium metal was presented at the annual meeting of the American Institute of Mining and Metallurgical Engineers in New York, March 1947.[16]

The price of lithium metal per pound, 98–99 percent, 5-ton lots, was \$10 from January to September and \$10–\$15 during the remainder of the year, according to E&MJ Metal and Mineral Markets.

Ores and compounds of lithium are discussed in the Minor Nonmetals chapter of this volume.

SELENIUM AND TELLURIUM

Domestic Production.—Selenium and tellurium are produced as byproduct metals in the United States by the American Smelting & Refining Co., Baltimore, Md.; International Smelting & Refining Co., Perth Amboy, N. J.; United States Metals Refining Co., Chrome, N. J.; and United States Smelting, Refining & Mining Co., East Chicago, Ind. Residues from the electrolytic refining of copper are the chief source of both selenium and tellurium. Some tellurium is recovered as a byproduct of lead refining. These residues are refined or stocked in accordance with demand. During 1947, steady plant operation resulted in a 76-percent increase in selenium output over 1946. Shipments increased 22 percent over 1946. The demand for tellurium increased during 1947.

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[15] Chemical Industries, New Chemicals for Industry: Vol. 61, No. 3, September 1947, p. 452.

[16] Kroll, W. J. and Schlechten, A. W., Laboratory Preparation of Lithium Metal by Vacuum Metallurgy: Am. Inst. Min. and Met. Eng., Metals Technol., Tech. Pub. 2179, June 1947, 9 pp.

Salient statistics of elemental selenium and tellurium in the United States, 1943–47, in pounds

Year	Selenium					Tellurium [1]		
	Production	Producers' shipments [2]	Producers' stocks at end of year	Imports [3]		Production	Producers' shipments [2]	Producers' stocks at end of year
				Pounds	Value			
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	458,486	604,445	371,258	[4] 216,793	395,934	80,750	60,328	183,527
1946	291,103	405,226	257,135	475,081	806,205	3,765	38,523	148,769
1947	512,648	494,982	280,368	529,175	893,171	45,248	71,300	122,717

[1] Includes tellurium content of small quantity of oxide.
[2] Bureau of Mines not at liberty to publish value.
[3] Includes selenium salts.
[4] Revised figure.

Uses.—Selenium is used in manufacturing rectifiers and light-sensitive cells, decolorizing glass, the manufacture of red glass, as a red pigment in enamels, in vulcanizing rubber, in insecticides, as an additive in the manufacture of certain lubricating oils, and for flame-proofing wire and cable insulation. Both selenium and tellurium are employed in improving the machinability of copper and copper alloys and to a small extent as modifying agents in stainless steels. Tellurium is used in toning silver prints, as a carbon stabilizer in steel, as an additive to lead and rubber, and to a limited extent in electric rectifiers.

Prices.—Selenium (black, powdered, 99.5 percent) was quoted at $1.75 a pound from January to the latter part of June then at $2 the remainder of the year, according to E&MJ Metal and Mineral Markets. Tellurium was quoted at $1.75 per pound throughout 1947. London prices for selenium per pound, according to the Metal Bulletin (London), were 8s. 6d. from January to July 15, then 8s. 11d. until July 25, and 10s. from July 25 to the end of the year. The London price for tellurium per pound was 7s. from January to December 9, then 8s. 9d.

Foreign Trade.—Imports of selenium and selenium salts for consumption during 1947 totaled 529,175 pounds valued at $893,171; 526,970 pounds were from Canada and 2,205 pounds from Belgium. Imports in 1946 totaled 475,081 pounds. Data on imports of tellurium and exports of selenium and tellurium are not available.

Canada.—In 1947 Canada produced 375,000 pounds of selenium valued at $704,250 compared with 521,867 pounds valued at $949,798 in 1946. Production of tellurium in Canada was 38,000 pounds valued at $66,500 in 1947 compared with 15,848 pounds valued at $24,405 in the previous year.

THALLIUM

United States production of thallium metal for 1947 about tripled that of the preceding year. The American Smelting & Refining Co. was again the only domestic producer, at its Globe smelter in Denver, Colo.

For many years the chief use of thallium has been as a rodent poison, generally being added to grain. The toxic effects of thallium on human beings and animals was reviewed.[17]

Increased interest in thallium has been evidenced in recent years because of the unusual physical properties of certain of its compounds; the bromoiodide will transmit wave lengths in the infrared region and was employed during World War II for sniper detection and signaling devices.

E&MJ Metal and Mineral Markets for 1947 quoted thallium metal on January 16 at a nominal price of $17.50 per pound; on January 30 the price changed to $20, where it remained until November 27, when a lower price of $15 was quoted and remained in effect for the balance of the year.

ZIRCONIUM

Domestic Production.—Domestic mine production of zircon in the United States in 1947 was about 50 percent greater than in 1946. However, the only producer was the Rutile Mining Co. of Florida, subsidiary of Titanium Alloy Manufacturing Co. Zircon is recovered by this company with ilmenite and rutile from dune sands near South Jacksonville, Fla. The Riz Mineral Co., which mined black sands near Vero Beach, Indian River County, Fla., in 1946, did not operate in 1947, but the company did ship zircon concentrates from stocks previously accumulated.

Mixed zircon-rutile-ilmenite concentrates imported from Australia were beneficiated by W. F. Berk & Co., Wood-Ridge, N. J.; Foote Mineral Co., Philadelphia, Pa.; International Titanium Corp., Carteret, N. J.; Orefraction, Inc., Pittsburgh, Pa.; and Titanium Alloy Manufacturing Co., Niagara Falls, N. Y. Zirconium ferrosilicon was produced by Electro Metallurgical Co. at Sheffield, Ala., Niagara Falls, N. Y., and Alloy, W. Va. Zirconium-copper was produced by the Beryllium Corp., Reading, Pa., and Metal Hydrides, Inc., Beverly, Mass. Zirconium metal was prepared by Foote Mineral Co., Metal Hydrides, Inc., and Titanium Alloy Manufacturing Co.

Consumption and Uses.—Shipments of foreign and domestic zircon to consumers continued to increase, reaching a new peak in 1947. Shipments were 29,213 short tons compared with 20,555 tons in 1946 and 15,988 tons in 1945. Use distribution in 1947, in percentages, according to estimates by principal shippers, was as follows: Vitreous enamels, 29; refractories, 24; electrical and chemical porcelains, 19; metal and alloys, 15; pottery glazes, 10; and miscellaneous, 3. Miscellaneous uses include in glass manufacture, as an abrasive, and in oxyhydrogen lights and incandescent (Nernst) lamps.

Stocks.—Producers' and distributors' inventories of zircon (including zircon content of zirconium-titanium concentrates) increased from 5,059 short tons at the end of 1946 to 9,592 tons at the end of 1947. Government stocks held by the Office of Metals Reserve were disposed of during the year. Data on stocks of the National Strategic Stock Pile are not available.

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[17] Heyroth, Francis F., Thallium: U. S. Public Health Service Reports, Review and Summary of Medical Literature, Suppl. 197, 1947, 23 pp.

Prices.—Zirconium ore per ton, 55 percent ZrO_2, f. o. b. Atlantic seaboard, was quoted nominally at $42–$45 early in January, $55–$60 from January 9, $60–$70 from January 30, $40–$45 from February 20, $40–$50 from March 15, and $45–$47 from September 18 to the end of the year, according to E&MJ Metal and Mineral Markets. Zirconium metal powder was quoted for the entire year at $7–$8 per pound, according to quantity purchased. Zirconium ferrosilicon, 12–15 percent Zr content, was quoted at $102.50–$107.50 per gross ton until mid-June, $0.055 per pound from June 26 to early December, and then $0.06 from December 11 to the end of the year. Zirconium ferrosilicon, 35–40 percent Zr, was quoted at $0.14–$0.16 per pound until mid-June, $0.1775 from June 26 to mid-September, $0.17 from September 25 to early December, and $0.184 from December 11 to the end of the year.

Foreign Trade.—Zircon imports were received from India for the first time since 1942. The chief source of zircon continued to be Australia. Imports from Australia are principally in the form of mixed zirconium-titanium concentrates. All baddeleyite entries were from Brazil. A total of 11,000 pounds of ferrozirconium and zirconium-ferrosilicon valued at $11,553 was reportedly imported from China. Exports comprised 330 short tons ($25,583) of zirconium concentrates and 9,592 pounds ($5,718) of metal and alloys in 1947, compared with 259 tons ($17,285) of concentrates and 2,377 pounds ($6,122) of metal and alloys in 1946.

Zirconium ore and concentrates imported for consumption in the United States, by countries, 1943–47, in short tons

Year	Zircon from—					Baddeleyite from Brazil [2]	Total zirconium concentrates	
	Australia [1]	Brazil	Canada	India	Senegal		Short tons	Value
1943	19,481	110				8,821	28,412	$697,704
1944	21,701	(2)				2,332	24,033	576,299
1945	25,672	(2)			6	792	26,470	554,400
1946	14,379	(2)	4			2,431	16,814	453,458
1947	21,894	(2)	2	4,181		4,619	30,696	891,161

[1] Imports of zircon, rutile, and ilmenite from Australia are generally in the form of mixed concentrates. These concentrates are classified by the U. S. Department of Commerce as zirconium ores and concentrates, rutile ores and concentrates, or ilmenite ores and concentrates. Total zircon content of the so-called zircon ore and concentrates and rutile and ilmenite ores and concentrates (see Titanium chapter) are estimated as follows: 1943, 11,472 tons; 1944, 11,317 tons; 1945, 17,138 tons; 1946, 11,535 tons, and 1947, 22,727 tons.
[2] Any zircon imports from Brazil in 1944–47 included with baddeleyite.

Technology.—The Bureau of Mines continued research and development on the preparation of zirconium metal. Patents were issued on the production of zirconium hydride,[18] zirconium silicate polishing material and process of preparing same,[19] and zirconyl and hafnyl compounds and their production.[20]

[18] U. S. Patent 2,427,339, Sept. 16, 1947.
[19] U. S. Patent 2,427,799, Sept. 23, 1947.
[20] U. S. Patent 2,424,262, July 22, 1947.

World Review.—Most of the world's supply of zircon has been produced in Australia as a coproduct of rutile and ilmenite. Zircon content of concentrates produced is estimated by the Australian Bureau of Mineral Resources 1943 through 1947, in long tons, respectively, as follows: 1943, 10,334; 1944, 14,000; 1945, 15,180; 1946, 12,403; and 1947, 21,576. Brazil also is a major supplier of zirconium ores. It is the only commercial source of baddeleyite. Some zircon also has been produced in Brazil, and reserves of both baddeleyite and zircon are reported to be large. Exports of zirconium concentrates from Brazil in 1947 were 3,977 metric tons compared with 4,453 tons in 1946. India produces zircon, chiefly obtained from the Travancore beach sands. Other countries producing zircon include Malaya, French Indochina, Egypt, Italy, Korea, and Senegal (French West Africa).

Minor Nonmetals

By G. RICHARDS GWINN[1]

GRAPHITE

PRODUCTION of crystalline and amorphous graphite in 1947 reached 4,387 short tons, and shipments totaled 5,207 tons valued at $221,260. There are too few domestic producers to permit showing separate statistics on amorphous and crystalline graphite. The accompanying table shows combined figures for the 1943–47 period. Producers' stocks totaled 599 short tons at the end of 1947. The production of manufactured graphite continued to expand, but figures are not available for publication.

Production and shipments of natural graphite in the United States, 1943–47

Year	Production (short tons)	Shipments		Year	Production (short tons)	Shipments	
		Short tons	Value			Short tons	Value
1943	9,939	9,597	$903,102	1946	5,575	4,844	$252,596
1944	5,408	5,768	349,663	1947	4,387	5,207	221,260
1945	4,888	5,334	289,207				

A description of the graphite deposits in the Raleigh, N. C., area has recently been published.[2]

As shown in the accompanying table, imports of all kinds of graphite reached 43,659 short tons valued at $1,511,275 in 1947, an increase of 32 percent in quantity and 14 percent in value from 1946. All classes except crystalline flake show increases. Quantitywise, natural amorphous shows the greatest change, increasing from 29,743 tons valued at $1,065,835 to 40,703 tons valued at $1,236,734. Imports from Mexico accounted for the major part of this increase.

[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] Harrington, J. W., The Origin and Importance of the Raleigh Graphite: Jour. Geol., vol. 55, No. 6, 1947, pp. 516–521.

Graphite (natural and artificial) imported for consumption in the United States, 1943–47

Year	Crystalline: Flake, Short tons	Crystalline: Flake, Value	Crystalline: Lump, chip, or dust, Short tons	Crystalline: Lump, chip, or dust, Value	Amorphous: Natural, Short tons	Amorphous: Natural, Value	Amorphous: Artificial, Short tons	Amorphous: Artificial, Value	Total, Short tons	Total, Value
1943	5,311	$493,382	1,012	$117,795	22,390	$331,800	205	$15,515	28,918	$958,492
1944	6,191	663,231	1,568	251,832	18,294	345,612	131	10,299	26,184	1,270,974
1945	2,883	286,532	5,207	558,242	28,042	569,600	154	6,223	36,286	1,420,597
1946:										
Brazil					1	75			1	75
Canada	113	24,524			1,413	117,276	4	558	1,530	142,358
Ceylon			56	7,990	3,674	482,899			3,730	490,889
Cuba					1	50			1	50
France	24	5,133							24	5,133
India					168	18,086			168	18,086
Madagascar	3,200	223,506							3,200	223,506
Mexico					24,389	441,189			24,389	441,189
Mozambique					96	5,980			96	5,980
Switzerland					1	280			1	280
	3,337	253,163	56	7,990	29,743	1,065,835	4	558	33,140	1,327,546
1947:										
Canada	253	41,013			1,708	130,246			1,961	171,259
Ceylon			198	16,313	3,707	432,763	28	2,660	3,933	451,736
China	56	4,068							56	4,068
Cuba					4	582			4	582
France	33	9,090							33	9,090
India					168	67,060			168	67,060
Italy					107	3,300			107	3,300
Madagascar	2,388	201,385	(1)	12					2,388	201,397
Mexico					34,857	591,473			34,857	591,473
Mozambique					135	7,730			135	7,730
Switzerland					11	3,328			11	3,328
Tangier					6	252			6	252
	2,730	255,556	198	16,325	40,703	1,236,734	28	2,660	43,659	1,511,275

[1] Less than 1 ton.

Consumption of natural graphite in the United States in 1947, by types

Country of origin	Flake, Short tons	Flake, Value	Fines, Short tons	Fines, Value	Lump and chip, Short tons	Lump and chip, Value
United States	126	$22,901	322	$41,560		
Canada			(1)	(1)		
Ceylon	145	45,301	539	200,631	1,393	$285,904
Madagascar	3,709	755,095	363	69,018		
Mexico			221	31,705		
Other [2]			243	20,776		
	3,980	823,297	1,688	363,690	1,393	285,904

Country of origin	Dust, Short tons	Dust, Value	Amorphous, Short tons	Amorphous, Value	Total, Short tons	Total, Value
United States	629	$81,857	673	$26,110	1,750	$172,428
Canada	476	43,263	672	79,865	1,148	123,128
Ceylon	643	101,143	508	155,814	3,228	788,793
Madagascar			(1)	(1)	4,072	824,113
Mexico	(1)	(1)	6,085	246,291	6,306	277,996
Other [2]	375	30,940	231	5,512	849	57,228
	2,123	257,203	8,169	513,592	17,353	2,243,686

[1] Included with "Other."
[2] Includes French Indochina, India, Italy, and Korea. In these instances specific types may not be revealed by specific countries.

The consumption of natural graphite by types and uses in 1947 is shown in the accompanying tables. Amorphous and flake graphite, respectively, supply the largest percentage of total consumption and value. Foundry facings make up the largest single use, followed by batteries, crucibles, and lubricants in that order.

Consumption of natural graphite in the United States in 1947, by uses

Use	Short tons	Value	Use	Short tons	Value
Crucibles	2,518	$512,578	Packings	136	$43,471
Retorts	497	103,771	Bearings	84	34,217
Stoppers, sleeves, and nozzles	973	173,640	Carbon brushes	192	82,435
Foundry facings	5,657	407,471	Other [1]	848	121,151
Batteries	2,644	99,359			
Lubricants	2,451	356,276		17,353	2,243,686
Pencils	1,353	309,317			

[1] Includes brake lining, electrodes, etc.

The procurement of graphite from Madagascar was again difficult in 1947. A rebellion that broke out in the section of the island that includes the graphite mines closed most of the operations. Some damage was done to the mills, and because of the fighting the companies were not able to maintain a working force. The imports received during 1947 represent almost entirely stocks on hand at the end of the previous year. The fluctuation in prices that began in 1946 continued through 1947, and in December the companies again requested higher export prices to cover the increased cost of materials and the expense of replacing plant equipment destroyed during the rebellion. The request was granted January 10, 1948. The new minimum export price f. o. b. Madagascar and the former price are shown in the accompanying table.

Minimum export price of graphite, f. o. b. Madagascar, 1947–48, per metric ton

Carbon, percent	Flake 1947	Flake 1948	Carbon, percent	Powder (fines) 1947	Powder (fines) 1948
85.0–87.5	$110	$132	75.0–77.5	$60	$66
87.6–89.5	114	137	77.6–82.5	70	77
89.6–92.5	120	144	82.6–87.5	85	100
92.6–94.9	135	165	87.6–89.9	105	125
95.0 and over	(1)	(1)	90.0 and over	(1)	(1)

[1] No fixed price.

A reduction in United States tariff rates on graphite was made in 1947, to become effective January 1, 1948. The new rates are: Amorphous natural and artificial, 5 percent ad valorem each; crystalline flake, 15 percent ad valorem with a specific minimum of 0.4125 cent per pound and a specific maximum of 0.825 cent per pound; crucible flake and dust and other crystalline lump and chip, 7½ percent ad valorem each.

Exports of natural graphite, 1943–47, were: 1943, 3,010 short tons valued at $317,586; 1944, 2,230 tons, $248,257; 1945, 1,308 tons, $134,414; 1946, 2,313 tons, $267,137; 1947, 1,546 tons, $171,607.

Trade-journal quotations of prices for graphite f. o. b. New York in 1947 were: Ceylon lump, 10–12 cents per pound; carbon lump, 9–10 cents; chip, 7–8 cents; dust, 4–5 cents; Madagascar No. 1 flake, 9–15 cents. Crude amorphous graphite was $16 to $32 per ton, according to grade. All prices were nominal.

The available statistics on the world production of graphite for the 1942–47 period are shown in the accompanying table. Comparable figures for the 1915–39 period were published in Minerals Yearbook, Review of 1940 (p. 1414), and for the 1937–45 period in Minerals Yearbook, 1945 (p. 1567).

World production of natural graphite, 1942–47, by countries, in metric tons [1]

[Compiled by P. Roberts]

Country [1]	1942	1943	1944	1945	1946	1947
Argentina	244	237	455	333	(2)	(2)
Australia:						
New South Wales	3	114	142	51	(2)	(2)
Queensland	225	360	52	58	234	187
South Australia	71	88	253	5	2	21
Tasmania	----------	7	----------	----------	(2)	(2)
Western Australia	6	11	----------	----------	----------	----------
Austria	[3] 26,203	[3] 31,305	22,487	3,483	246	4,291
Brazil (exports)	72	19	199	131	92	[4] 84
Canada	[5] 463	1,726	1,435	1,733	1,792	2,132
Ceylon (exports)	28,180	20,397	12,461	7,946	4,623	[4] 5,644
China	16,800	(2)	(2)	(2)	(2)	(2)
Czechoslovakia	13,126	21,252	21,459	10,973	5,108	(2)
Egypt	----------	----------	260	152	----------	(2)
Germany: Bavaria	33,316	34,960	36,357	(2)	3,750	(2)
India	1,072	1,152	943	1,312	4,561	(2)
Indochina, French	14	25	30	----------	----------	(2)
Italy	5,483	(2)	(2)	1,793	2,593	4,287
Japan	2,866	7,791	10,382	12,449	11,339	9,595
Kenya	----------	(6)	10	3	(2)	(2)
Korea	96,054	96,471	103,306	32,407	[5 7] 5,687	[5 7] 12,797
Madagascar	9,562	12,949	14,478	9,185	6,315	[8] 524
Malayan Union	[9] 163	[9] 163	[9] 163	(2)	(2)	(2)
Mexico	20,811	20,677	12,977	23,634	21,949	27,984
Morocco:						
French	1,067	265	213	262	637	440
Spanish	251	79	42	100	[9] 120	[9] 150
Norway	2,933	3,178	3,784	(2)	(2)	(2)
Portuguese East Africa	165	428	(2)	----------	(2)	(2)
Southern Rhodesia	----------	----------	5	6	----------	(2)
South-West Africa	181	1,758	1,973	1,318	1,193	1,639
Spain	----------	57	91	128	320	309
Sweden	174	171	----------	802	----------	(2)
Union of South Africa	661	442	324	196	278	164
United States:						
Amorphous / Crystalline	6,459	9,016	4,906	4,434	5,058	4,033
Total (estimate) [1]	267,000	286,000	270,000	157,000	86,000	(2)

[1] In addition to countries listed, graphite has been produced in Bulgaria, Greenland, Nyasaland, and U.S.S.R., but production data are not available. No estimates for these countries are included in totals.
[2] Data not available; estimates by author of chapter included in totals (except for 1947).
[3] Includes scrap.
[4] January to September, inclusive.
[5] Exports.
[6] Less than 1 ton.
[7] South Korea only.
[8] January to June, inclusive.
[9] Estimate.

GREENSAND

Production of greensand in New Jersey by the Zeolite Chemical Co., Medford, N. J.; Inversand Co., 226 Atlantic Avenue, Clayton, N. J.; and the Permutit Co., 330 West Forty-second Street, New York 18, N. Y., with operations near Birmingham, N. J., reached 8,745 short tons. Shipments totaled 8,337 short tons valued at $432,980. All materials shipped in 1947 were utilized in the manufacture of water-softening compounds and water-purification agents.

Prices f. o. b. works in 1947 for refined greensand ranged from approximately $53 to $114 per short ton, depending upon the degree of refinement attained and whether it was to be used as a water softening or purification compound.

Statistics for greensand sold or used are shown inthe accompanying table.

Greensand marl sold or used by producers in the United States, 1943–47

Year	Short tons	Value	Year	Short tons	Value
1943	10,056	$522,124	1946	5,140	$424,900
1944	4,908	505,651	1947	8,337	432,980
1945	4,986	477,919			

KYANITE, ANDALUSITE, AND SILLIMANITE

Domestic production of kyanite in 1947 approached very closely the all-time high reached in 1946. Imports from India in 1947 declined sharply from the previous year's total. The decrease was due to transportation and political factors rather than to depletion of the deposits. A sharp increase in the quantity of kyanite received from Kenya Colony, British East Africa, over the previous year's figure brought total imports for 1947 well above the 1946 figure. The tonnage, value, and consumption of imported kyanite in recent years are shown in the accompanying table.

The receipt of 1,163 tons of sillimanite valued at $14,588 from Australia was also reported. The material received from the United Kingdom and British Guiana is calcined kyanite, which originated in India.

Statistics on the domestic kyanite industry are not available for publication, because there are too few producers. Shipments of domestic kyanite were last published in 1943, and statistics for the 1940–43 period were published in Minerals Yearbook, 1943 (p. 1579).

Consumption and stocks of imported kyanite in the United States, 1943–47

	Imports		Consumption (short tons)	Stocks Dec. 31 (short tons)
	Short tons	Value		
1943: India	9,972	$105,042	[1] [2] 8,416	[1] 11,000
1944:				
British East Africa	55	591	(3)	(3)
India	5,680	66,850	(3)	(3)
	5,735	67,441	[1] 8,064	[1] 8,600
1945:				
British East Africa	560	7,000	(3)	(3)
India	13,994	160,997	(3)	(3)
	14,554	167,997	[4] 15,000	[4] 8,000
1946:				
British East Africa	395	3,308	(3)	(5)
India	10,110	109,990	(3)	(5)
Union of South Africa	277	3,187	(3)	(5)
	10,782	116,485	[4] 11,500	7,280
1947:				
British East Africa	7,226	82,921	(5)	(5)
British Guiana	(6)	65	(5)	(5)
India	3,793	53,057	(5)	(5)
United Kingdom	(6)	43	(5)	(5)
	11,019	136,086	13,807	1,436

[1] Consumption and stocks as reported by War Production Board.
[2] Includes 316 tons reexported to Canada.
[3] Data not available.
[4] Partly estimated.
[5] Bureau of Mines not at liberty to publish figures.
[6] Less than 1 ton.

Production of kyanite in 1947 was reported by the Kyanite Mining Corp. near Farmville, Va., the only company selling on the open market, and the A. P. Green Firebrick Co., of Mexico, Mo., from a deposit near Clarksville, Ga. The Vitrefrax Corp., 5050 Pacific Street, Los Angeles, Calif., whose mine is near Ogilby, Calif., is reportedly liquidating. A new company, Commercialores, Inc., 39 Cortlandt Street, New York, N. Y., was formed in March 1947 to recover kyanite from the Henry Knob deposit near Clover, S. C. It expects to get into production in April or May 1948.

Champion Sillimanite Co., Inc., Toledo, Ohio, sold its andalusite mine in Mono County, Calif., and its dumortierite mine in Pershing County, Nev., to R. A. Stranahan, Jr., and associates in September 1947. The mines were not operated, however, at any time during the year. The Technical Porcelain & Chinaware Co., El Cerrito, Calif., purchased and operated the Pyramid andalusite mine near Thorne, Nev. Andalusite was shipped to its California plant for use in the manufacture of chinaware.

The extent and possibilities of working commercial deposits of sillimanite schists in the Southeastern States have been investigated. Pilot-plant work on the manufacture of a refractory brick that will meet Navy and Federal thermal shock tests is encouraging and is being pushed to completion.

Prices for domestic kyanite in 1947 ranged from $19.50 per short ton for crude kyanite to $37.50 for calcined material, 35-mesh, in carlots. The cost of Indian kyanite laid down at Atlantic seaports in 1947 was about $40 per ton.

Separate classification of exports of kyanite and associated minerals started in 1945. Exports for 1945 were 307 short tons valued at $20,205; 1946, 342 tons ($17,881); and 1947, 239 tons ($20,533). The markets were Canada, Mexico, Argentina, Netherlands, and Brazil. The bulk of the material exported in each year, however, was purchased by Canada.

LITHIUM MINERALS

Sales of lithium minerals in 1947 reached 2,441 short tons valued at $151,113, a decline of 20 percent in quantity and 50 percent in value from the previous year's totals.

Tonnagewise, the Lithium Corp. of America, Inc., Minneapolis, Minn. (operation in South Dakota), was the largest producer of lithium ores, but because of the higher Li_2O content of the dilithium sodium phosphate recovered at the American Potash & Chemical Corp. plant at Searles Lake, Calif., the latter company is still the largest producer of lithium raw materials.

The Hayden Mining Co., Colorado Springs, Colo., the only domestic producer of lepidolite, announced the permanent closing of its Pidlite mines, San Miguel County, N. Mex.; the Harding mine, Taos County, N. Mex.; and the Brown Derby mine, Gunnison County, Colo., effective December 31, 1947.

The tonnage and value of lithium ores and compounds shipped in recent years and the approximate Li_2O content are shown in the accompanying table.

Shipments of lithium ores and compounds from mines in the United States, 1935–39 (average) and 1943–47

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	1945	2,446	$285,520	274
1943	8,155	314,660	463	1946	3,065	303,892	323
1944	13,319	552,977	848	1947	2,441	151,113	199

Approximately 1,080 short tons of lepidolite were imported into the United States from South-West Africa in 1947. Mines Development, Ltd., subsidiary of the Lithium Corp. of America, has started development work on spodumene deposits in the Cat Lake district, about 100 miles northeast of Winnipeg, Canada.

Experimental results have demonstrated that it is technically feasible to prepare lithium metal by reacting a mixture of spodumene, lime, and ferrosilicon or aluminum in a vacuum furnace. It is believed that the costs of producing lithium by this method and redistilling it to present required commercial purity may be below those of the electrolytic process.[3]

[3] Stauffer, R. A., Vacuum Process for Preparation of Lithium Metal from Spodumene: Am. Inst. Min. and Met. Eng., Metals Technol., vol. 14, No. 6, September 1947, Tech. Pub. 2268, 10 pp.

Trade-journal prices of lithium ores were as follows: Spodumene, \$6 to \$8 per 20 pounds of contained Li_2O on 6 percent grade carlots; amblygonite, air-floated, \$110 per short ton in carlots; and lepidolite, 4 percent Li_2O lump, \$56 per ton. The price of dilithium sodium phosphate was reported at about \$191 per ton.

MINERAL-EARTH PIGMENTS

[By G. W. Josephson]

During 1947 the demand for mineral-earth pigments remained at a high level and total domestic output was approximately the same as in 1946.

Imports of pigments from foreign countries have increased only moderately since the end of hostilities. Receipts of most types increased considerably in 1946, but in 1947 the trend was down. As shown in the accompanying table, total imports of the pigments listed declined 25 percent. Receipt of about 1,500 tons of crude Persian Gulf red iron oxide was reported during the year. Postwar dislocations in the producing countries, high costs of production, high ocean freight rates, and satisfactory substitution of domestic pigments have discouraged imports.

Exports of iron oxide pigments increased 25 percent in 1947. Nearly half of the total was shipped to Canada, and the remainder went as small shipments to a large number of countries throughout the world. Details are shown in the accompanying table.

A discussion of systems of classifying color has recently been published.[4]

Natural mineral pigments and manufactured iron-oxide pigments sold by processors in the United States, 1946–47, by kinds

Pigment	1946		1947	
	Short tons	Value	Short tons	Value
Mineral blacks	6,369	\$118,171	(1)	(1)
Precipitated magnetic blacks	(1)	(1)	(1)	(1)
Natural brown oxides (metallic browns)	5,823	276,379	5,861	\$308,440
Vandyke brown (finished pigment)	(1)	(1)	(1)	(1)
Pure browns (96 percent or better iron oxides)	1,018	206,806	1,016	219,686
Natural red oxides	22,436	972,405	20,524	946,997
Pure red oxides (98 percent or better Fe_2O_3)	17,050	3,117,706	17,331	3,481,083
Venetian reds	9,727	721,354	7,127	579,603
Pyrite cinder	964	52,471	1,682	110,863
Other red iron oxides	17,345	1,683,166	18,817	2,214,358
Natural yellow oxides (high Fe_2O_3)	(1)	(1)	(1)	(1)
Pure yellows (85 percent or better Fe_2O_3)	(2) 9,527	(2) 1,293,379	10,496	1,635,365
Ochers (low Fe_2O_3)	(2) 10,774	(2) 250,168	9,130	213,133
Siennas:				
Burnt	1,197	168,978	940	141,943
Not burnt	2,401	303,483	1,441	201,493
Umbers:				
Burnt	3,727	325,856	3,051	322,688
Not burnt	916	68,615	671	61,443
Other	(2) 5,823	(2) 445,213	17,280	730,066
	115,097	10,004,150	115,367	11,167,161

(1) Included with "other."
(2) Revised figure.

[4] Nicherson, D., Color and Its Description: Am. Ceram. Soc. Bull., vol. 27, No. 2, Feb. 15, 1948, pp. 47–63.

Selected mineral pigments imported for consumption in the United States, 1944–47

[U. S. Department of Commerce]

Pigment	1944		1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Iron oxide pigments:								
Natural	1,494	$61,231	2,853	$126,152	5,423	$318,239	3,755	$250,137
Synthetic	686	86,188	439	58,380	759	106,302	595	94,937
Ocher, crude and refined	4	221	784	36,608	167	6,528	258	14,362
Siennas, crude and refined					755	73,129	725	65,787
Umber, crude and refined	1,172	31,599	1,989	57,281	3,134	95,815	2,206	59,524
Vandyke brown					101	10,432	253	23,955
	3,356	179,239	6,065	278,421	10,339	610,445	7,792	508,702

Dry ocher, sienna, umber, and other forms of iron oxide for paint exported from the United States, 1944–47, by countries

[U. S. Department of Commerce]

Country	1944		1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Argentina	19	$5,837	1	$721	55	$11,340	98	$21,522
Belgian Congo	40	4,106	50	6,450	22	2,402		
Belgium and Luxembourg					201	30,886	759	148,725
Bolivia	10	1,414	(1)	88	15	2,618	6	1,358
Brazil	249	54,287	139	18,054	304	58,265	396	94,122
Canada	3,333	194,489	3,484	285,177	3,279	327,323	3,234	337,037
Chile	90	19,656	30	10,962	28	4,980	95	22,563
China					147	25,219	158	34,873
Colombia	137	30,777	93	21,728	181	40,654	216	63,449
Cuba	238	32,198	386	55,859	410	48,649	307	53,716
Curacao (N. W. I.)	10	937	5	893	6	1,398	11	2,683
France							157	27,569
Mexico	220	44,004	165	33,870	136	31,660	183	44,238
Netherlands					198	13,353	487	44,953
Panama, Republic of	120	8,937	71	7,584	45	6,420	13	3,598
Peru	61	8,621	23	5,653	41	7,957	29	8,732
Portugal	160	6,488	195	8,648	125	7,660	77	18,330
Sweden			131	9,006	103	18,468	145	26,577
Union of South Africa			11	2,841	52	25,742	50	10,244
United Kingdom			1	369	75	7,815	276	10,907
Venezuela	112	17,407	130	31,799	187	35,704	153	30,038
Other countries	360	55,692	301	52,184	477	85,604	763	182,079
	5,159	484,850	5,216	551,886	6,087	794,117	7,613	1,187,313

[1] Less than 1 ton.

In general, prices advanced during the year, and according to the Oil, Paint and Drug Reporter, were quoted (in cents per pound, barrels, works) as follows in December 1947: Pure magnetic iron oxide black, 9¾; metallic brown, 2¾ to 3; synthetic (pure) browns, 12 to 12½; burnt siennas, American type, 6¾ to 10¾; Italian-type burnt siennas, 10¾ to 14; American-type raw siennas, 5¾ to 10¾; Italian-type raw siennas, 11¾ to 12¾; Turkey-type umbers, 5¼; Vandyke brown, regular, 10 to 11; sap brown (special Vandyke brown), crystals, 12; synthetic (pure) red iron oxides, 10½ to 10¾; Venetian reds, 3.1 to 4.4, depending on iron oxide content; natural (metallic) red oxide, 2½ to 2¾; Persian Gulf oxide, 6¾; natural yellow oxides, high iron, 1¼ to 2¾; synthetic (pure) iron oxide yellows, 8¼.

MINERAL WOOL

The latest available marketing statistics on the mineral-wool industry are those for 1944 published in Minerals Yearbook, 1944 (p. 1541). Although no statistics have been compiled since 1944, it is estimated, on the basis of information received from the industry and the National Mineral Wool Association, that the output of home and industrial insulation in 1947 was approximately 867,000 short tons valued at $122,923,000. This represents an increase over the 1945 production but is believed to be somewhat below the 1946 output.

New plants and improved techniques are still being added to the industry. Plants at Florence, Colo., and Longview, Wash., started operations in 1947, and additional plants are under construction at Dallas, Oreg., and Birmingham, Ala. There is also a plant in the planning stage at Baldwin Park, Calif.

Among new methods are the utilization of exhaust gases from the cupolas to preheat the air for combustion within the cupola and the use of waste steam from the cupolas to assist in the generation of steam to blow the melt into fibers. In one plant this use of waste steam has reduced by 15 percent the quantity of coke required in the cupola charged.[5]

A review of factors involved in estimating the quantity of mineral wool, metal strips, and rings required for the installation of industrial mineral wool insulation products such as blankets and pipe covering,[6] and a report on the use of blanket type insulation where most of the processing operations are unhoused [7] have also recently been released.

A light-weight, high-temperature insulating product in felted and bulk form, which will withstand temperatures up to 1,800° F., was developed in 1947 by glass-wool manufacturers to meet the need for a flexible removable type of insulation.[8] It is designed for industrial, marine, and aircraft applications. Glass-fiber mats have also been substituted for rag felt in built-up roofing over precast concrete deck tile.[9]

MONAZITE

Presence of thorium—an atomic-energy source material—in monazite has created some uncertainties regarding publication of statistics of the mineral. However, it is now possible to present figures on the importation and consumption of monazite sands in 1946–47.

Imports of monazite sand in 1947, as shown in the accompanying table, reached 2,397 short tons valued at $277,327, compared with 3,686 tons valued at $218,705 in 1946. A break-down of imports, by country of origin, cannot be shown without revealing purchases by individual companies. The major part of total supplies in 1947 were obtained from Brazil. Exports of monazite sand from Brazil are now subject to Government control.

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[5] Nordberg, B., Saving Fuel in Mineral Wool Manufacture; Rock Products, vol. 50, No. 11, November 1947, pp. 91–92.

[6] Otto, F. C., Estimating Mineral Wool Insulation: Chem. Eng., vol. 54, No. 7, July 1947, pp. 102–105.

[7] Von Ludwig, D., Insulating Unhoused Plants: Chem. Eng., vol. 54, No. 3, March 1947, pp. 114–117.

[8] Chemical and Engineering News, Insulation Materials: Vol. 25, No. 38, September 1947, p. 2788.

[9] Engineering News Record, vol. 139, No. 20, Nov. 30, 1947, p. 126.

Monazite sand and other thorium ore imported for consumption in the United States, 1943–47, by countries[1]

Country	1943		1944		1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Brazil	1,911	$88,548			437	$15,342	(2)	(2)	(2)	(2)
India	3,033	128,379	384	$13,782	112	4,239	(2)	(2)	(2)	(2)
United Kingdom	36	3,553								
	4,980	220,480	384	13,782	549	19,581	3,686	$218,705	2,397	$277,327

1 1943–45, U. S. Department of Commerce, valued at port of origin; 1946–47, Bureau of Mines, valued at Atlantic coast port of destination.
2 Bureau of Mines not at liberty to publish figure.

Early in 1947 the state of Travancore reasserted state ownership of all its mineral-bearing sands and took steps to obtain a larger share of the profits arising from working these deposits. The embargo on exports of monazite sand placed in 1946 was lifted and exports were resumed on a restricted basis. A tentative agreement between the state and federal officials calling for a joint committee to act in an advisory capacity in the domestic exploitation of these deposits has also been made, and the state of Travancore has agreed to set up a plant to treat monazite in excess of the export quota.

A review of the production of rare-earth compounds from monazite has recently been published.[10] The paper discusses mixed oxides, chlorides, and fluorides for use in preparing glass-polishing powders, alloys, and core materials for arc and searchlight carbons, and pure lanthanum and didymium compounds.

It is not possible to show separately the consumption of monazite sand from India and Brazil without revealing the activities of individual companies. Total consumption, however, reached 2,655 short tons in 1946 and stocks at the end of the year were 3,289 tons. Comparable figures for 1947 were, respectively, 2,494 and 3,192 tons.

OLIVINE

Shipments of olivine in 1947 reached a new high of 10,838 short tons valued at $129,094. As in previous years, the bulk of the material shipped was consumed in refractories for furnace linings and refractory cements. The recent war period marked the beginning of the use of forsterite refractories in the glass industry. These refractories are now used extensively as glass-tank checkers for walls and arches of the regenerative chamber. Their reaction with alkalies is a dry one, and they do not become glazed or fluxed.

10 Pitkington, E. S., and Wylie, A. W., Production of Rare Earth and Thorium Compounds from Monazite Sand: Jour. Soc. Chem. Ind., vol. 66, No. 11, November 1947, pp. 387–394.

The tonnage and value of olivine shipped in recent years are shown in the accompanying table.

Olivine sold or used by producers in the United States, 1943–47

Year	Short tons	Value	Year	Short tons	Value
1943	5,415	$48,633	1946	7,649	$92,868
1944	3,270	35,207	1947	10,838	129,094
1945	(1)	(1)			

[1] Data not available for publication.

United States patent 2,419,026, granted to Dr. V. M. Goldschmidt on March 25, 1947, covers a method of making fused magnesium orthosilicate by melting dunite rock (olivine) in contact with a reducing agent for the iron compound present in the rock. The fused silicate is recovered by separation from the reduced iron. It is reported that a rock consisting essentially of olivine has been used successfully as a foundry sand in Norway.[11]

PERLITE

The production of perlite in 1947 (second year of commercial operation) reached 10,810 short tons, compared with 4,206 tons in 1946. Shipments of crude and refined perlite in 1947 reached 9,265 tons valued at $94,309.

Seven companies reported production and sales: Chemi-Cote Perlite Corp., Superior, Ariz.; Western Perlite Corp., 919 North First Street, Phoenix, Ariz.; Grolite Co., Superior, Ariz.; Dant & Russell, Inc., Portland, Oreg. (quarry at Frieda, Oreg.); High Grade Products Co., 232 West First Street, Reno, Nev.; Great Lakes Carbon Co., California office at 756 South Broadway, Los Angeles (quarry at Superior, Ariz.); and National Perlite Co., Campbell, Calif. In addition, four companies reported experimental or development output: Valtex Corp., Henderson, Nev.; Wilson Research, Engineering & Exploration Co., Veyo, Utah (quarries in Washington County, Utah, and Lincoln County, Nev.); Volcanite Co., 113 Vineland Avenue, Puenta, Calif.; and Alexite Engineering Co., Custer County, Colo. These companies expect to get into commercial production in 1948.

As perlite is a rock and not a single mineral its composition may vary greatly from deposit to deposit and even within the same deposit. A review of the preparation and processing of perlite has recently been released.[12] Expanded perlite, weighing 12 to 14 pounds per cubic foot, when used as aggregate for concrete in a 4-to-1 mix makes a product that will float on water. Such concrete also has low thermal conductivity and may be used for concrete insulation blocks, partition tile, and roofing slabs. Other uses for expanded perlite are pipe covering, roofing tile, plaster aggregate, abrasive compounds, foundry sands, and powdered silica for paint manufacture. The largest volume of sales in 1947 was made for plaster and concrete aggregate.

[11] Journal of the American Ceramic Society, vol. 30, No. 2, February 1947, p. 54.

[12] Pit and Quarry, West Coast Perlite Concern Leads Move to Standardize New Industry: Vol. 20, No. 2, August 1947, pp. 81–82.

RADIO-GRADE QUARTZ

Imports of Brazilian pebble, the classification under which radio-grade quartz crystals are imported, reached 473,788 pounds valued at $1,815,468 in 1947, compared with 370,556 pounds valued at $2,376,598 in 1946. Thirty-one companies manufactured 1,051,400 finished piezoelectric units in 1947 compared to 1,744,100 manufactured by 36 companies in 1946. The increase in quantity of quartz crystals imported in 1947 over the previous year's total and the decrease in value are attributed largely to the increased demand for small crystals, which command a lower price. The accompanying table shows the quantity of quartz imported and the number of piezoelectric units manufactured in recent years.

Imports of uncut quartz crystal, consumption of radio-grade quartz, and production of piezoelectric units in the United States, 1943–47

Year	Imports of uncut quartz crystal [1]		Consumption of radio-grade quartz [2] (pounds)	Production of piezoelectric units [2] [3] (number)
	Pounds	Value		
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
1946	370,556	2,376,598	172,400	1,744,100
1947	473,788	1,815,468	87,800	1,051,400

[1] Includes optical-grade quartz used in production of optical instruments.
[2] 1943–44, War Production Board.
[3] Includes oscillators, resonators, and other piezoelectric units.

Except for 443 pounds valued at $1,662 imported from France and 100 pounds valued at $1,056 received from India, all imports of radio-grade quartz were obtained from Brazil. The quantities received from France and India are negligible; however, the quality of the material from France has improved greatly, and 1947 marks the first appearance of India as a possible source of radio-grade quartz.

The difference between the quantity of quartz imported and that consumed is attributed to losses from reinspection and rejection of part of the material after it has been received in this country, stocks in the hands of industry, and purchases made for the national strategic stock pile.

An adequate supply of quartz crystals of radio grade is required wherever accurate frequency control is necessary. Laboratory study and commercial and military experience during the recent war confirmed the fact that no other material is now available that will maintain the same high degree of frequency control under exacting conditions.

A program for the synthesis of substitute materials for natural quartz, which includes the synthesis of quartz, nepheline, tourmaline, and berlinite, is in progress. Favorable progress on quartz synthesis has recently been reported. The commercial production of ethylene diamine tartrate for use as piezoelectric oscillator plates was started in 1947. These man-made crystals are being substituted for quartz plates in telephone lines and other places where the units are not subjected to severe temperature change and rough handling. Quartz-crystal oscillator plates are still essential for the more exacting uses, and quartz must be stock-piled for national security.

One new use for quartz oscillator plates is to produce powerful sound waves for precipitating smoke, testing metal parts for flaws, making mixtures, and homogenizing milk.

STRONTIUM MINERALS

Rowe, Gabelic & Buehler, 1555 Sunset Avenue, Pasadena 3, Calif., was the only domestic producer of strontium minerals in 1947. They produced only small quantities of celestite and strontianite and shipped only sample lots, which were not of commercial grade. Pan Chemical Co., 204 First National Bank Building, Pomona, Calif., did not operate during 1947. A description of the celestite and strontianite deposits in San Bernardino County, Calif., owned and operated by Rowe, Gabelic & Buehler, and of the uses of strontium has recently been released.[13]

In addition to the major use of celestite in signal flares, it is also said to have commercial possibilities in the manufacture of rayon and in sugar refining. Strontianite has been utilized as a flux for removing sulfur from steel.[14]

Imports of celestite into the United States for the 1945–47 period are shown in the accompanying table. In all, 14,117 short tons valued at $242,584 were imported in 1947. The material obtained from Spain represents the delivery of celestite purchased during the war on a preclusive buying program and will be added to the national strategic stock pile. Celestite in Mexico is mined chiefly in the State of San Luis Potosi. The mines are readily accessible by highway and rail transportation and also are not far from the United States border.

Celestite imported for consumption in the United States, 1945–47, by countries, in short tons

[U. S. Department of Commerce]

Country	1945		1946		1947	
	Short tons	Value	Short tons	Value	Short tons	Value
Mexico	3,016	$38,365	1,977	$24,165	3,937	$57,317
Spain	675	12,251			5,836	110,884
United Kingdom			2,530	42,033	4,344	74,383
	3,691	50,616	4,507	66,198	14,117	242,584

Trade-journal quotations of prices in 1947 for celestite, in carlots, 92 percent $SrSO_4$, finely powdered, were $45 per short ton; and for strontianite, in carlots, in lump form containing a minimum of 84 to 86 percent $SrCO_3$, $55 per ton.

Exports of strontium salts have not been separately classified since 1945.

[13] Pit and Quarry, Celestite—Strontianite Beds Worked by California Firm: Vol. 39, No. 12, June 1947, p. 59.

[14] Work cited in footnote 13.

TOPAZ

Shipments of topaz in 1947 from the Brewer mine, Jefferson, S. C., by the Carolina Mining & Exploration Corp., Naples, N. C., reached 2,294 short tons, valued at $45,873, compared with 700 tons, valued at $10,500, in 1946.

The material was sold as crude in lump or crushed form for use in refractories and as flux for thinning slag in open-hearth furnaces. A review of the uses and advantages of topaz as an admixture in refractory concrete has recently been released.[15] Topaz extends the field of usefulness of refractory concretes by providing greater load-bearing capacity and structural stability for walls, slabs, and arches in furnaces. It also provides a denser, less friable concrete for hearths and floors of many types of kilns.

VERMICULITE

The continued expansion of the construction industry has placed large demands on vermiculite producers, and sales in 1947 reached 131,385 short tons, again a new high, 52 percent above the previous record set in 1946.

Production in 1947 was reported by the following companies: Universal Zonolite Insulation Co., 135 South La Salle Street, Chicago, Ill. (mines at Libby, Mont., and Tigerville, S. C.); Alexite Engineering Co., Colorado Springs, Colo. (mines at Iola, Colo., and Encampment, Wyo.); George B. Coggins, Asheville, N. C. (mine at Tigerville, S. C.); Vercalite Industries Inc., Franklin, N. C.; and the Mikolite Co., 4707 Grand Avenue, Kansas City, Kans. (mines at Encampment, Wyo.). As in previous years the bulk of the output came from the Universal Zonolite Insulation Co. mine at Libby, Mont. The Alexite Engineering Co. ceased operation of its vermiculite properties at the end of 1947. New deposits of vermiculite have been found in Fulton, Hall, Meriwether, Rabun, Jasper, and Elbert Counties, Ga. Development work to prove their economic value is now in progress.[16]

In addition to the record domestic output of vermiculite in 1947, considerable quantities of this material were imported from the Palabora area of northern Transvaal, Africa. A description of these deposits, which includes a summary of the occurrence, geology, and mining methods, has recently been released.[17]

In 1947 as in the previous year, the principal industrial use for vermiculite was as lightweight aggregate for cement and plaster. Vermiculite concrete can be placed over wood, tile, steel, or structural concrete. It has low sound-transmission values and thus helps prevent factory noises from disturbing occupants on other floors; it also reduces the volume of outside noises that ordinarily penetrate buildings. It can also be used as an insulating roof fill. A review of the vermiculite

[15] Lobaugh, F., Topaz as an Admixture in Refractory Concrete: Jour. Am. Ceram. Soc., vol. 30, No. 12, December 1947, pp. 349–353.
[16] Furcron, A. S., and Teague, K. H., Vermiculite in Georgia: Eng. and Min. Jour., vol. 149, No. 9, September 1947, pp. 125–126.
[17] Mining and Industrial Magazine of Southern Africa, Vermiculite in the Transvaal: Vol. 37, No. 7, July 1947, p. 347.

industry, which includes material on composition and on uses by the construction industry, has recently been released.[18]

The tonnage and value of screened and cleaned vermiculite shipped in recent years are shown in the accompanying table. Domestic screened and cleaned vermiculite averages $8 to $12 per short ton, and South African vermiculite $28 to $30 per ton f. o. b. Atlantic seaports. Assuming an average price of $75 per ton for exfoliated material and a 5 percent loss of weight in exfoliating, the total value of exfoliated vermiculite sold in 1947 would be approximately $9,361,000.

Screened and cleaned vermiculite sold or used by producers in the United States, 1940–47

Year	Short tons	Value	Year	Short tons	Value
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	1946	86,390	867,973
1943	46,645	471,595	1947	131,385	1,338,572

WOLLASTONITE

Production and sales of wollastonite from the Bristol Mountain mine of Northern Minerals Inc., Willsboro, N. Y., in 1947 reached 80 short tons valued at $1,600. This property was purchased from the estate of John B. Burnham in September 1947. The output was used in experimental work on pigments and by the chemical industry.

[18] Coggins, G. B., Vermiculite, What It Is, How It Works, and Where It's Used in Buildings: Brick and Clay Record, vol. 3, No, 5, December 1947, pp. 36–39.

PART III. STATE REVIEWS

The Mineral Industry of Alaska

(MINE REPORT)

By ALFRED L. RANSOME[1]

GENERAL SUMMARY

AN outstanding feature of the Alaska mineral production record for 1947 was the production for the first time, of zinc, from Alaska ores. The metal was recovered from zinc concentrates shipped to a smelter in the United States by the Big Four Mining Co. from its Maloney mine on George Inlet, 15 miles south of Ketchikan.

Production of gold in Alaska in 1947 continued the upward trend that began in July 1945 following recision of War Production Board Limitation Order L–208. However, the 23-percent increase in output from 1946 to 1947 was only one-tenth of the marked gain from 1945 to 1946. Production of gold from placer operations provided all of the increased output, as the total from lode mines was lower than in 1946.

Mineral production of Alaska, 1945–47

	1945		1946		1947	
	Quantity	Value	Quantity	Value	Quantity	Value
Antimony ore .... short tons					40	$16,056
Coal, bituminous, and lignite .... do	297,644	$1,868,592	366,809	$2,354,952	349,000	(1)
Copper .... do	5	1,350	2	648	12	5,040
Gold .... troy ounces	68,117	2,384,095	226,781	7,937,335	279,988	9,799,580
Lead .... short tons	11	1,892	115	25,070	264	76,032
Mercury .... flasks (76 pounds)	(1)	(1)	699	68,670	127	10,635
Platinum metals (crude) .... troy ounces	26,505	(1)	22,882	(1)	13,512	(1)
Silver .... do	9,983	7,099	41,793	33,769	66,150	59,866
Tin .... short tons					1	2,200
Tungsten (60-percent concentrates)[2] short tons			19	(1)	13	(1)
Zinc .... do					25	6,050
Miscellaneous[3]		5,910,704		2,005,241		8,411,319
Total		10,174,000		12,426,000		18,387,000

[1] Bureau of Mines not at liberty to publish separately; value included with "Miscellaneous."
[2] Shipments.
[3] Comprises value of sand and gravel, stone, and items indicated by "(1)."

[1] Statements on minerals other than gold, silver, copper, lead, and zinc were prepared by other members of Bureau of Mines.

GOLD, SILVER, COPPER, LEAD, AND ZINC

The accompanying tables show the mine production of gold, silver, copper, lead, and zinc in Alaska, 1943–47, and 1880–1947, in terms of recovered metals; the gold production at placer mines, by classes of mines and methods of recovery; mine production of gold, silver, copper, lead, and zinc, by regions; ore and old tailings sold or treated; and various metallurgical compilations, based on output in 1947, which have not heretofore been presented in the chapter on Alaska.

A small proportion of the production shown in the tables following was mined before 1947 but was not shipped or sold until that year.

During 1947, 27 connected-bucket dredges and 6 dragline dredges (excluding dragline equipment used in conjunction with nonfloating washing plants) were operated, as compared with 25 (revised) and 7, respectively, in 1946. In addition, 233 other placer properties were active some portion of the year (230 in 1946). Of the lode mines, production was reported from 19 properties, 3 more than in 1946.

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 gold, silver, copper, lead, and zinc production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Gold.—Production of 279,988 ounces of gold in Alaska in 1947, although 23 percent above the output in 1946, was only 37 percent of the output in 1940 (755,970 ounces valued at $26,458,950). The principal factor in the slow recovery of gold mining is the problem of mining costs that affect lode mining to a much greater degree than placer operation. This is illustrated by a further comparison of 1947 with 1940: The 276,443 ounces of placer gold produced in 1947 was 99 percent of the total Alaska gold output, and was 51 percent of the comparable placer production total for 1940. On the other hand, the lode-gold output of 3,545 ounces in 1947 was only 1 percent of the total Alaska production of gold as compared with 28 percent in 1940. The greatest single factor causing the low showing for lode gold was the continued shut-down of the Alaska Juneau mine, which supplied 70 percent of the total lode gold output in 1940.

Mine production of gold, silver, copper, lead, and zinc in Alaska, 1943–47, and total, 1880–1947, 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
1943	8	114	1,483,527	99,583	$3,485,405	42,788	$30,427
1944	9	198	381,574	49,296	1,725,360	13,362	9,502
1945	18	143	6,512	68,117	2,384,095	9,983	7,099
1946	16	256	10,798	226,781	7,937,335	41,793	33,769
1947	19	260	13,891	279,988	9,799,580	66,150	59,866
1880–1947			(2)	26,363,416	635,734,162	19,856,448	14,141,457

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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
1946	4,000	648	230,000	25,070			7,996,822
1947	24,000	5,040	528,000	76,032	50,000	$6,050	9,946,568
1880–1947	[3] 685,878	226,568,904	[3] 25,190	2,850,665	[3] 25	6,050	879,301,238

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Figure not available.
[3] Short tons.

Mine production of gold, silver, copper, lead, and zinc in Alaska in 1947, by months, in terms of recovered metals [1]

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	396	126			
February	739	139			
March	839	128			
April	354	1,057		15	
May	2,256	465			
June	17,409	2.946			
July	44,483	6,928			
August	48,066	7,510	1	2	11
September	34,649	13,809	3	105	
October	73 237	17,220	4	54	
November	34,215	9,197	3	51	14
December	23,345	6,625	1	37	
Total: 1947	279.988	66,150	12	264	25
1946	226,781	41,793	2	115	

[1] Based on mint and smelter receipts.

Monthly production of gold in 1947, as shown in an accompanying table, is indicative of striking seasonal limitations to mining activity in the Territory.

The 15 leading gold-producing mines (all placer) in Alaska in 1947, listed in the accompanying table, yielded 72 percent of the total gold output of the Territory; the leading 5 mines produced 61 percent. The Fairbanks district in the Yukon River Basin region ranked first in gold production in the Territory by a wide margin, owing to the connected-bucket dredging operations of the United States Smelting, Refining & Mining Co.

The more important producers of gold in 1947 from lode operations were: The Nixon Fork Mining Co., operating the Nixon Fork Mine in the McGrath district; the Cleary Hill Mines Co., operating the Cleary Hill mine in the Fairbanks district; and the J. H. Scott Co., operating the Riverside mine (lead ore) in the Hyder district.

15 leading gold-producing mines in Alaska in 1947, in order of output

Rank	Mine	District	Region	Rank in 1946	Operator	Source of gold
1	United States Smelting, Refining & Mining Co.	Fairbanks	Yukon River Basin	1	United States Smelting, Refining & Mining Co.	Dredge.
2	New York Alaska Gold Dredging Corp.	Tuluksak-Aniak.	Kuskokwim	2	New York Alaska Gold Dredging Corp.	Do.
3	Cripple Creek Mining Co.	Innoko	Yukon River Basin	5	Cripple Creek Mining Co.	Placer.
4	Arctic Circle Exploration Co.	Fairhaven	Seward Peninsula	3	Arctic Circle Exploration Co.	Dredge.
5	Yukon Placer Mining Co.	Fortymile	Yukon River Basin	8	Yukon Placer Mining Co.	Placer.
6	Alluvial Golds, Inc	Circle	do	4	Alluvial Golds, Inc	Dredge.
7	Gold Placers, Inc	do	do	7	Gold Placers, Inc	Do.
8	Mohawk Association	Iditarod	do	12	North American Dredging Co.	Do.
9	Alder Creek Mining Co.	Fairbanks	do	19	Alder Creek Mining Co.	Placer.
10	Wade Creek Dredging Co.	Fortymile	do	10	Wade Creek Dredging Co.	Do.
11	C. J. Berry Dredging Co.	Circle	do	11	C. J. Berry Dredging Co.	Dredge.
12	Nome Creek Mining Co.	Tolovana	do	9	Nome Creek Mining Co.	Do.
13	Lammers Exploration Co.	Kiana	Northwestern Alaska.	29	Lammers Exploration Co.	Do.
14	Bristol Bay Mining Co.	Goodnews Bay.	Kuskokwim	13	Bristol Bay Mining Co.	Placer.
15	Lee Bros. Dredging Co.	Nome	Seward Peninsula	20	Lee Bros. Dredging Co.	Dredge.

Gold produced at placer mines in Alaska, 1943–47, by classes of mines and by methods of recovery

Class and method	Mines producing	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered		
				Fine ounces	Value	Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Connected-bucket dredges:						
1943	7	7	1,458,059	18,554	$649,390	$0.445
1944	9	10	2,074,385	26,280	919,800	.443
1945	12	15	3,143,000	34,885	1,220,975	.388
1946	19	25	9,800,000	148,995	5,214,825	.532
1947	21	27	8,385,000	188,239	6,588,365	.786
Dragline dredges:						
1943	(1)	(1)	(1)	(1)	(1)	(1)
1944	(1)	(1)	(1)	(1)	(1)	(1)
1945	2	2	9,700	1,098	38,430	3.962
1946	7	7	160,000	6,641	232,435	1.453
1947	6	6	203,000	5,809	203,315	1.002
Nonfloating washing plants: [2]						
1943	(1)	(1)	(1)	(1)	(1)	(1)
1944	(1)	(1)	(1)	(1)	(1)	(1)
1945	22	22	487,000	7,815	273,525	.562
1946	61	61	2,006,000	33,978	1,189,230	.593
1947	73	73	2,865,000	44,675	1,563,625	.546
Gravel hydraulically handled:						
Hydraulic:						
1943	46	----------	448,700	8,872	310,520	.692
1944	(1)	----------	(1)	(1)	(1)	(1)
1945	80	----------	858,000	12,903	451,605	.526
1946	116	----------	2,123,000	30,390	1,063,650	.501
1947	113	----------	2,366,000	36,551	1,279,285	.541
Small-scale hand methods:						
Wet:						
1943	(1)	----------	(1)	(1)	(1)	(1)
1944	(1)	----------	(1)	(1)	(1)	(1)
1945	26	----------	12,800	645	22,575	1.764
1946	51	----------	18,800	688	24,080	1.281
1947	44	----------	46,600	1,121	39,235	.842
Underground placers:						
Drift:						
1943	(1)	----------	(1)	(1)	(1)	(1)
1944	(1)	----------	(1)	(1)	(1)	(1)
1945	1	----------	1,500	362	12,670	8.447
1946	2	----------	200	16	560	2.800
1947	3	----------	400	48	1,680	4.200
Other placers: [3]						
1943	61	----------	(4)	14,685	513,975	(4)
1944	189	----------	(4)	7,331	256,585	(4)
1945–47	----------	----------	----------	----------	----------	----------
Grand total placers:						
1943	114	----------	(4)	42,111	1,473,885	(4)
1944	198	----------	(4)	33,611	1,176,385	(4)
1945	[5] 143	----------	4,512,000	57,708	2,019,780	.448
1946	[5] 256	----------	14,108,000	220,708	7,724,780	.548
1947	[5] 260	----------	13,866,000	276,443	9,675,505	.698

[1] Data not available separately according to method; included under "Other placers."
[2] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."
[3] Includes all placer operations (dragline dredges, nonfloating washing plants, hydraulic, small-scale hand, and drift) for which separate figures are not available.
[4] Figure not available.
[5] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

Silver.—Of the silver produced in Alaska in 1947, 66 percent was a byproduct of gold mining (83 percent in 1946), and 34 percent came from lead ore (including a small quantity from zinc ore). The ratio of silver production to gold production in 1947 was 1:4.2, compared with 1:5.4 in 1946. The most important producer of silver in Alaska in 1947 was the United States Smelting Refining & Mining Co.; the silver was a byproduct of connected-bucket gold-dredging operations in the Fairbanks district. Taking a close second place was the J. H. Scott Co., which recovered silver as a byproduct from lead ore produced from the Riverside mine in the Hyder district, Southeastern Alaska region.

Copper, Lead, and Zinc.—Production of the base metals, copper, lead, and zinc, was limited to output from two mines in the Southeastern Alaska region. Copper output of 24,000 pounds was recovered as a byproduct from lead concentrate shipped from the Riverside mine near Hyder, operated by the J. H. Scott Co. Lead production of 528,000 pounds came almost entirely from the Riverside mine. Available records indicate that zinc production of 50,000 pounds was the first to be produced from Alaska ores; the metal was recovered from zinc-lead concentrate shipped to a smelter in the United States from the Big Four Mining Co. Maloney mine on George Inlet, Ketchikan district.

Mine production of gold, silver, copper, lead, and zinc in Alaska in 1947, by regions, in terms of recovered metals [1]

Region	Mines producing [1]		Gold			Silver	Total value
	Lode	Placer	Lode (fine ounces)	Placer (fine ounces)	Total (fine ounces)	Lode and placer (fine ounces)	
Cook Inlet-Susitna	3	19	358	4,046	4,404	672	$154,748
Copper River		9		1,294	1,294	171	45,445
Kenai Peninsula	3	2	331	64	395	120	13,934
Kuskokwim	1	9	775	19,219	19,994	2,295	701,867
Seward Peninsula and Northwestern Alaska [2]		72		26,220	26,220	3,012	920,426
Southeastern Alaska	8	3	955	18	973	22,524	[3] 141,561
Yukon River Basin	4	146	1,126	225,582	226,708	37,356	7,968,587
Total Alaska: 1947	19	260	3,545	276,443	279,988	66,150	9,946,568
1946	16	[4] 256	6,073	220,708	226,781	41,793	7,996,822

[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 output.
[3] Includes value of 24,000 pounds of copper ($5,040), 528,000 pounds of lead ($76,032), and 50,000 pounds of zinc ($6,050).
[4] Revised; excludes itinerant prospectors, snipers, etc.

MINING INDUSTRY

Dredges of the connected-bucket type washed 60 percent of the total gravel mined in the Territory in 1947 and recovered 68 percent of the total placer gold and 67 percent of the total Alaska gold (lode and placer). Dragline dredging (including all operations using a power excavator and a floating washing plant) decreased slightly in 1947; equipment of this type washed only 1 percent of the total gravel mined and recovered 2 percent of the placer gold. Placer operations using mechanical equipment of various types and combinations, in conjunction with nonfloating washing plants, washed 21 percent of the total gravel mined and recovered 16 percent of the placer gold, an increase over comparable totals in 1946. Operations in which gold was recovered primarily by hydraulic methods showed a decrease in the number of mines but a gain in gravel washed and gold produced. Gold output from all other placer-mining methods increased over 1946. The total yardage of gravel washed at placer mines decreased 2 percent, whereas production advanced 25 percent. The average recoverable gold content of gravels increased 28 percent.

The tonnage of material from lode mines in Alaska treated in 1947 increased 29 percent; but the output of lode gold decreased 42 percent, and the gold from this source comprised only 1 percent of the Territory total.

ORE CLASSIFICATION

Of the 13,891 tons of ore (including 6,000 tons of old tailings) sold or treated in 1947, 60 percent was gold ore, 36 percent lead ore, and the remainder zinc ore. Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore and old tailings sold or treated in Alaska in 1947, with content in terms of recovered metals

Source	Material sold or treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
Dry and siliceous gold ore	2,327	6,000	2,847	672			
Lead ore	5,064		697	22,284	24,000	510,200	
Zinc ore	[1] 500		1	180		17,800	50,000
Total lode mines	7,891	6,000	3,545	23,136	24,000	528,000	50,000
Placers			276,443	43,014			
Total: 1947	7,891	6,000	279,988	66,150	24,000	528,000	50,000
1946	7,698	3,100	226,781	41,793	4,000	230,000	

[1] Estimated.

METALLURGIC INDUSTRY

During 1947, 60 percent of the total ore and old tailings handled was treated at amalgamation mills, and 40 percent was treated at concentration mills. No ore was shipped for direct smelting, although smelters in the United States received 987 tons of flotation concentrates and 6 tons of gravity concentrates from Alaska mine operators. Of the total concentrates shipped, 92 percent was lead concentrate, and 98 percent came from Southeastern Alaska.

Mine production of metals in Alaska in 1947, 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 old tailings amalgamated	8,327	2,688	592			
Concentrates smelted:						
Flotation	987	793	22,522	24,000	528,000	50,000
Gravity	6	64	22			
Total lode mines		3,545	23,136	24,000	528,000	50,000
Placers		276,443	43,014			
Total: 1947		279,988	66,150	24,000	528,000	50,000
1946		226,781	41,793	4,000	230,000	

Mine production of metal from amalgamation and cyanidation mills [1] (with or without concentration equipment) in Alaska in 1947, in terms of recovered metals

Region	Material treated		Recovered in bullion		Concentrates smelted and recovered metal		
	Ore (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)
Cook Inlet-Susitna	562	--------	320	29	2	38	3
Kenai Peninsula	680	--------	274	87	5	57	20
Kuskokwim	454	--------	775	206	--------	--------	--------
Southeastern Alaska	170	6,000	233	51	3	24	3
Yukon River Basin	461	--------	1,086	219	10	40	54
Total: 1947	2,327	6,000	2,688	592	20	159	80
1946	5,339	3,100	5,519	956	61	312	81

[1] No cyanidation mills were active in 1947 or 1946.

Mine production of metals from concentrating mills in Alaska in 1947, by regions, in terms of recovered metals

Region	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)
Southeastern Alaska	5,564	973	698	22,464	24,000	528,000	50,000
Total: 1947	5,564	973	698	22,464	24,000	528,000	50,000
1946	2,358	186	242	7,055	4,000	230,000	----------

Gross metal content of concentrates produced from ores mined in Alaska in 1947, by classes of concentrates

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	20	159	80	31	292	----------
Lead	911	697	22,284	26,154	537,433	----------
Zinc-lead	62	1	180	214	18,705	51,115
Total: 1947	993	857	22,544	26,399	556,430	51,115
1946	247	554	7,136	4,978	238,219	----------

Mine production of metals from Alaska concentrates shipped to smelters in 1947, in terms of recovered metals

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY REGIONS						
Cook Inlet-Susitna	2	38	3	----------	----------	----------
Kenai Peninsula	5	57	20	----------	----------	----------
Southeastern Alaska	976	722	22,467	24,000	528,000	50,000
Yukon River Basin	10	40	54	----------	----------	----------
Total: 1947	993	857	22,544	24,000	528,000	50,000
1946	247	554	7,136	4,000	230,000	----------
BY CLASSES OF CONCENTRATES						
Dry gold	20	159	80	----------	----------	----------
Lead	911	697	22,284	24,000	510,200	----------
Zinc-lead	62	1	180	----------	17,800	50,000
Total 1947	993	857	22,544	24,000	528,000	50,000

REVIEW BY REGIONS AND DISTRICTS

COOK INLET—SUSITNA REGION

Willow Creek District.—The Palmer-Mabelle Gold Mines, Inc., operated its Mabel mine on Reed Creek during a 10-month period in 1947; gold ore was treated in a 20-ton amalgamation-flotation-concentration mill. The Gold Cord Mining Co. operated the Gold Cord mine on Fishhook Creek north of Wasilla during the first few weeks of 1947, treating gold ore by amalgamation. Lloyd Hill recovered 38 ounces of gold and 3 ounces of silver from 12 tons of ore treated by amalgamation during 1947 at the Lonesome mine 22 miles north of Palmer.

Yentna-Cache Creek District.—Among the larger producers operating in 1947 were the Collinsville Mines (dry-land dredge with dragline equipment) operating on Mills and Twin Creeks; the Nugget Creek Mining Co. hydraulicking on Nugget Creek bench; and the Sunset Mining Co. operating bulldozers and a pumping unit on Cache Creek.

COPPER RIVER REGION

Nizina District.—The Chititu Mines hydraulicked 30,000 cubic yards on Chititu Creek from May 15 to September 15 and recovered 119 ounces of gold and 12 ounces of silver. Using similar equipment, Dan Creek Gold Mines recovered 141 ounces of gold and 15 ounces of silver from 25,000 cubic yards of gravel washed on Dan Creek from April 1 to October 13, 1947.

KENAI PENINSULA REGION

Moose Pass-Hope District.—The Chugach Mining Co. operated its hydraulic placer mine on Resurrection Creek from April 28 to June 30, but the greater production of gold from the district came from two lode mines—the Marigold operated by George Lindsay and the Skeen-Leckner (Falls Creek) mine by the Falls Creek Mining Co.

Turnagain Arm-Girdwood District.—The Monarch Mining Co. operated its Monarch mine in the Barns Mountains from June 22 to July 3, 1948; 23 ounces of gold and 12 ounces of silver were recovered from 25 tons of gold ore treated by amalgamation.

KUSKOKWIM REGION

Goodnews Bay District.—The largest producer of gold in the district was the Bristol Bay Mining Co. operating on Watamuse Creek; 2,592 ounces of gold and 621 ounces of silver were recovered from 105,195 cubic yards of stream gravel, using dragline excavator and floating washing plant. The Goodnews Bay Mining Co. operated its Diesel-electric connected-bucket dredge (equipped with ninety-three 8-cubic-foot buckets) and two 1¼-cubic-yard dragline excavators on its property on the Salmon River for the recovery of platinum from April 20 to November 14, 1947; gold was recovered as a by-product. John B. Huff hydraulicked 14,000 cubic yards of bench gravel on Butte Creek from June 1 to October 15 to recover 272 ounces of gold and 40 ounces of silver.

McGrath District.—The only producing lode mine in the district was the Nixon Fork operated by the Nixon Fork Mining Co. throughout 1947; 454 tons of gold ore were milled in a 50-ton stamp mill and 595 ounces of gold and 167 ounces of silver recovered by amalgamation.

Mine production of gold, silver, copper, lead, and zinc in Alaska in 1947, by regions and districts, in terms of recovered metals [1]

Region and district	Mines producing [2]		Ore and old tailings (short tons)	Gold			Silver (lode and placer) (fine ounces) [3]	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode (fine ounces)	Placer (fine ounces)	Total (fine ounces)					
Cook Inlet-Susitna region:											
Willow Creek	3	(4)	562	358	(4)	[5] 358	[5] 32				[5] $12,559
Yentna-Cache Creek		15			3,889	3,889	616				136,672
Copper River region:											
Nizina		5			568	568	88				19,960
Yakataga, including Icy Bay		1			87	87	5				3,050
Kenai Peninsula region:											
Nuka Bay-Homer		1			3	3					105
Turnagain Arm-Girdwood	1		25	23		23	12				816
Kuskokwim region:											
Bethel		(6)			19	19	5				670
Goodnews Bay		4			3,628	3,628	666				127,583
McGrath	1	(4)	454	775	(4)	[5] 775	[5] 206				[5] 27,311
Tuluksak-Aniak		4			15,563	15,563	1,418				545,988
Seward Peninsula region:											
Council-Bluff		6			2,916	2,916	308				102,339
Fairhaven		11			7,721	7,721	1,077				271,210
Kougarok		20			5,571	5,571	596				195,524
Koyuk		8			595	595	64				20,883
Nome		18			6,144	6,144	649				215,627
Port Clarence		8			634	634	74				22,257
Southeastern Alaska region:											
Hyder	1		5,064	697		697	22,284	24,000	510,200		123,071
Juneau	3	(4)	6,010	162	(4)	[5] 162	[5] 19				[5] 5,687
Ketchikan	2	(4)	648	85	(4)	[5] 85	[5] 212		17,800	50,000	[5] 11,780
Yukon River Basin region:											
Bonnifield-Nenana		10			644	644	110				22,640
Chandalar		(6)			5	5	1				176
Chisana		(6)			3	3	1				106
Circle		14			15,342	15,342	2,195				538,956
Eagle		5			156	156	25				5,483

Fairbanks	4	26	461	1,126	150,808	151,934	25,501				5,340,768
Fortymile		18			10,953	10,953	1,980				385,147
Hot Springs		8			3,476	3,476	854				122,433
Iditarod		13			10,899	10,899	1,755				383,053
Innoko		11			15,489	15,489	2,339				544,232
Kantishna		6			1,726	1,726	584				60,939
Koyukuk		16			4,971	4,971	449				174,391
Rampart		5			1,050	1,050	116				36,855
Ruby		5			3,535	3,535	670				124,331
Tolovana		7			5,365	5,365	628				188,343
Other districts [7]	4	15	667	319	4,683	5,002	611				175,623
Total Alaska	19	260	13,891	3,545	276,443	279,988	66,150	24,000	528,000	50,000	9,946,568

[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; others producing listed in footnote 7 and their output included with "Other districts."
[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[3] Sources of total silver as follows: 23,136 ounces from lode mines, and 43,014 ounces from placers.
[4] Included with "Other districts."
[5] Exclusive of placer output, which is included with "Other districts."
[6] Output from property not classed as a mine.
[7] Includes following: Valdez Creek and Willow Creek districts (placer) in Cook Inlet-Susitna region; Chistochina and Nelchina (placer) in Copper River region; Moose Pass-Hope in Kenai Peninsula region; McGrath (placer) in Kuskokwim region; Kiana in Northwestern Alaska region; Chichagof Island (lode) and Juneau and Ketchikan (placer) in Southeastern Alaska region; and Marshall in Yukon River Basin region.

Tuluksak-Aniak District.—The New York Alaska Gold Dredging Corp., the largest gold producer in the region and the second largest in the Territory in 1947, operated two floating connected-bucket dredges on the Tuluksak River. Other important producers at placer properties were Peandori Placer Mining Co. (hydraulicking on Cripple Creek) and Marvel Creek Mining Co. (using bulldozer, dragline, and hydraulic equipment on Marvel Creek).

NORTHWESTERN ALASKA REGION

Kiana District.—The Lammers Exploration Co. recovered a sizable quantity of gold from its operation of a floating Diesel-electric connected-bucket dredge (with fifty-seven 3-cubic-foot buckets) on Klery Creek, from June to October 1947.

SEWARD PENINSULA REGION

The Seward Peninsula region had 13 floating connected-bucket dredges in 1947; in addition there were numerous operations using hydraulic giants, bulldozers, and dragline excavators either separately or in combination. There were no producing lode mines.

Council-Bluff District.—The principal producers in the district were the Alaska Placer Co. on Niukluk River and the Council Dredging Co. on Ophir Creek; each operation used a floating connected-bucket dredge.

Fairhaven District.—The Arctic Circle Exploration Co., operating two dredges (each with sixty-six 4-cubic-foot buckets) on Candle Creek, ranked first in production of gold in the region and fourth in the Territory. Other companies operating connected-bucket dredges in the district were Dry Creek Dredging Co. and Forsgren Dredging Co., both operating on the Inmachuk River. Other larger producers of gold from placers worked hydraulically and in combination with bulldozers, draglines, and pumping equipment were Havenstrite Mining Co. on Upper Candle Creek (1,123 ounces of gold and 157 ounces of silver recovered using a dragline excavator and floating washing plant) and Northern States Mining & Construction Co. (Black Diamond bench on Inmachuk River).

Kougarok District.—The Kougarok Dredging Corp. operated a connected-bucket dredge with sixty-four 2½-cubic-foot buckets (formerly owned by Fox Bar Dredging Co.) on Kougarok River during August and September 1947, and the North Fork Dredging Co. operated a dredge on the North Fork Kougarok River during the 1947 season. Other mining in the district in 1947 was limited to placer operations, principally by hydraulicking and with combinations of mechanical equipment using nonfloating washing plants.

Koyuk District.—Of the eight placer mines worked during 1947, the Wallace Porter operation on Bear and Sweepstake Creeks was the largest. Although most of the properties used hydraulic or mechanical equipment with nonfloating washing plants, the Shaw & Cook operation in Hopeful Gulch used a connected-bucket dredge to recover a small quantity of gold.

Nome District.—The largest gold producer in the district in 1947 was the Lee Bros. Dredging Co., operating a Risdon Diesel-powered floating connected-bucket dredge (with seventy-five 5-cubic-foot buckets) on the Solomon River from July 5 to November 9, 1947;

a Bucyrus-Erie dredge (with sixty-five 3½-cubic-foot buckets) was not operated in 1947; 2,376 ounces of gold and 231 ounces of silver were recovered from material dredged. Casa de Paga Gold Co. operated its connected-bucket dredge (equipped with sixty-six 2-cubic-foot buckets) on Pajara Creek from June 20 to September 28, 1947; 1,075 ounces of gold and 107 ounces of silver were recovered from 180,000 cubic yards of gravel handled. At the season's end the property was considered to be worked out. Tolbert Scott & Sons operated a Diesel-powered connected-bucket dredge on Iron Creek from July 1 to October 2, 1947, and recovered 258 ounces of gold and 27 ounces of silver.

Among the larger producers of gold from placers worked by hydraulic giants with some combination of bulldozers, draglines, and pumping equipment were: Andrew Peterson on Iron Creek, Kougarok Freighting & Mining Co. on Buster Creek, C. O. Roberts on Big Hurrah Creek, E. W. Quigley on Solomon River (hydraulic), Herb Engstrom on Basin Creek, Glacier Creek Mines on Glacier Creek (hydraulic), and the Rocky Mountain Mining Co. on Rocky Mountain Creek.

SOUTHEASTERN ALASKA REGION

Nearly a third of the total Alaska lode-gold output in 1947 came from eight mines in the Chichagof Island, Hyder, Juneau, and Ketchikan districts; placer operations were confined to a few small-scale hand operations. Nearly all of the lode silver and all of the copper, lead, and zinc came from this region.

Hyder District.—The J. H. Scott Co. operated the Riverside mine from January 1 to December 15, 1947, treating lead ore in its 50-ton combination flotation-gravity concentration mill. From 5,064 tons of lead ore milled, 859 tons of lead concentrate (containing 613 ounces of gold, 22,974 ounces of silver, 26,154 pounds of copper, and 537,433 pounds of lead) were produced and shipped to smelters in the United States. These shipments were made almost entirely during the latter half of the year, following approval on July 30, 1947, of Public Law 277, Eightieth Congress, first session, which allowed the company to ship on foreign vessels. In addition to the above production, 52 tons of lead concentrate produced in 1946 was shipped in March 1947.

Ketchikan District.—The Big Four Mining Co. operated the Maloney mine on George Inlet, 15 miles south of Ketchikan, beginning in June 1947. Zinc ore was treated in a 30-ton mill, and 62 tons of zinc-lead flotation concentrate (containing 1 ounce of gold, 180 ounces of silver, 214 pounds of copper, 18,705 pounds of lead, and 51,115 pounds of zinc) were shipped to a smelter in the United States. Available records indicate the Alaska zinc production in 1947, entirely from this mine, was the first to be produced from Alaska ores.

YUKON RIVER BASIN REGION

The Yukon River Basin region accounted for 81 percent of the total Alaska gold in 1947 from 146 placer mines and 4 lode mines in 16 districts. Of the 225,582 ounces of placer gold produced in the region, 71 percent was recovered by 11 floating connected-bucket dredges. Nearly one-third of the total Alaska gold from lode mines came from the region. The Fairbanks district continued to be the most important.

Circle District.—Three connected-bucket dredges were active in the Circle district in 1947. On Woodchopper Creek, Alluvial Golds, Inc., operated its Diesel-powered dredge equipped with seventy-two 4-cubic-foot buckets. Gold Placers, Inc., ran a similar type dredge (equipped with sixty 4-cubic-foot buckets) on Coal Creek. The C. J. Berry Dredging Co. operated its dredge on Lower Mammoth Creek during the season. The output by these dredges accounted for 80 percent of the gold from the district (82 percent in 1946) and placed the district third in gold produced in the Yukon River Basin region.

Fairbanks District.—The United States Smelting, Refining & Mining Co., operating five floating connected-bucket dredges in the Fairbanks district, was—as in previous years—by far the largest producer of gold not only in the district but in the Territory. The company operated two 6-cubic-foot Bethlehem dredges (with 68 and 78 buckets, respectively), one 10-cubic-foot Bethlehem dredge (with 113 buckets), one 10-cubic-foot Yuba dredge (with 106 buckets), and one 3-cubic-foot Yuba dredge (with 68 buckets); all dredges are electrically operated. Other equipment used (chiefly for removing overburden) included 200 Joshua Hendy hydraulic giants, a Bucyrus 10-W power shovel, and 4 Caterpillar bulldozers and carry-alls.

The Alder Creek Mining Co., the second largest producer in the Fairbanks district, recovered 3,596 ounces of gold and 587 ounces of silver from 249,464 cubic yards of gravel and overburden handled, using hydraulic equipment in conjunction with two dragline excavators and three bulldozers. The operation, located on Fairbanks Creek, was continuous from May 6 to October 13, 1947.

The Cleary Hill Mines Co., operating the Cleary Hill mine and amalgamation-flotation mill 27 miles northeast of Fairbanks, continued to be the leading producer of lode gold in the district. The Cheechako Mining Co. operated its mine at the head of Little El Dorado Creek from June to November 1947; 375 ounces of gold and 68 ounces of silver were recovered from 140 tons of gold ore treated by amalgamation. In addition, 3 ounces of gold and 5 ounces of silver were recovered from 1 ton of concentrate shipped to a smelter.

Fortymile District.—Of the placer gold recovered at 18 mines in the district during 1947, 73 percent came from properties operated by the Yukon Placer Mining Co. on Walker's Fork Creek (Association claims 0 and 1) and by the Wade Creek Dredging Co. on Jack Wade Creek (Nos. 5 and 6 above Lower Discovery). The Yukon Placer Mining Co. washed 204,000 cubic yards of gravel (using bulldozers and sluice boxes) to recover 4,839 ounces of gold and 712 ounces of silver; and the Wade Creek Dredging Co. recovered 3,169 ounces of gold and 685 ounces of silver from 91,500 cubic yards of gravel, using similar equipment.

Hot Springs District.—The largest producer of gold in the district in 1947 was the Pioneer Mining Co., hydraulicking on Skookum, Seattle, Jr., and Upper Pioneer Creeks. Cleary Hill Mines Co. operated its dragline equipment on the Midnight Sun claim on Sullivan, Tofty, and Eureka Creeks during the latter half of 1947.

Iditarod District.—The largest gold producer in the Iditarod district in 1947 was the North American Dredging Co., operating a Diesel-powered connected-bucket dredge (with seventy 3½-cubic-foot buckets) on the Mohawk Association property on Flat and Otter Creeks. The Awe Mining Co.—the second largest producer of gold in the district—

recovered 2,171 ounces of gold and 322 ounces of silver from 160,000 cubic yards of gravel hydraulicked on Chicken Creek from May 28 to October 16, 1947. Hatton, Bauquier & Turner, operating on Willow Creek from May 15 to October 1, recovered 1,392 ounces of gold and 199 ounces of silver from 150,000 cubic yards of gravel washed; equipment included a bulldozer and hydraulic lift, with a dragline excavator to move tailings.

Innoko District.—The only connected-bucket dredge in operation in the district in 1947 was worked by Isacson & Peterson on Ganes Creek from July 1 to Septmeber 30. In 1947, as in the previous year, the Cripple Creek Mining Co., operating a dragline and portable dry-land washing plant on Cripple Creek, was the largest producer of gold in the district. Degnan & Rosander operated similar equipment on Bonanza Creek from May 15 to November 15. Nos. 1, 2, and 3 claims on Helena Gulch (Upper Little Creek) were worked by Hubbard & McFarland, under lease from Robert Jaquemai, from May 1 to September 29, 1947; 1,966 ounces of gold and 352 ounces of silver were recovered from 60,000 cubic yards of gravel sluiced through bedrock boxes using a dragline and bulldozer. Using similar equipment, Uotila & Hard recovered 1,518 ounces of gold and 147 ounces of silver from lower Ophir Creek; Hard and Uotila recovered 555 ounces of gold and 54 ounces of silver from 72,000 cubic yards of gravel washed on Bear Creek; Savage & Matheson recovered 915 ounces of gold and 117 ounces of silver from 72,000 cubic yards of gravel washed on Spruce Creek; Alpha Mining Co. (Patrick Savage, co-owner) recovered 1,446 ounces of gold and 180 ounces of silver from 35,000 cubic yards of gravel washed on Alpha Association property on Flat Creek, and N. J. Vibe operating on Little Creek (Discovery and Gold Run Association) recovered 429 ounces of gold and 88 of silver.

Kantishna District.—Caribou Mines washed 73,203 cubic yards of gravel on Caribou Creek from June 9 to August 24, using a 1½-cubic-yard dragline, three bulldozers, and a dry-land washing plant; 920 ounces of gold and 443 ounces of silver were recovered.

Koyukuk District.—The two principal producers of gold in the Koyukuk district in 1947 were the South Fork Mining Co., operating a dragline bulldozer combination on the South Fork Koyukuk River (2,264 ounces of gold and 212 ounces of silver recovered from 100,000 cubic yards of gravel washed), and the Myrtle Creek Mining Co., using similar equipment on Myrtle Creek (Nos. 12 and 13).

Rampart District.—The Little Minook Mining Co. operated from May 20 to September 18, 1947, recovering 843 ounces of gold and 101 ounces of silver from 150,000 cubic yards of gravel washed; equipment used included a 1½-cubic-yard Diesel-powered dragline excavator, two bulldozers, a pumping unit, and two hydraulic giants.

Ruby District.—Peter Miscovitch & Sons washed 56,100 cubic yards of gold-bearing gravel on Flatt Creek from March 25 to November 14, 1947, recovering, 1,527 ounces of gold and 389 ounces of silver; equipment included nine hydraulic giants, one hydraulic lift, a 1½-cubic-yard dragline excavator, and two bulldozers. Other large producers in the district using this or similar type of equipment were the Iditarod Operating Co., Iver Johnson & Co. (and Eli Linn) on Trail Creek, and Coyle & Rasmussen Mining Co. operating the Midnight claim on Midnight Creek (Fox Association).

Tolovana District.—The Nome Creek Mining Co., the largest producer in the Tolovana district, operated its connected-bucket dredge on Nome Creek from July 2 to October 27. Parker & Son worked the Perfection placer claim on Olive Creek from April 15 to September 20; equipment used included a 1¾-cubic-yard dragline excavator and four bulldozers with a nonfloating washing plant.

OTHER MINERALS

Antimony.—The Stampede mine in Kantishna district was the only Alaskan producer of antimony in 1947. Shipments totaled 40 short tons of concentrates containing 65.41 percent antimony.

Coal.—Alaska mined 349,000 short tons (preliminary figure) of bituminous coal and lignite in 1947. The output was 5 percent less than in 1946 but approximated the second largest on record. The principal mines are in the lower Matanuska Valley field, 45 miles northeast of Anchorage, and the Nenana field, about 75 miles southwest of Fairbanks.

Gem Stones.—Jade (nephrite) production in the Kobuk River region was greatly curtailed in 1947 compared with 1946. The principal producer and fabricator was the Arctic Circle Exploration Co., Inc.

Mercury.—The Decoursey Mountain mine produced 127 flasks of mercury from 25 tons of ore in 1947 and was the only property for which production was reported. The Red Devil mine, active in 1946, will not resume production under conditions prevailing in 1947. Efforts were being made to complete installation of a small retort at the Red Top mine, 15 miles from Dillingham.

Platinum Metals.—Placer deposits in the Goodnews Bay district in Southwestern Alaska in 1947 yielded 13,512 ounces of crude platinum containing 86.5 percent platinum-group metals and 3 percent gold. The output was 41 percent below that of 1946 as a result of dredging operations being temporarily in ground of lower grade.

Sand and Gravel.—Production of sand and gravel in Alaska was 712,496 short tons ($499,269) in 1944. The annual output was considerably greater in 1945–47, but data are not available for publication.

Tin.—The Office of Metals Reserve early in 1948 acquired 2.5 long tons of alluvial tin concentrates, containing 1.3 tons of tin, from Alaska. The year of production is not known but is being recorded as 1947.

Tungsten.—Production of tungsten concentrates in Alaska was 5 short tons (60 percent WO_3 equivalent) in 1947 compared with 26 tons in 1946. Shipments were 13 tons (60 percent WO_3 equivalent) in 1947 and 19 tons in 1946, all of which went to the United States. J. H. Scott Co., operating the Riverside mine near Hyder, produced a small quantity of concentrate averaging 55 percent WO_3 and a smaller tonnage averaging 18 percent WO_3 in 1947. The Big Chief mine of the Yukon Corp. near Fairbanks made no output in 1947.

Miscellaneous Minerals.—Data on production of stone are not available for publication. There was no recorded production of asbestos, chromite, or petroleum in Alaska in 1947.

Arizona
Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By C. E. NEEDHAM AND PAUL LUFF

GENERAL SUMMARY

THE mining of copper ore, the most important part of Arizona's mining industry, rose to 37,810,448 tons in 1947, the largest output in any year in the history of the State and a 24-percent gain over 1946. The State also made a record output (624,397 tons) of zinc-lead ore. These increases in ore output in 1947 resulted in a record production of lead and zinc, the greatest output of silver and copper since 1943, and the greatest yield of gold since 1944. The State remained the largest producer of copper in the United States, ranked third in zinc, and again ranked first in total value of the five metals. Production in 1947 (in terms of recoverable metals) was 95,860 fine ounces of gold, 4,569,084 fine ounces of silver, 732,436,000 pounds of copper, 57,132,000 pounds of lead, and 109,288,000 pounds of zinc, indicating increases over 1946 of 21 percent in gold, 40 percent in silver, 27 percent in copper, 19 percent in lead, and 25 percent in zinc. The total value of the five metals was $182,752,537 in 1947, the highest value since 1918 and a 59-percent gain over 1946. The total value of the gold was $3,355,100—2 percent of the State total value; silver, $4,135,021—2 percent; copper, $153,811,560—84 percent; lead, $8,227,008—5 percent; and zinc, $13,223,848—7 percent. The value of the metals recovered from copper ore was $157,260,992 in 1947 ($96,309,170 in 1946) or 86 percent of the State total. About 89 percent of the State gold production and 76 percent of the silver in 1947 came from six districts—Ajo, Big Bug, Copper Mountain (Morenci), Pioneer (Superior), Verde (Jerome), and Warren (Bisbee); 99 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); 86 percent of the lead came from five districts—Big Bug, Harshaw, Old Hat, Pima, and Warren (Bisbee); and 93 percent of the zinc came from six districts—Big Bug, Cochise (Dragoon), Harshaw, Old Hat, Pima, and Warren (Bisbee).

Of outstanding significance to the copper industry was the continued development by the Magma Copper Co. of the San Manuel property in Pinal County, which has proved to date a total of 462,784,500 tons of copper ore. According to the company annual report, the ore body is probably the second largest tonnage of copper ore in any known ore body in the United States, and its economic value is great.

The average price of silver, copper, and lead rose in 1947—silver to $0.905 per fine ounce, copper to $0.210 per pound, and lead to $0.144 per pound. The average price of zinc declined to $0.121 per pound, and the price of gold remained at $35 per fine ounce. The Federal law providing for premium payments for overquota production of copper, lead, and zinc expired June 30, 1947.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1943–47, and total, 1860–1947, 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
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
1946	194	33	31,058,179	79,024	2,765,840	3,268,765	2,641,162
1947	315	30	38,636,280	95,860	3,355,100	4,569,084	4,135,021
1860–1947			(1)	10,964,019	271,235,820	297,256,498	221,399,720

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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	80,462,000	9,251,980	95,963,006
1946	578,446,000	93,708,252	47,860,000	5,216,740	87,330,000	10,654,260	114,986,254
1947	732,436,000	153,811,560	57,132,000	8,227,008	109,288,000	13,223,848	182,752,537
1860–1947	[2] 11,544,310	3,463,088,362	[2] 402,623	56,588,140	[2] 332,114	66,597,769	4,078,909,811

[1] Figure not available.
[2] Short tons.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1947, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	7,539	381,423	61,690,000	4,838,000	9,490,000
February	7,084	381,425	59,194,000	4,376,000	9,132,000
March	8,484	377,423	64,302,000	4,638,000	9,714,000
April	8,339	412,406	60,734,000	4,994,000	9,868,000
May	8,564	397,440	63,052,000	4,780,000	9,150,000
June	8,549	391,420	59,734,000	5,138,000	9,892,000
July	7,908	377,425	64,222,000	4,776,000	9,190,000
August	7,338	385,425	59,724,000	4,618,000	8,440,000
September	7,593	359,420	59,218,000	4,542,000	8,012,000
October	8,038	377,430	62,226,000	4,934,000	9,032,000
November	8,537	362,427	58,054,000	4,722,000	8,660,000
December	7,887	365,420	60,286,000	4,776,000	8,708,000
Total 1947	95,860	4,569,084	732,436,000	57,132,000	109,288,000

Gold and silver produced at placer mines in Arizona, 1943–47, in fine ounces, in terms of recovered metals

Year	Sluicing [1]		Drift mining		Dredges: Dry-land [2]		Dredges: Dragline floating [2]		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1943	315	14	4						319	14
1944	242	90							242	90
1945	535	45	5						540	45
1946	88	2	9		116	14	185	46	398	62
1947	243	18	42		29	3			314	21

[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.—Most of the gold produced in Arizona is a byproduct of copper ore and zinc-lead ore; and, owing to a substantial increase in both classes of ore in 1947, the State output of gold rose to 95,860 ounces, a 21-percent gain over 1946. In 1947, 79 percent of the State gold output was recovered from copper ore, 14 percent from zinc-lead ore, 5 percent from siliceous ores, and most of the remainder from lead ore. Gold from copper ore increased 14,364 ounces, that from siliceous ores 1,008 ounces, and that from zinc-lead ore 722 ounces. Gold from placers decreased from 398 ounces to 314 ounces. The New Cornelia mine of the Phelps Dodge Corp. in Pima County was by far the leading gold producer in Arizona; it was followed by the Copper Queen (Bisbee) branch of the Phelps Dodge Corp. in Cochise County, the Iron King mine in Yavapai County, the Magma mine in Pinal County, the Morenci branch of the Phelps Dodge Corp. in Greenlee County, and the United Verde branch of the Phelps Dodge Corp. in Yavapai County; these six properties (all copper mines except the Iron King) 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 1947 these two classes of ore yielded 4,181,916 ounces of silver (92 percent of the State total) compared with 2,970,243 ounces in 1946. Copper ore yielded

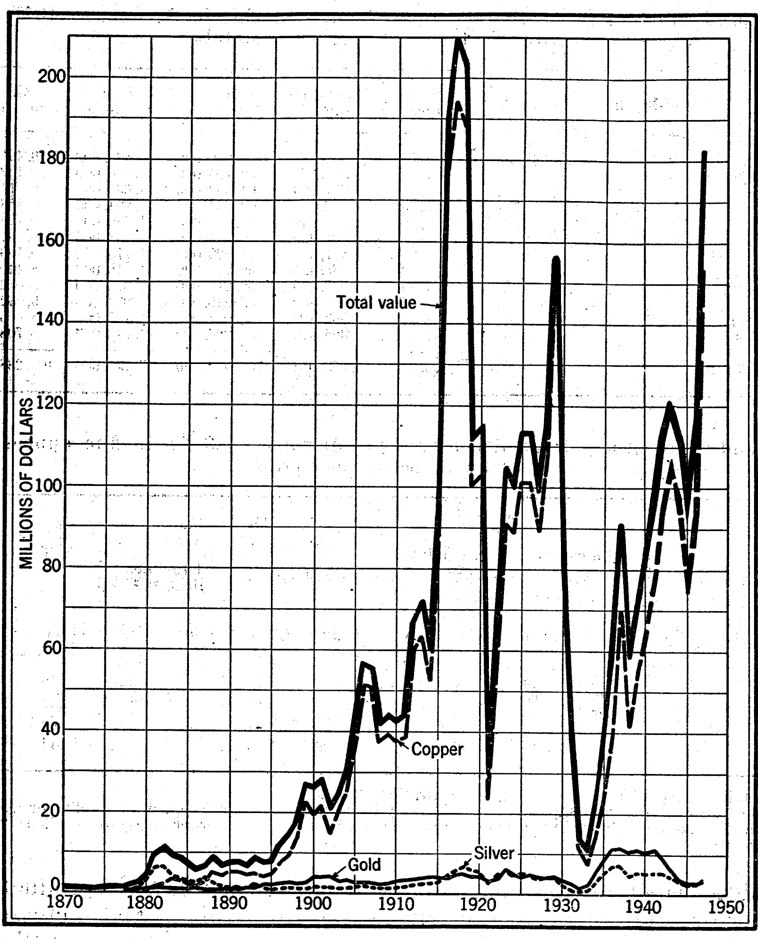

FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead, and zinc in Arizona, 1870–1947. The value of lead and zinc has been less than $2,000,000 annually, except in a few years.

2,583,264 ounces of silver, 57 percent of the State total, and zinc-lead ore 1,598,652 ounces, 35 percent; the remainder came principally from siliceous ores, lead ore, zinc-copper ore, zinc-lead-copper ore, and zinc ore. Silver from copper ore increased 818,706 ounces or 46 percent and that from zinc-lead ore 392,967 ounces or 33 percent. The Phelps Dodge Corp. continued to be the chief silver producer in Arizona, and its output was about 1,000,000 ounces more than in 1946; its four properties (Copper Queen, Morenci, New Cornelia, and United Verde) produced 68 percent of the State gold output, 61 percent of the silver, and more than 62 percent of the copper. Other large silver producers in Arizona in 1947 were Iron King, Magma, Flux-January-Norton, and San Xavier (Eagle-Picher Mining & Smelting Co.) properties.

Copper.—With no labor strikes, an improvement in the labor supply, and a rise in the price of copper in 1947, Arizona's output of recoverable copper rose to 732,436,000 pounds, the largest output since 1943 and a 27-percent gain over 1946. The Copper Mountain (Morenci) district, with an output of 295,798,900 net pounds of copper, remained the leading copper-producing area in the State; it was followed by the Globe-Miami district with 182,064,100 pounds, Ajo with 99,374,000, Mineral Creek (Ray) with 37,870,600, Warren (Bisbee) with 34,118,000, Pioneer (Superior) with 31,844,300, Verde (Jerome) with 29,205,600, and Eureka (Bagdad) with 12,981,900. Marked increases in copper output were made in each of these districts except the Verde (Jerome), where a decline of 3,145,400 pounds was recorded. Copper ore and its products yielded 725,100,822 pounds of copper, as follows: 33,494,441 tons of copper ore treated by concentration yielded 81 percent; 644,207 tons of copper ore shipped crude to smelters, 8 percent; and 3,671,800 tons of copper ore leached and 10,577 tons of cement copper (from mine-water precipitates and underground leaching operations), 11 percent. The Morenci branch of the Phelps Dodge Corp. was again the largest copper producer in Arizona in 1947; it was followed in order by the New Cornelia branch of the Phelps Dodge Corp., Inspiration, Miami, Castle Dome, Ray (Kennecott Copper Corp.), Copper Queen branch of the Phelps Dodge Corp., Magma, United Verde branch of the Phelps Dodge Corp., and Bagdad properties.

Lead and Zinc.—In 1947 Arizona exceeded its 1946 record output of both lead and zinc. The production of lead in 1947 (57,132,000 pounds) and of zinc (109,288,000 pounds) was the largest of any year in the history of the State; the lead output exceeded that of 1946 (a record) by 9,272,000 pounds or 19 percent and the zinc output that of 1946 by 21,958,000 pounds or 25 percent. These increases in both lead and zinc resulted from a greater yield of zinc-lead ore from all of the principal zinc-lead districts in the State, especially the Warren (Bisbee) district. The Copper Queen mine of the Phelps Dodge Corp. at Bisbee was by far the largest producer of lead and zinc in Arizona in 1947. Other large producers of lead, in order of output, were the St. Anthony property at Tiger, San Xavier mine near Sahuarita, Iron King mine at Humboldt, and Flux-January-Norton group near Patagonia. Other large producers of zinc, in order of output, were the Iron King, San Xavier, St. Anthony, Republic & Mammoth, Flux-January-Norton, and Abril properties. Of the State total, 47 percent of the lead and 60 percent of the zinc came from the Warren (Bisbee) district in Cochise County. Other large producing districts of both lead and zinc were the Old Hat in Pinal County, Big Bug in Yavapai County, Pima in Pima County, Harshaw in Santa Cruz County, and Wallapai in Mohave County. About 89 percent of the total lead and 89 percent of the total zinc came from zinc-lead ore; 10 percent of the total lead came from lead ore and most of the remainder of the lead from zinc-lead-copper ore, zinc ore, and siliceous ores; and 10 percent of the total zinc came from zinc-copper ore and zinc ore and nearly all the rest from zinc-lead-copper ore.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1947, 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
Cochise	24	1	22,052	$771,820	1,651,621	$1,494,717
Coconino	4				222	201
Gila	30		3,079	107,765	207,390	187,688
Graham	11		236	8,260	16,073	14,546
Greenlee	7		8,710	304,850	611,547	553,450
Maricopa	16	2	88	3,080	8,642	7,821
Mohave	27		589	20,615	51,874	46,946
Pima	32	1	30,658	1,073,030	527,316	477,221
Pinal	26		10,535	368,725	427,979	387,321
Santa Cruz	25		172	6,020	199,947	180,952
Yavapai	88	15	19,363	677,705	830,810	751,883
Yuma	25	11	378	13,230	35,663	32,275
Total: 1947	315	30	95,860	3,355,100	4,569,084	4,135,021
1946	194	33	79,024	2,765,840	3,268,765	2,641,162

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Cochise	36,545,000	$7,674,450	28,496,500	$4,103,496	73,995,000	$8,953,395	$22,997,878
Coconino	15,400	3,234					3,435
Gila	183,150,400	38,461,584	1,190,000	171,360	165,000	19,965	38,948,362
Graham	107,600	22,596	1,602,500	230,760	39,000	4,719	280,881
Greenlee	295,799,500	62,117,895	11,000	1,584			62,977,779
Maricopa	175,200	36,792	97,000	13,968			61,661
Mohave	633,600	133,056	1,335,000	192,240	2,130,400	257,778	650,635
Pima	101,478,000	21,310,380	6,016,000	866,304	9,816,200	1,187,761	24,914,696
Pinal	70,258,800	14,754,348	9,675,000	1,393,200	6,853,200	829,237	17,732,831
Santa Cruz	356,500	74,865	3,385,500	487,512	4,706,200	569,450	1,318,799
Yavapai	43,871,400	9,212,994	4,757,500	685,080	11,583,000	1,401,543	12,729,205
Yuma	44,600	9,366	566,000	81,504			136,375
Total: 1947	732,436,000	153,811,560	57,132,000	8,227,008	109,288,000	13,223,848	182,752,537
1946	578,446,000	93,708,252	47,860,000	5,216,740	87,330,000	10,654,260	114,986,254

MINING INDUSTRY

Mining operations at the principal copper and zinc-lead-silver mines in Arizona were continuous throughout the year, resulting in the greatest output of copper ore and zinc-lead ore in the history of the State. No labor strikes interfered with operations in 1947, and the increase in the market prices of silver, copper, and lead and a steady price for zinc caused greater activity at all mining districts in the State. A shortage of labor still exists at some of the underground copper mines and at zinc-lead mines; however, some of the larger copper producers reported that the supply of labor was beginning to meet requirements at the close of the year. The total production of ore of all classes increased from 31,058,179 tons in 1946 to 38,636,280 in 1947. The output of copper ore was 37,810,448 tons—7,424,299 tons more than in 1946, a 24-percent gain; zinc-lead ore, 624,397 tons—109,350 tons more than in 1946, a 21-percent gain; zinc-copper ore, 82,192 tons—a 29-percent gain; lead ore, 24,478 tons—an 82-percent gain; zinc ore, 16,619 tons—a 26-percent gain; and zinc-lead-copper ore, 4,944 tons—a 60-percent loss. The output of siliceous ores was 73,190 tons compared with 53,094 tons in 1946—a 38-percent increase. Of the State total ore, 37,694,406 tons (97.5 percent) was copper ore mined in the Copper Mountain (Morenci), Globe-Miami, Ajo, Mineral Creek (Ray), Eureka (Bagdad), Verde (Jerome), Warren (Bisbee), and Pioneer (Superior) districts, and 621,444 tons (99.5 percent) of the State total zinc-lead ore was mined in the Warren (Bisbee), Big Bug, Old Hat (Oracle), Pima, Harshaw, and Wallapai (Chloride) districts. Mining operations at three open pits—Ajo, Miami (Castle Dome), and Morenci—produced 25,861,211 tons of copper ore in 1947 compared with 20,052,078 tons in 1946.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Arizona in 1947, 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	60	27,722	2,823	7,795	40,408	7,577	70,800
Dry and siliceous gold-silver ore	10	27,933	1,388	75,123	149,616	41,699	----------
Dry and siliceous silver ore	31	17,535	361	135,368	32,297	7,962	----------
	101	73,190	4,572	218,286	222,321	57,238	70,800
Copper ore	101	37,810,448	75,711	[1] 2,583,264	[2] 725,100,822	14,450	----------
Lead ore	105	24,478	1,398	94,728	230,003	5,955,323	298
Lead-copper ore	2	12	----------	101	1,214	1,954	----------
Zinc ore	8	16,619	53	10,256	200,997	65,084	3,199,606
Zinc-copper ore	10	82,192	168	45,355	2,346,941	33,095	8,082,163
Zinc-lead ore	32	624,397	13,639	1,598,652	4,229,942	50,700,341	97,248,183
Zinc-lead-copper ore	3	4,944	5	18,421	103,760	304,515	686,950
Total lode mines	[3] 315	38,636,280	95,546	[1] 4,569,063	[2] 732,436,000	57,132,000	109,288,000
Placers	30	----------	314	21	----------	----------	----------
Total: 1947	345	38,636,280	95,860	[1] 4,569,084	[2] 732,436,000	57,132,000	109,288,000
1946	227	31,058,179	79,024	[4] 3,268,765	[5] 578,446,000	47,860,000	87,330,000

[1] Includes 255 ounces recovered from underground mine-water precipitates.
[2] Includes 83,310,570 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 475 ounces recovered from underground mine-water precipitates.
[5] Includes 73,554,391 pounds recovered from ore leached and mine-water precipitates.

METALLURGIC INDUSTRY

Of the 38,636,280 tons of ore produced in 1947 in Arizona, 34,231,377 tons (88.6 percent) were treated at 28 concentration plants, 3,671,800 tons (9.5 percent) at 2 leaching plants, 21,878 tons at 2 cyanidation plants, and 456 tons at 10 amalgamation plants; 710,769 tons (almost 2 percent) were shipped crude to smelters.

Ore treated at concentration plants in 1947 comprised chiefly 33,494,441 tons of copper ore, 624,346 tons of zinc-lead ore, 82,192 tons of zinc-copper ore, and 16,619 tons of zinc 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), Castle Dome (10,000-ton), Bagdad (3,000-ton), and Superior (1,150-ton), and the copper-leaching plants at Inspiration (9,000-ton) and Miami (3,000-ton) were operated continuously in 1947, most of them at a higher rate than in 1946. The copper smelters of the Phelps Dodge Corp. at Clarkdale, Douglas, and Morenci, the International Smelting & Refining Co. copper smelter at Miami, the American Smelting & Refining Co. copper smelter at Hayden, and the Magma Copper Co. copper smelter at Superior operated continuously throughout the year. Most of the copper concentrates produced at mills in Arizona are treated at smelters in Arizona, but all the lead concentrates produced at mills in Arizona in 1947 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.; Bartlesville, Okla.; and Great Falls and Anaconda, Mont.

The following tables give details of the treatment of ores produced in Arizona in 1947.

Mine production of metals in Arizona in 1947, 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	456	329	80			
Ore and old tailings cyanided	21,878	955	7,010			
Concentrates smelted	1,268,436	65,551	3,190,591	593,765,148	51,614,538	109,268,900
Ore smelted	710,769	28,711	1,371,127	55,360,282	5,517,462	19,100
Copper precipitates smelted	10,577		255	[1] 15,392,462		
Copper ore leached	[2] 3,671,800			67,918,108		
Placer		314	21			
Total: 1947		95,860	4,569,084	732,436,000	57,132,000	109,288,000
1946		79,024	3,268,765	578,446,000	47,860,000	87,330,000

[1] Distributed as follows: Cochise County, 570,637 pounds; Gila County, 7,085,380 pounds; Greenlee County, 775,000 pounds; Mohave County, 385,224 pounds; Pinal County, 6,354,421 pounds; and Yavapai County, 221,800 pounds.

[2] Treated by straight leaching at 1 plant in Gila County and 1 plant in Mohave County.

Gross metal content of Arizona ore treated at mills in 1947, by classes of ore and methods of treatment [1]

Class of ore	Method of treatment	Ore (short tons)	Gross metal content of mill feed: Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold.	Amalgamation	456	393	159	40		
Do	Cyanidation	20,078	1,700	5,070			
Do	Concentration	5,331	536	1,800	32,350	1,800	152,000
Dry and siliceous silver.	Cyanidation	1,800	33	4,700			
Copper	Concentration	33,494,441	66,880	1,921,009	701,777,060		5,570,000
Lead	do	3,504	77	14,118	4,202	625,737	50,900
Zinc	do	16,619	96	14,372	275,339	114,028	4,216,754
Zinc-copper	do	82,192	218	59,169	2,687,614	79,902	10,376,554
Zinc-lead	do	624,346	21,885	2,006,857	6,079,880	59,727,248	127,139,348
Zinc-lead-copper	do	4,944	7	21,516	155,454	350,277	887,440
Total: 1947		34,253,711	91,825	4,048,770	711,011,939	60,898,992	148,392,996
1946		27,616,655	88,450	3,411,067	561,084,992	53,671,749	126,116,936

[1] Exclusive of copper ore by leaching.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Arizona in 1947, by types of mills and by counties, in terms of recovered metals

County	Material treated (short tons)	Recovered in bullion: Gold (fine ounces)	Recovered in bullion: Silver (fine ounces)	Concentrates smelted and recovered metal: Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
AMALGAMATION MILLS									
Gila	17	13	4						
Santa Cruz	235	45	31	3	11	14	19		
Yavapai	128	52	18						
Yuma	76	219	27	1	14	3			
Total: 1947	456	329	80	4	25	17	19		
1946	83	194	33						
CYANIDATION MILLS									
Mohave	1,800	28	3,989						
Yavapai	20,078	927	3,021						
Total: 1947	21,878	955	7,010						
1946	23,505	889	6,823						
Grand total: 1947	22,334	1,284	7,090	4	25	17	19		
1946	23,588	1,083	6,856						

Mine production of metals from concentrating mills in Arizona in 1947, 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	366,917	102,828	3,112	799,036	4,994,831	26,950,838	73,995,000
Gila	8,739,243	161,870	2,800	171,621	107,115,059	254,686	165,000
Graham	223	44		328		1,200	39,000
Greenlee	14,804,537	552,030	8,115	534,400	293,400,000		
Mohave	25,419	4,182	480	45,727	241,595	1,278,711	2,130,400
Pima	7,160,668	190,986	30,482	500,355	99,934,825	5,850,803	9,816,200
Pinal	1,800,657	121,316	8,649	344,624	57,717,248	9,197,779	6,853,200
Santa Cruz	47,942	7,224	43	184,921	209,561	3,049,012	4,706,200
Yavapai	1,283,706	127,592	11,845	602,344	30,152,010	4,695,973	11,563,900
Yuma	2,065	360		7,218		335,536	
Total: 1947	34,231,377	1,268,432	65,526	3,190,574	593,765,129	51,614,538	109,268,900
1946	27,593,067	1,008,835	62,422	2,493,508	471,549,204	44,434,907	87,070,205

Gross metal content of concentrates produced from ores mined in Arizona in 1947, 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 gold	25	122	306	326	664	
Copper	1,102,150	53,012	1,629,942	603,236,055	25,908	4,962,647
Lead	52,672	10,753	1,216,785	3,488,758	48,615,453	9,830,302
Lead-copper	325	35	18,977	100,066	363,529	92,009
Zinc	110,671	2,906	467,802	2,149,760	5,790,031	116,362,517
Zinc-lead	19	1	2,704	1,000	17,915	6,570
Iron	2,574	607	7,335	5,647	54,454	372,670
Total: 1947	1,268,436	67,436	3,343,851	608,981,612	54,867,954	131,626,715
1946	1,008,835	65,718	2,785,507	485,240,935	48,397,994	111,518,451

Mine production of metals from Arizona concentrates shipped to smelters in 1947, in terms of recovered metals

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Cochise	102,828	3,112	799,036	4,994,831	26,950,838	73,995,000
Gila	161,870	2,800	171,621	107,115,059	254,686	165,000
Graham	44		328		1,200	39,000
Greenlee	552,030	8,115	534,400	293,400,000		
Mohave	4,182	480	45,727	241,595	1,278,711	2,130,400
Pima	190,986	30,482	500,355	99,934,825	5,850,803	9,816,200
Pinal	121,316	8,649	344,624	57,717,248	9,197,779	6,853,200
Santa Cruz	7,227	54	184,935	209,580	3,049,012	4,706,200
Yavapai	127,592	11,845	602,344	30,152,010	4,695,973	11,563,900
Yuma	361	14	7,221		335,536	
Total: 1947	1,268,436	65,551	3,190,591	593,765,148	51,614,538	109,268,900
1946	1,008,835	62,422	2,493,508	471,549,204	44,434,907	87,070,205
BY CLASSES OF CONCENTRATES						
Dry gold	25	122	306	275	609	
Copper	1,102,150	51,633	1,539,259	588,953,842	14,754	
Lead	52,672	10,753	1,216,785	2,887,794	46,438,349	2,135
Lead-copper	325	35	18,977	84,616	345,884	
Zinc	110,671	2,400	405,225	1,833,205	4,745,794	109,260,961
Zinc-lead	19	1	2,704	850	17,600	4,702
Iron	2,574	607	7,335	4,566	51,548	1,102
Total 1947	1,268,436	65,551	3,190,591	593,765,148	51,614,538	109,268,900

Gross metal content of Arizona crude ore shipped to smelters in 1947, 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	1,857	1,081	3,221	15,382	7,606	1,663
Dry and siliceous gold-silver	27,933	1,388	75,123	166,012	66,921	2,580
Dry and siliceous silver	15,735	333	131,379	42,573	10,161	
Copper	644,207	24,551	1,077,921	57,832,051	25,819	4,793,852
Lead	20,974	1,357	83,073	269,335	5,626,227	578,913
Lead-copper	12		101	1,373	2,045	
Zinc-lead	51	1	309	1,420	4,870	26,379
Total: 1947	710,769	28,711	1,371,127	58,328,146	5,743,649	5,403,387
1946	472,483	15,121	767,864	35,375,016	3,682,559	6,684,577

Mine production of metals from Arizona crude ore shipped to smelters in 1947, in terms of recovered metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Cochise	307,066	18,935	852,430	30,979,532	1,545,662	----------
Coconino	137	----------	222	15,400	----------	----------
Gila	33,734	266	35,665	1,031,853	935,314	----------
Graham	5,766	236	15,745	107,600	1,601,300	----------
Greenlee	79,338	595	77,147	1,624,500	11,000	----------
Maricopa	2,616	83	8,642	175,200	97,000	----------
Mohave	491	81	2,158	6,781	56,289	----------
Pima	33,757	173	26,961	1,543,175	165,197	----------
Pinal	53,937	1,886	83,355	6,187,131	477,221	----------
Santa Cruz	4,107	73	14,981	146,920	336,488	----------
Yavapai	188,043	6,289	225,406	13,497,590	61,527	19,100
Yuma	1,777	94	28,415	44,600	230,464	----------
Total: 1947	710,769	28,711	1,371,127	55,360,282	5,517,462	19,100
1946	472,483	15,121	767,864	33,342,405	3,425,093	259,795
BY CLASSES OF ORE						
Dry and siliceous gold	1,857	1,081	3,221	14,410	6,539	----------
Dry and siliceous gold-silver	27,933	1,388	75,123	149,616	41,699	----------
Dry and siliceous silver	15,735	333	131,379	32,297	7,962	----------
Copper	644,207	24,551	1,077,921	54,934,237	14,450	----------
Lead	20,974	1,357	83,073	227,308	5,440,081	----------
Lead-copper	12	----------	101	1,214	1,954	----------
Zinc-lead	51	1	309	1,200	4,777	19,100
Total 1947	710,769	28,711	1,371,127	55,360,282	5,517,462	19,100

REVIEW BY COUNTIES AND DISTRICTS

COCHISE COUNTY

California District.—The output of the California district in 1947 was 106 tons of lead ore from the Carbonate, Hilltop, and Pine Zinc claims near Portal and 20 tons of silver ore from the El Tigre claim.

Cochise District.—Mining and milling zinc-copper ore at the Republic and Mammoth mines by the Coronado Copper & Zinc Co. were continuous throughout the year; 65,116 tons of ore, containing an average of 0.40 ounce of silver to the ton, 1.67 percent copper, and 6.10 percent zinc, were treated in the company 150-ton flotation mill. In addition, 1,467 tons of copper ore were shipped direct to a smelter.

Dos Cabezas and Tevis District.—The Dorsey Bros. operated the LeRoy Consolidated property in 1947 and shipped 61 tons of gold-silver-lead ore, and C. C. Clark worked a placer claim in Gold Gulch and recovered 5 fine ounces of gold.

Hartford (Huachuca Mountains) District.—Operations at the Cave Creek Canyon property by the Cave Mountain Mines Corp. produced 388 tons of ore, containing 285 ounces of silver, 3,938 pounds of copper, 50,281 pounds of lead, and 73,716 pounds of zinc, and 25 tons of lead ore were produced from the James mine.

Swisshelm (Elfrida) District.—The output of the Swisshelm district in 1947 was 5,253 tons of ore, containing 546 ounces of gold, 28,494 ounces of silver, 5,428 pounds of copper, 1,410,693 pounds of lead, and 75,000 pounds of zinc. The Mountain Queen (Scribner) mine produced 4,063 tons of ore and the Chance mine 1,190 tons.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1947 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	4		126	2		2	937		937	100	42,500		$7,059
Cochise	1		66,583				15,580		15,580	2,072,000	8,000	6,285,200	1,210,881
Dos Cabezas and Tevis	1	1	61	49	5	54	400		400	400	8,000		3,488
Golden Rule	1		47				10		10	900			198
Hartford (Huachuca Mountains)	2		413	1		1	305		305	3,400	54,000	18,000	10,979
Swisshelm	2		5,253	513		513	27,663		27,663	4,500	1,403,500		246,039
Tombstone	6		32,034	1,328		1,328	81,189		81,189	153,400	119,000	639,800	246,722
Turquoise	4		10,588	23		23	2,979		2,979	192,300	17,500	1,960,000	283,564
Warren	3		558,878	20,131		20,131	1,522,558		1,522,558	34,118,000	26,844,000	65,092,000	20,988,948
Coconino County: Jacob Canyon	4		137				222		222	15,400			3,435
Gila County:													
Banner and Dripping Springs	5		29,662	223		223	16,811		16,811	1,040,900	758,000	165,000	370,725
Globe-Miami	21		12,389,332	2,761		2,761	190,242		190,242	182,064,100	413,000		38,561,737
Green Valley	1		2	2		2							70
Pioneer [1]	1		58	92		92	252		252	700	19,000		6,331
Summit	2		2,047	1		1	85		85	44,700			9,499
Graham County:													
Aravaipa	8		5,960	229		229	15,958		15,958	106,900	1,588,500	39,000	278,369
Clark	1		8	1		1	21		21				54
Stanley	2		21	6		6	94		94	700	14,000		2,458
Greenlee County:													
Ash Peak	1		8,305	308		308	71,284		71,284				75,292
Copper Mountain (Morenci)	4		14,875,523	8,400		8,400	540,232		540,232	295,798,900	3,200		62,901,140
Metcalf	2		47	2		2	31		31	600	7,800		1,347
Maricopa County:													
Cave Creek and Camp Creek	2		208	20		20	6,348		6,348	14,900			9,574
Gila Bend Mountains	1		5	6		6	10		10				219
New River	1		1,960	14		14	485		485	157,700			34,046
Osborn	4		52				42		42	100	23,000		3,371
San Domingo		2			5	5							175
Sunflower	1		194	33		33	1,526		1,526	400	32,500		7,300
Vulture	5		178	1		1	221		221	1,800	41,500		6,589
White Butte	1		9	9		9	10		10				324
White Tanks	1		10							300			63
Mohave County:													
Bentley	1		10				21		21	3,800			817
Cedar Valley	3		3,275	15		15	2,137		2,137	173,200	11,000	417,200	90,896
Greenwood	1		3	13		13	10		10				464
Indian Secret	1		1,800	28		28	3,989		3,989				4,590
Maynard	1		10				327		327	100	500		389
Music Mountain	1		12	26		26	63		63				967

Owens	5		69	33		33	74		74	400	15,000		3,466
Wallapai	14		46,224	474		474	45,253		45,253	456,100	1,308,500	1,713,200	549,046
Pima County:													
Ajo	1		7,095,446	30,477		30,477	353,789		353,789	99,374,000			22,255,414
Amole	2		124	7		7	63		63	100	11,000		1,907
Arivaca	1	1	19	8	3	11	32		32				414
Baboquivari	1		50	2		2	222		222	2,000			691
Cababi	2		30	2		2	494		494	200			559
Cerro Colorado	1		31				589		589	100			554
Empire	2		101	3		3	274		274	600	26,500		4,295
Helvetia (Rosemont)	9		29,801	124		124	9,936		9,936	1,264,400	3,000	41,800	284,346
Old Hat [2]	4		1,019	13		13	2,011		2,011	112,900	7,800		27,107
Pima (Sierritas, Papago, Twin Buttes)	6		62,011				143,653		143,653	516,400	5,818,000	9,453,400	2,220,104
Roskruge and Waterman	1		167				990		990	8,100	8,200		3,778
Silver Bell	2		5,536	19		19	15,263		15,263	199,200	141,500	321,000	115,527
Pinal County:													
Bunker Hill	1		598	3		3	1,085		1,085	2,100	31,200		6,021
Casa Grande	2		62	1		1	64		64	2,500	1,000		762
Cottonwood	2		38	72		72	211		211	2,900			3,320
Crozier Peak	1		30				10		10	800			177
Mineral Creek (Ray)	5		1,513,193	431		431	28,074		28,074	37,870,600	397,500		8,050,558
Mineral Hill	5		281	57		57	316		316	1,300	42,500		8,674
Old Hat [2]	4		89,149	626		626	82,715		82,715	455,800	9,198,000	6,853,200	2,346,234
Pioneer (Superior)[1]	4		249,311	9,339		9,339	314,126		314,126	31,844,300			7,298,452
Sasco	1		1,900	6		6	1,200		1,200	77,700			17,613
Vekol	1		32				178		178	800	4,800		1,020
Santa Cruz County:													
Gardner Canyon	1		1,239	6		6	3,137		3,137	12,000			5,569
Greaterville	1		36	1		1	695		695	5,000			1,714
Harshaw	3		43,222	33		33	168,800		168,800	108,100	2,786,800	4,011,400	1,063,298
Nogales	2		3	4		4	21		21		500		231
Oro Blanco	4		1,073	89		89	4,200		4,200	8,600	121,000	19,800	28,542
Pajarito	1		1				10		10		800		124
Patagonia (Duquesne)	5		5,547	3		3	18,810		18,810	196,300	309,000	627,000	178,714
Tyndall	7		1,155	36		36	4,242		4,242	25,600	166,200	48,000	40,216
Wrightson	1		8				32		32	900	1,200		391
Yavapai County:													
Agua Fria	2		5,113	128		128	1,769		1,769	328,700			75,108
Big Bug	7	4	124,274	9,510	210	9,720	386,431	21	386,452	378,500	4,646,000	9,982,200	2,646,294
Black Canyon	3	2	5,293	409	15	424	2,011		2,011	25,900	900	70,800	30,796
Black Hills	2		4				22		22	600			146
Black Rock	3		9	1		1	10		10	800			212
Blue Tank	1	1	106	1	2	3	10		10	9,000			2,004
Bullard (Pierce)	1		2							300			63
Castle Creek	3	2	57	27	3	30	536		536	2,500	7,600		3,154
Cherry Creek	2		37	34		34	32		32				1,219
Copper Basin	2		15,096	5		5	822		822	754,000	3,300	56,200	166,534
Eureka (Bagdad)	13		959,441	9		9	31,326		31,326	12,981,900	31,700	514,400	2,821,671
Granite Creek		1			1	1							35
Hassayampa	9	1	566	190	2	192	3,558		3,558	4,400	45,700	44,600	22,842
Kirkland	1		5	2		2							70
Martinez	1		20,078	927		927	3,021		3,021				35,179
Peck	2		239	1		1	2,736		2,736	700	100		2,672

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1947 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				
Yavapai County—Continued													
Pine Grove	4		10,321	481		481	28,011		28,011	170,000	8,000	912,600	$189,462
Silver Mountain	1		1				11		11		300		53
Tiger	2		102	106		106	180		180	700			4,020
Turkey Creek	4		30				1,673		1,673	400	1,000	400	1,790
Verde (Jerome)	3		350,645	6,931		6,931	367,778		367,778	29,205,600			6,708,600
Walker	10	1	183	163	1	164	547		547	1,100	12,500	1,800	8,484
Walnut Grove	4		118	7		7	21		21	6,300			1,587
Weaver	5	3	224	174	16	190	137		137				6,774
White Picacho	3		11	7		7	147		147		400		436
Yuma County:													
Castle Dome	5		2,464				9,631		9,631		459,000		74,812
Cienega	1		2							100			21
Dome		1			9	9							315
Ellsworth (Harqua Hala)	6		334	50		50	105		105	38,200			9,867
Eureka	2		2				22		22		1,000		164
La Cholla		1			3	3							105
La Paz		2			5	5							175
Middle Camp		2			4	4							140
Plomosa	7	4	975	260	29	289	25,842		25,842	1,700	106,000		49,123
Santa Maria	2		107	11		11	32		32	4,300			1,317
Trigo		1			1	1							35
Weaver	1		2	1		1	31		31	300			126
Yuma	1		32	5		5							175
Total 1947	315	30	38,636,280	95,546	314	95,860	4,569,063	21	4,569,084	732,436,000	57,132,000	109,288,000	182,752,537

[1] Pioneer district is in both Gila and Pinal Counties.
[2] Old Hat district is in both Pima and Pinal Counties.

Tombstone District.—Old siliceous tailings (27,564 tons), containing 1,310 ounces of gold, 72,815 ounces of silver, 162,652 pounds of copper, and 52,333 pounds of lead, were shipped from the Grand Central dump near Fairbank to the smelters at El Paso, Tex., and Douglas, Ariz. The remainder of the district output comprised 4,000 tons of zinc ore produced from the San Juan group by Operations, Inc.; 468 tons of silver-lead ore from the Great Carbonite, Tombstone, and Tombstone Extension properties; and 2 tons of silver ore from the Elsicor claim.

Turquoise (Courtland, Pearce, Gleeson) District.—The Shattuck Denn Mining Corp. continued to develop the Abril mine near Pearce and hauled 9,990 tons of ore (containing 26 ounces of gold, 3,508 ounces of silver, 188,162 pounds of copper, 12,725 pounds of lead, and 2,435,910 pounds of zinc) to its custom flotation mill at Bisbee. The rest of the district output was mainly 332 tons of copper ore from the Great Western mine and 240 tons of gold-silver-copper ore from the Shannon group.

Warren (Bisbee, Warren) District.—The value of the metal output of the Warren district increased from $10,106,446 in 1946 to $20,988,948 in 1947, owing to the marked gain in output of copper ore and zinc-lead ore from the Copper Queen mine of the Phelps Dodge Corp. As a result of the large output of zinc-lead ore, the district made a record production of lead and zinc. The Phelps Dodge Corp. reported that the Copper Queen branch produced 286,730 tons of zinc-lead ore and 270,719 tons of copper ore in 1947 compared with 211,956 and 46,560 tons, respectively, in 1946. In addition, 778 tons of copper precipitates (produced by surface and underground precipitation plants), 100 tons of old mill cleanings (containing gold, silver, and copper), and 38 tons of lead ore were shipped to smelters. The zinc-lead ore was treated in the corporation 900-ton flotation mill at Bisbee, which yielded 26,605 tons of lead concentrate and 63,659 tons of zinc concentrate, and the copper ore was shipped direct to the corporation smelter at Douglas.

According to the corporation annual report for 1947, a shortage of underground miners continued at the Copper Queen branch, which prevented maximum production in both the copper and zinc-lead divisions. However, the copper produced in 1947 totaled 32,304,614 net pounds compared with 7,126,062 net pounds in 1946; lead produced totaled 21,241,846 net pounds compared with 19,826,044 net pounds; and zinc produced totaled 56,572,604 net pounds compared with 44,105,768 net pounds. During the year 24,830 feet of prospecting and development, 6,841 feet of stope preparation, and 43,239 feet of diamond drilling were completed. Ore reserves were adequately maintained.

The rest of the district output was mainly 682 tons of copper ore, 522 tons of lead ore, and 45 tons of gold-silver ore produced from the Shattuck mine at Bisbee by lessees.

The Shattuck Denn Mining Corp. 150-ton flotation mill at Bisbee was utilized entirely in 1947 for treating custom ores; during the year it handled 15,924 tons of various classes of ores, principally zinc ore from the Abril mine near Pearce, zinc-copper ore from the Antler and Copper World properties near Yucca, and zinc-lead ore from the "79" mine near Hayden. According to the corporation annual report for 1947, with sale of the Denn mine in March 1947 and termination in December 1947 of the lease by the lessee at the Shattuck mine, the corporation's mining operations in the Bisbee district have ended after a period of approximately 43 years.

COCONINO COUNTY

All the output in Coconino County in 1947 was carbonate copper ore (137 tons) shipped by the Paria Copper Co. from the Black Beauty, Brown Derby, Little Buck, and South Phantom claims in the Jacob Canyon (Warm Springs) district.

GILA COUNTY

Banner and Dripping Springs District.—The Sam Knight Mining Lease, Inc., continued working the Christmas mine near Winkelman and in 1947 shipped 26,637 tons of high-lime fluxing ore, containing an average of 2.03 percent copper to the ton, to the smelter at Hayden. The remainder of the district output comprised 1,510 tons of lead ore and 1,100 tons of zinc-lead ore produced from the "79" mine by the 79 Lead-Copper Co., 267 tons of copper ore and 109 tons of lead ore from the London-Arizona group, 33 tons of gold ore from the Round Top claim, and 6 tons of copper ore from the Chilito claim.

Globe-Miami District.—The Globe-Miami district, with a production of 182,064,100 net pounds of copper in 1947 (177,111,500 net pounds in 1946), continued to rank second among the important copper-producing areas in Arizona; the Copper Mountain (Morenci) district in Greenlee County remained in first place. The Inspiration property, with a yield of 73,812,725 net pounds of copper (61,658,590 net pounds in 1946), was the chief copper producer in the district and ranked third in the State. The Inspiration Consolidated Copper Co. reported that 3,926,772 tons of copper ore were treated in 1947 compared with 3,176,483 tons in 1946. Of the total ore, 3,648,107 tons, averaging 1.070 percent copper—0.502 percent copper as oxide and 0.568 percent as sulfide—from which the slimes had been removed, were treated in the main leaching plant; the ore was leached by acid ferric sulfate. Slimes (276,173 tons, averaging 1.28 percent copper) removed from ore at the main leaching plant were treated in the company flotation concentrator for extraction of the sulfide copper content, and the tailings from the operation were leached by sulfuric acid solution for extraction of oxide copper content. In addition, 2,492 tons of crude copper ore were sent direct to the smelter at Miami. The total copper production per ton of ore treated in 1947 was 18.735 pounds.

According to the annual report of the company for 1947, ore mined during the year totaled 3,929,477 dry tons, assaying 1.085 percent copper—0.526 percent as oxide and 0.559 percent as sulfide. Of the total ore mined, 127,815 tons were from development. Total underground development aggregated 45,186 feet of drifts and raises and 4,527 cubic yards of miscellaneous development. Also, 4,725 feet of diamond drilling were done in exploration and development. Development on the open-pit mining project was begun in March and continued steadily the remainder of the year. Ore production from open-pit operations is expected to begin in March 1948, and thereafter ore requirements for plant operation will come from both underground and open-pit sources. The labor supply increased during the year, and by January 1, 1948, it was adequate.

The Miami mine of the Miami Copper Co. and the Castle Dome Copper Co., Inc. (a wholly owned subsidiary of the Miami Copper Co.), ranked second and third, respectively, in copper production in the district. The Miami Copper Co. reported that 106,796,369 net pounds of copper were produced from the two properties in 1947 (53,930,393 net pounds from the Miami mine and 52,865,976 net pounds from the Castle Dome mine) compared with 113,636,362 net pounds in 1946.

According to the annual report of the Miami Copper Co. for 1947, the Castle Dome open pit and 10,000-ton concentrator were operated continuously throughout the year. The mill treated 3,890,627 tons of ore averaging 0.782 percent copper. In addition to copper, the concentrate contained 1,407 ounces of gold and 88,850 ounces of silver. Ore reserves, as of January 1, 1948, are estimated to be 17,144,000 tons averaging 0.706 percent copper. Exploratory drilling continued throughout the year indicated a moderate tonnage of low-grade ore.

The Miami Copper Co. 18,000-ton concentrator and 3,000-ton leaching plant at the Miami mine treated 4,557,079 tons of ore averaging 0.695 percent copper, and 1,821 tons of copper precipitates were produced from leaching of ore in place. In addition to copper, the concentrate contained 1,257 ounces of gold and 73,000 ounces of silver, and the re-treatment of copper concentrate recovered 534,082 pounds of molybdenum. Ore reserves as of January 1, 1948, are estimated to be 32,281,000 tons averaging 0.879 percent copper.

The rest of the district output was principally 8,808 tons of copper ore shipped direct to smelters from various claims and waste dumps of the Old Dominion property and from the Carlota, Monroe Doctrine, and Superior & Boston properties and 4,826 tons of silver ore shipped from the Centennial, McMillan, Rambo, and Rescue properties. Lead ore (434 tons) was shipped from the Defiance and Irene mines and lead residue (457 tons) from the Inspiration plant.

Pioneer District.—W. L. Black worked his So & So claim, 15 miles south of Globe, in 1947 and shipped 58 tons of lead ore, containing appreciable quantities of gold and silver.

Summit District.—Lessees shipped 1,994 tons of copper ore from the Gibson group 9 miles southwest of Miami and 53 tons of similar ore from the Black Hawk group.

GRAHAM COUNTY

Aravaipa District.—In 1947 eight mines in the Aravaipa district produced 5,960 tons of ore. The principal output was 5,368 tons of ore (containing 226 ounces of gold, 13,562 ounces of silver, 118,850 pounds of copper, 1,540,358 pounds of lead, and 920,000 pounds of zinc) shipped direct to a smelter from the Aravaipa group by the Athletic Mining Co. Other producers included the Rutledge, Landsman, Last Chance, Sein Fein, and Silver Coin properties.

Stanley District.—The output of the Stanley district was 21 tons of lead ore from the Stanley Butte and Starlight mines south of Coolidge.

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GREENLEE COUNTY

Ash Peak District.—From the Ash Peak mine near Duncan, the Ash Peak Lease shipped 8,305 tons of fluxing ore, averaging 0.037 ounce of gold and 8.58 ounces of silver to the ton and 81 percent silica, to the International copper smelter at Miami.

Copper Mountain (Morenci) District.—The Copper Mountain district, with a production of 295,798,000 net pounds of copper in 1947 (190,731,500 net pounds in 1946), remained the chief copper-producing area in Arizona, as the Morenci mine of the Phelps Dodge Corp. continued to be the outstanding producer of copper in the State. The corporation reported that 14,804,537 tons of copper ore from the Morenci mine were treated in the combined (Phelps Dodge and Reconstruction Finance Corporation) 45,000-ton concentrator and that 552,030 tons of copper concentrate, 70,601 tons of crude copper ore, and 691 tons of copper precipitates were shipped direct to the Morenci smelter. In addition to copper, the mine was an important producer of gold and silver.

According to the annual report of the Phelps Dodge Corp. for 1947, full-scale operations prevailed at the Morenci branch throughout the year, resulting from marked improvement in the labor supply and because there were no labor strikes. Copper ore mined totaled 14,875,138 tons, and waste and leach material removed 20,262,564 tons, or a ratio of waste to ore of 1.36 : 1. The average tons of ore milled per day was 47,911, an increase of 5,000 tons per day over 1946.

The remainder of the district output was 152 tons of gold ore and gold-silver ore shipped from the Climax Lode claim, 144 tons of gold ore from the Gold Belt mine, and 89 tons of gold-silver ore from the Wilhelmina claim.

MARICOPA COUNTY

Cave Creek and Camp Creek District.—Gold ore (62 tons) was produced in 1947 from the Verkroost property near Cave Creek and silver-copper ore (146 tons) from the Red Rover mine.

New River District.—A lessee worked the Orizaba mine, 45 miles north of Phoenix, the last 6 months of the year and shipped 1,960 tons of copper ore.

Osborn District.—Output of the Osborn district in 1947 was all crude lead ore (52 tons), which came principally from the Moon Anchor mine 30 miles southwest of Wickenburg.

Sunflower District.—S. M. Storey worked the Tri-Metals mine at Sunflower in 1947 and shipped 194 tons of silver-lead ore to a smelter.

Vulture District.—The output of the Vulture district was 171 tons of lead ore and 7 tons of copper ore; the chief producer was the Montezuma mine near Morristown, with an output of 166 tons of lead ore.

MOHAVE COUNTY

Cedar Valley District.—Three mines in the Cedar Valley district east of Yucca produced 3,275 tons of ore containing 23 ounces of gold, 2,774 ounces of silver, 196,698 pounds of copper, 21,996 pounds of lead, and 583,958 pounds of zinc; nearly all of it was zinc-copper ore (3,267 tons) from the Antler and Copper World mines shipped to the Shattuck Denn custom mill at Bisbee for treatment.

Indian Secret (White Hills) District.—About 1,800 tons of silver ore were produced from the White Hills group north of Chloride in 1947 and treated in a cyanide mill.

Owens (McCracken and Potts Mountain) District.—The principal output of the owens district in 1947 was 23 tons of gold ore produced from the Dorothea claim and 35 tons of lead ore from the Lead Pill mine 50 miles southeast of Yucca.

Wallapai (Cerbat, Chloride, Mineral Park, Stockton Hill) District.—The output of the Wallapai district in 1947 comprised 23,693 tons of copper ore, 22,076 tons of zinc-lead ore, 305 tons of lead ore, 76 tons of gold ore, 48 tons of gold-silver ore, and 26 tons of silver ore. All of the copper ore, which came from the open pit at the Emerald Isle mine, was treated by sulfuric acid in a 300-ton leaching plant by the Lewin-Mathes Mining Co. Mining and milling zinc-lead ore from the Tennessee mine at Chloride by the Miners Co-Operative Association were continuous throughout the year; 11,797 tons of ore, containing an average of 0.02 ounce of gold and 1.95 ounces of silver to the ton, 3.60 percent lead, and 6.50 percent zinc, were treated in the company 150-ton flotation mill. The Arizona Metals Co. (Ralph R. Langley) operated the Summit group and produced 6,906 tons of ore, which contained 317 ounces of gold, 28,448 ounces of silver, 66,997 pounds of copper, 521,501 pounds of lead, and 754,675 pounds of zinc. Other producers of zinc-lead ore included the New Moon mine (1,694 tons), El Oro mine (980 tons), De La Fountaine mine (303 tons), and New London group (176 tons). The rest of the district output was largely 303 tons of lead ore from the New London group. The Mineral Park Milling Co. operated its 100-ton flotation mill near Chloride exclusively on zinc-lead ore produced by various operators in the district; however, the mill ceased operating in October, owing to an inadequate supply of ore caused by termination of the Premium Price Plan on June 30. In 1947 the mill treated 8,571 tons of zinc-lead ore.

PIMA COUNTY

Ajo District.—In 1947, as in 1946, all the output of the Ajo district was copper ore from the New Cornelia mine of the Phelps Dodge Corp. The district continued to rank first in gold and third in copper output in the State. According to the annual report of the Phelps Dodge Corp. for 1947, operations at the New Cornelia branch were continuous throughout the year except for the usual 2 weeks' vacation shut-down. Production in 1947 was 7,108,676 tons of copper ore and 5,842,872 tons of waste, or an 0.82 : 1 ratio of waste to ore. The New Cornelia 25,000-ton concentrator treated 7,095,446 tons of copper ore in 1947 compared with 6,344,842 tons in 1946, and smelter production from the concentrate totaled 101,105,513 pounds of copper compared with 88,210,002 pounds. During the year the program for substitution of electric haulage for steam haulage was completed, resulting in marked improvement in pit efficiency and substantial lowering of haulage costs.

Amole District.—Virtually all the output of the Amole district in 1947 was 123 tons of lead ore shipped from the Old Yuma waste dump west of Tucson.

Empire District.—Lead ore (101 tons) was produced in 1947 from the Empire (Hilton) and Lone Mountain claims, 38 miles southeast of Tucson.

Helvetia (Rosemont) District.—The output of the Helvetia district in 1947 comprised 29,142 tons of copper ore, 731 tons of zinc-copper ore, and 18 tons of zinc-lead ore. Operators of the Helvetia group shipped 17,735 tons of ore, containing an average of 0.45 ounce of silver to the ton and 2.43 percent copper. Other producers of copper ore included the Mohawk (7,342 tons), Newman (1,757 tons), Rosemont (1,379 tons), Daylight (496 tons), and Forbes (349 tons) properties. In addition to copper ore, the Daylight and Mohawk mines produced 731 tons of zinc-copper ore, which were treated in the Eagle-Picher custom mill near Sahuarita.

Old Hat (Oracle) District.—Copper ore (979 tons), containing 12 ounces of gold, 1,930 ounces of silver, and 116,311 pounds of copper, was produced in 1947 from the Daily, Leatherwood, and Hartman properties near Oracle and lead ore (40 tons) from the Single Jack mine.

Pima (Sierritas, Papago, Twin Buttes) District.—In 1947 the Pima district ranked third in output of lead and zinc in Arizona, owing to the large production of zinc-lead ore from the San Xavier mine near Sahuarita. This mine and its 400-ton flotation mill were operated continuously by the Eagle-Picher Mining & Smelting Co. The mill treated 65,739 tons of ore, of which 58,658 tons, averaging 2.727 ounces of silver to the ton, 0.511 percent copper, 5.881 percent lead, and 10.229 percent zinc came from the San Xavier mine, and the remainder—7,081 tons—comprised various classes of ore received from custom shippers. The rest of the district output consisted mainly of 1,730 tons of low-grade copper ore produced from the Cowboy mine, 839 tons of zinc-lead-copper ore from the Franklin group, and 779 tons of zinc-copper ore from the Contention mine.

Roskruge and Waterman (Silver Hill) District.—Lessees operated the Silver Hill mine part of the year and shipped 126 tons of copper ore and 41 tons of lead ore to smelters in Arizona and Texas.

Silver Bell District.—About 3,000 tons of zinc-copper ore were produced in 1947 from the old Atlas group and treated in various custom mills. In addition, 654 tons of copper ore and 174 tons of old copper slag were shipped to smelters. The remainder of the district output was 894 tons of lead ore, 557 tons of copper ore, and 257 tons of zinc-lead ore produced from the Arizona-Indiana mine by the Indiana-Arizona Mining Co.

PINAL COUNTY

Bunker Hill District.—After being closed for 7 years the Bluebird mine near Mammoth was reopened in 1947 by the Bluebird Mines, Inc.; 500 tons of lead ore were treated in the company 50-ton flotation mill for testing purposes, and 98 tons of similar ore were shipped to a smelter.

Mineral Creek (Ray) District.—Mining of copper ore at the Ray property of the Kennecott Copper Corp. was continuous throughout the year; in 1947 the output was 1,493,309 tons compared with 1,300,758 tons in 1946. The crude ore, averaging 1.231 percent copper, was hauled by rail 26 miles to the corporation 10,000-ton flotation mill at Hayden, where it was reduced to 61,687 tons of concentrate averaging 0.006 ounce of gold and 0.42 ounce of silver to the ton and 24.74 percent copper; the concentrate was smelted in the American Smelting & Refining Co. plant also at Hayden. In addition, 3,928 tons of copper precipitates were shipped to the Kennecott Copper Corp. smelter at Hurley, N. Mex. According to the annual report of the Kennecott Copper Corp. for 1947, extensive exploration and drilling were done at the Ray property. As a result of this work, the corporation has decided to mine the larger part of the ore body by open-pit methods. This partial change from underground to surface mining will extend the life of the property, expand production, reduce costs, and improve the labor situation.

The remainder of the district output was 18,211 tons of oxide copper ore produced from an open pit at the Copper Butte property and 1,673 tons of oxide lead ore from the Lead Queen, Phillips, and Ray Silver-Lead properties.

Mineral Hill District.—Lead ore (216 tons) was produced in 1947 from the Ajax, Silver Queen, and Wedge properties and gold ore (65 tons) from the Thanksgiving and Greenwood claims.

Old Hat (Oracle) District.—The St. Anthony Mining & Development Co., Ltd., one of the most important producers of zinc-lead ore in Arizona, operated its mine and 350-ton flotation mill at Tiger continuously in 1947. The mill treated 88,975 tons of ore, averaging 0.013 ounce of gold and 1.16 ounces of silver to the ton, 0.42 percent copper, 5.95 percent lead, and 6.46 percent zinc, which yielded 6,980 tons of lead concentrate and 7,120 tons of zinc concentrate. The property ranked second in production of lead in Arizona in 1947 and fourth in zinc. The rest of the district output was mainly 102 tons of lead ore and 51 tons of zinc-lead ore produced from the Stove Lid claim, 6 miles south of Oracle. No ore was produced in 1947 from the San Manuel property south of Tiger, owned by the Magma Copper Co.; but, according to the company annual report for 1947, active drilling continued throughout the year, although it was indefinitely suspended February 23, 1948. The entire drilling campaign has developed 123,499,580 tons of oxide ore averaging 0.767 percent copper and 339,284,920 tons of sulfide ore averaging 0.788 percent copper—a total of 462,784,500 tons. This estimate does not represent the ultimate tonnage of ore contained in the property. However, the tonnage developed is so great that little is to be gained by further development. The ore body is probably the second largest tonnage of copper ore in any known ore body in the United States, and its economic value is great; the ore must be mined by underground methods.

Pioneer (Superior) District.—The Magma mine, one of the most important producers of gold, silver, and copper in Arizona, was operated continuously in 1947 and at a greater rate than in 1946. During the year 217,822 tons of copper ore were treated in the company 1,150-ton (increased from 850-ton) concentrator, and 31,281 tons of crude copper ore and 45,500 tons of copper concentrate were sent to the company 450-ton smelter at Superior; the concentrates averaged 0.168 ounce of gold and 5.179 ounces of silver to the ton and 30.665 percent copper.

According to the company annual report for 1947, the net metal produced from Magma crude ore and concentrates comprised 8,467 ounces of gold, 281,103 ounces of silver, and 29,535,233 pounds of copper. The average cost of producing copper (after gold and silver values were deducted) was 16.74 cents a pound in 1947 compared with 15.69 cents in 1946. The labor supply has improved considerably; however, the supply of skilled miners is still inadequate, and additional men are needed to fulfill present requirements for full production and development. A new crusher was installed during the year, which increased the grinding capacity from 850 to 1,150 tons of ore a day. New mill construction is progressing slowly but should be completed in June 1948. Development during the year comprised 3,004 feet of drifting, 2,523 feet of raising, and 910 feet of crosscutting. In addition, 8,326 feet of diamond drilling were done.

The remainder of the district output was largely 156 tons of silver ore produced from the Picket Post mine.

Sasco District.—In 1947 about 1,900 tons of copper ore were shipped from the old Sasco dump 7 miles west of Redrock.

SANTA CRUZ COUNTY

Gardner Canyon District.—Leasing operations at the Redberry & Hidden Tunnel group, north of Patagonia, produced 1,239 tons of low-grade silver-copper ore.

Harshaw District.—In 1947 two mines and one tailing dump in the Harshaw district produced 43,037 tons of ore and 185 tons of old tailings. Most of the output was 42,544 tons of zinc-lead-silver ore produced from the Flux-January-Norton groups near Patagonia by the American Smelting & Refining Co. This tonnage, along with 4,491 tons of ore received from custom shippers, was treated in the company 200-ton flotation mill, which yielded 2,409 tons of lead concentrate and 4,613 tons of zinc concentrate. The remainder of the district output was 493 tons of oxide lead ore shipped direct to a smelter from the Hardshell mine and 185 tons of old lead tailings from the Iron Cap dump.

Oro Blanco (Ruby) District.—Hugo W. Miller worked the Montana mine continuously, shipped 426 tons of silver-lead ore to the smelter at El Paso, and hauled 226 tons of zinc-lead ore to the Eagle-Picher mill near Sahuarita. The rest of the district output was mainly 235 tons of gold ore (treated by amalgamation and concentration) from the Oro Blanco property and 156 tons of old lead slag from a dump near Ruby.

Patagonia (Duquesne) District.—The output of the Patagonia district in 1947 was largely 4,047 tons of zinc-lead-copper ore and 987 tons of copper ore produced from the Duquesne group by A. R. Byrd, Jr., and 295 tons of lead ore from the Mowry mine. The copper ore from the Duquesne property averaged 1.72 ounces of silver to the ton and 5.52 percent copper, and the zinc-lead-copper ore averaged 4.63 ounces of silver to the ton, 1.59 percent copper, 3.42 percent lead, and 9.18 percent zinc.

Tyndall District.—In 1947 seven mines in the Tyndall district produced 1,155 tons of ore, containing 39 ounces of gold, 4,642 ounces of silver, 28,652 pounds of copper, 193,710 pounds of lead, and 73,741 pounds of zinc. Most of the ore (729 tons) was zinc-lead ore produced from the Bland and Jefferson mines, zinc-copper ore (178 tons) from the Compadre claim, and copper ore (131 tons) from the Royal Blue mine.

YAVAPAI COUNTY

Agua Fria District.—High-silica copper ore shipped direct to smelters continued to be the output of the Agua Fria district; 3,424 tons, averaging 3.82 percent copper and 55 percent silica, were produced in 1947 from the Stoddard mine, 5 miles southeast of Mayer, and 1,689 tons from the Binghampton mine.

Big Bug District.—In 1947 the Big Bug district ranked second in zinc production in the State, third in gold and silver, and fourth in lead. The Iron King mine of the Shattuck Denn Mining Corp. continued to be the principal producer; 122,368 tons of ore averaging 0.124 ounce of gold and 4.335 ounces of silver to the ton, 0.17 percent copper, 2.54 percent lead, 6.95 percent zinc, and 22.00 percent iron were treated in the company 470-ton (increased from 375-ton) flotation mill. The mill treated 123,344 tons of ore (including 976 tons of custom ores) in 1947, which yielded 10,209 tons of lead concentrate, 11,575 tons of zinc concentrate, and 2,429 tons of iron-gold concentrate.

The rest of the district lode output was mainly 1,335 tons of copper ore, produced from the Blue Bell mine, 207 tons of lead ore, copper ore, and zinc-lead-copper ore from the Hackberry mine, and 235 tons of gold-copper ore from the Henrietta and Lone Pine properties. The placer output was 210 ounces of gold and 21 ounces of silver; most of it was recovered by sluicing at the Jane and Shanks properties on Big Bug Creek.

Black Canyon District.—Nearly all the output of the Black Canyon district in 1947 was 5,255 tons of gold ore produced from the French Lilly mine near Cleator and treated in a 50-ton flotation mill; the mine and mill were operated by the Cedar Talisman Consolidated Mines Co. Sluicing at the Dreams End and Golden Star properties recovered 15 ounces of placer gold.

Blue Tank District.—E. Nutter worked the Camp B. mine near Wickenburg in 1947 and shipped 106 tons of copper ore to a smelter.

Castle Creek District.—Leasing operations at the Grey Eagle and Mayflower claims produced 33 tons of silver-lead ore and 23 tons of gold-copper ore.

Copper Basin District.—Fred D. Schemmer continued to operate the Commercial mine near Skull Valley and shipped 14,809 tons of high-silica copper ore to the smelter at Clarkdale. The rest of the district output was 287 tons of zinc ore produced from the Boston-Arizona mine and treated in the Iron King flotation mill at Humboldt.

Eureka (Bagdad) District.—Copper ore produced from the Bagdad mine by the Bagdad Copper Corp. continued to be the most important output in the Eureka district. The corporation reported that 957,302 tons of ore, averaging 0.95 percent copper, were treated in 1947 in its 3,000-ton flotation mill, compared with 862,535 tons in 1946. An acid leaching plant was built on the property during the year to treat the oxide copper ore, which increased production of copper by half a million pounds a month. The remainder of the district output was principally 1,742 tons of zinc ore produced from the Old Dick and Copper King mines and 126 tons of copper ore and 117 tons of zinc-copper ore from the Eureka mine. The Copper King mine also produced 51 tons of zinc-lead ore and 33 tons of copper ore.

Hassayampa (Groom Creek, Hassayampa River, Senator, Prescott) District.—The output of the Hassayampa district in 1947 was 566 tons of ore. Most of it was zinc-lead-gold ore (243 tons) produced from the Sun Dance and Ruth mines, silver-lead ore (165 tons) from the Pick group, and gold ore (113 tons) from the Alma and Sacramento mines.

Martinez (Congress) District.—In 1947 waste dump ore and old tailings from the Congress property were the only output in the Martinez district; 10,078 tons of gold ore and 10,000 tons of old tailings were treated in a 300-ton cyanide mill from January 1 to May 7, when operations ceased owing to an inadequate supply of water for the mill.

Peck District.—Leasing operations at the Peck mine near Cleator produced 237 tons of silver ore. Silver ore (2 tons) was produced also from the Jubilee claim.

Pine Grove (Crown King) District.—Mining and milling zinc-copper ore from the Crown King-Wildflower group by the Golden Crown Mining Co. were continuous throughout the year. The company reported that 9,004 tons of ore, averaging 0.02 ounce of gold and 3.49 ounces of silver to the ton and 0.845 percent copper and 6.30 percent zinc, were treated in 1947 in its 75-ton flotation mill, which yielded 214 tons of copper concentrate and 939 tons of zinc concentrate. The rest of the district output was mainly 579 tons of gold ore and 297 tons of zinc ore produced from the Gladiator-War Eagle group, and 408 tons of copper ore from the Springfield mine.

Tiger District.—J. D. McClintock worked the Oro Belle mine, 5 miles south of Crown King, in 1947 and shipped 98 tons of rich gold ore to a smelter. Similar ore (4 tons) from the Snowdrift mine was treated by amalgamation.

Turkey Creek District.—The output of the Turkey Creek district in 1947 was largely 14 tons of zinc-lead ore produced from the Trinity claim and 9 tons of silver ore from the Goodwin claim.

Verde (Jerome) District.—Production of gold, silver, and copper in the Verde district continued to drop in 1947, owing to a decrease in metal content of the copper ore mined at the United Verde mine by the Phelps Dodge Corp. The corporation reported that 186,942 tons of siliceous copper ore were treated in its 2,100-ton concentrator in 1947 and that 157,953 tons of similar ore and 230 tons of copper precipitates were shipped to its smelter at Clarkdale. In addition to gold, silver, and copper, the ore contained an average of 1.49 percent zinc, but no zinc was recovered.

According to the annual report of the corporation for 1947, 12,595 feet of prospecting and development were done at the United Verde mine, which resulted in discovery of a mineralized zone apparently extending from the 3,750 to the 4,500-foot level. Some ore occurs in this zone, which, at present metal prices, can be profitably mined. However, this discovery is not regarded as of major importance; and, unless further discoveries are made, it is estimated that the mine will have to be shut down in approximately 2 years because ore reserves will be exhausted.

The remainder of the district output was 5,750 tons of siliceous copper ore shipped to the smelter at Clarkdale from the Dundee-Arizona, Florentia, and Verde properties.

Walker District.—Numerous small lots of ore were produced in 1947 from claims in the Walker district and sold to local ore buyers in Prescott and Wickenburg. The principal output comprised high-grade gold-lead ore (66 tons) from the Oro Plata claim, zinc-lead ore (31 tons) from the Duration claim, and gold ore (31 tons) from the Copper Top claim.

Walnut Grove (Kirkland) District.—The output in 1947 was chiefly 98 tons of copper ore produced from the Victory Copper claim near Kirkland.

Weaver (Octave) District.—The output of the Weaver district in 1947 was 224 tons of gold ore produced from the George Myers, May Queen, Monica, Octave, and Surprise properties and 16 ounces of placer gold recovered principally from the Antelope Creek and Stacy claims.

YUMA COUNTY

Castle Dome District.—All the output of the Castle Dome district in 1947 was oxide lead ore; 2,065 tons (containing 8,508 ounces of silver, 397,000 pounds of lead, and 50,000 pounds of zinc) were treated in concentration mills, and 399 tons (containing 2,413 ounces of silver, 129,960 pounds of lead, and 15,865 pounds of zinc) were shipped direct to smelters. The principal producers were the Rialto (operated by the Joplin Lead Co.), Sonora, Colorado, and Big Jim properties.

Ellsworth (Harqua Hala) District.—In 1947 six mines in the Ellsworth district produced 334 tons of ore; the chief output was 189 tons of copper ore from the Yuma Copper mine near Vicksburg and 131 tons of gold-copper ore from the Columbia and Critic mines.

Plomosa District.—Lessees continued working the R. & A. mine near Vicksburg and shipped 585 tons of siliceous silver ore and 15 tons of silver-lead ore to smelters in Arizona and Texas. The Mohave Mining Co. worked its mine on Moon Mountain throughout the year and hauled 52 tons of ore containing 260 ounces of gold and 52 ounces of silver to a nearby custom mill. The remainder of the district lode output was largely 279 tons of lead ore produced from the Leadville group by the Arizona Leadville Mining Corp. The placer output (29 fine ounces of gold) was recovered principally by drift mining at the Big Wash Basin and N. R. A. properties.

California

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By ALFRED L. RANSOME

GENERAL SUMMARY

CALIFORNIA lead production in 1947, continuing the upward trend begun in 1945, was 2 percent greater than in 1946—only 8 percent below the record output of 1917—and the value was the largest in the history of the State. The output of gold in 1947 was 21 percent above that for 1946 but considerably below the prewar level (1,408,793 fine ounces in 1941). Silver production was 19 percent higher than in 1946. In contrast, copper output was 43 percent under that of 1946, and the production of zinc dropped 21 percent below the total for the previous year. The total value of the five metals was $21,769,620, an increase of 16 percent above 1946. The larger output of gold was due principally to the operation of more gold-producing properties, lode as well as placer. The increase in prices for all the metals except gold and zinc reacted favorably in stimulating the production of lead and silver (silver largely a byproduct metal). This advance in price was not reflected in the output of copper, which had expanded in the State during war years. The shutting down of three leading copper-producing operations in the State in 1947 followed termination of the Premium Price Plan in the middle of the year. Zinc production likewise was adversely affected by the closing of two important zinc-copper mines as well as curtailment of zinc production at other properties when premium payments on the metal were dropped.

Comparing 1947 with 1946, gold increased 21 percent in quantity and value; silver advanced 19 percent in quantity and 33 percent in value; copper decreased 43 percent in quantity and 26 percent in value; lead increased 2 percent in quantity and 34 percent in value; and zinc decreased 21 percent in quantity and 22 percent in value. Of the total value of the five metals in 1947, gold represented 69, lead 13, silver 7, zinc 6, and copper 5 percent. Due largely to lead pro-

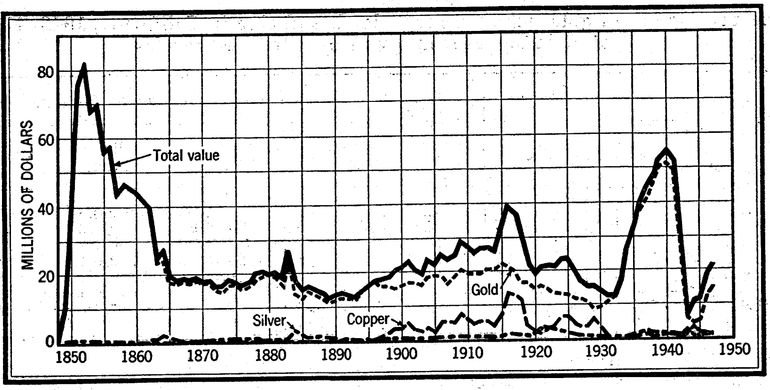

FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead, and zinc in California, 1848–1947. The value of lead and zinc has exceeded $1,000,000 in only a few years.

duction as well as substantial quantities of silver, copper, and zinc, Inyo County was the largest contributor to metal-mining output in California (an advance from second place in 1946); it supplied 18 percent of the State total value of the five metals. Sacramento County yielded by a narrow margin the first place which it held in 1946 and ranked second as the result of large-scale gold dredging in 1947. Nevada County (largely from gold ore) contributed 13 percent of the total value of the five metals.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946 to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Gold.—Production of 431,415 ounces of gold in California in 1947 was 21 percent greater than the output in 1946, thereby continuing the upward trend that began in 1945 following rescinding the War Production Board Order L–208. The increase in production at lode mines (up 37 percent over 1946) was accomplished despite the fixed price for gold and the prevailing high costs of labor, supplies, and equipment. Many of the lode mines that were large gold producers

Mine production of gold, silver, copper, lead, and zinc in California, 1943–47, and total, 1848–1947, in terms of recovered metals

Year	Mines producing[1] Lode	Mines producing[1] Placer	Ore, old tailings etc. (short tons)	Gold (lode and placer) (Fine ounces)	Gold (lode and placer) Value	Silver (lode and placer) (Fine ounces)	Silver (lode and placer) Value
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
1946	150	172	627,767	356,824	12,488,840	1,342,651	1,084,862
1947	210	210	648,789	431,415	15,099,525	1,597,442	1,445,685
1848–1947			(2)	102,312,634	2,283,045,842	109,797,530	88,586,627

Year	Copper Pounds	Copper Value	Lead Pounds	Lead Value	Zinc Pounds	Zinc Value	Total value
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
1946	8,480,000	1,373,760	19,846,000	2,163,214	13,754,000	1,677,988	18,788,664
1947	4,814,000	1,010,940	20,160,000	2,903,040	10,830,000	1,310,430	21,769,620
1848–1947	[3] 628,231	202,304,804	[3] 169,732	23,546,057	[3] 85,622	17,168,826	2,614,652,156

[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, by classes of mines and methods of recovery, 1943–47, and total, 1848–1947 [1]

Class and method	Mines producing[2]	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered Fine ounces	Gold recovered Value	Gold recovered Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Connected-bucket dredges:						
1943	8	10	17,880,000	66,999	$2,344,965	$0.131
1944	5	7	21,524,000	64,925	2,272,375	.106
1945	16	26	30,738,000	88,318	3,091,130	.101
1946	22	32	78,175,000	244,679	8,563,765	.110
1947	22	35	95,478,000	271,165	9,490,775	.099
Dragline dredges:						
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
1946	39	38	4,309,000	16,932	592,620	.138
1947	41	35	5,718,000	26,617	931,595	.163
Suction dredges:[3]						
1943–45						
1946	1	1	22,900	112	3,920	.171
1947	7	5	60,000	485	16,975	.283
Nonfloating washing plants:[4]						
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
1946	13	13	771,000	2,576	90,160	.117
1947	25	25	261,000	3,916	137,060	.525

See footnotes at end of table.

Gold production at placer mines in California, by classes of mines and methods of recovery, 1943–47, and total, 1848–1947 [1]—Continued

Class and method	Mines producing [2]	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered: Fine ounces	Gold recovered: Value	Gold recovered: Average value per cubic yard
Surface placers—Continued						
Gravel hydraulically handled:						
Hydraulic:						
1943	12		366,000	1,723	$60,305	$0.165
1944	13		212,000	838	29,330	.138
1945	17		282,300	922	32,270	.114
1946	17		442,300	1,147	40,145	.091
1947	23		332,000	1,194	41,790	.126
Small-scale hand methods: [5]						
Wet:						
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
1946	72		624,000	4,165	145,775	.234
1947	86		682,000	8,931	312,585	.458
Dry:						
1943	1		40	4	140	3.500
1944	(6)		200	3	105	.525
1945						
1946	1		100	3	105	1.050
1947	3		600	6	210	.350
Underground placers:						
Drift:						
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
1946	7		5,700	158	5,530	.970
1947	3		1,400	224	7,840	5.600
Grand total placers:						
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
1946	172		84,351,000	269,772	9,442,020	.112
1947	210		102,533,000	312,538	10,938,830	.107
1848–1947 [1]			(7)	65,845,332	1,440,324,266	(7)

[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 with "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] Complete data not available.

before the war remained closed during 1947; however, the Empire Star Mines Co., Ltd., in the Grass Valley district, Nevada County, which suspended operation of its Empire Star group of mines in 1946, resumed mining in 1947, principally on a lessee-operation basis. Placer operations, which accelerated production rapidly after July 1, 1945, raised their total output again in 1947, but at a more moderate rate of increase than in 1946.

The 25 leading gold-producing mines in California in 1947, listed in the accompanying table, yielded 85 percent of the total gold output of the State; the leading 5 mines produced 53 percent and the leading 10 mines, 64 percent.

Twenty-five leading gold-producing mines in California in 1947, in order of output

Rank	Mine	District	County	Rank in 1946	Operator	Source of gold
1	Natomas Co	Folsom	Sacramento	1	Natomas Co	Dredge.
2	Yuba Unit	Yuba River	Yuba	2	Yuba Consolidated Gold Fields	Do.
3	Idaho Maryland and Brunswick	Grass Valley-Nevada City	Nevada	3	Idaho Maryland Mines Corp	Gold ore.
4	Empire Star Group	do	do	11	Empire Star Mines Ltd	Do.
5	Butte Unit	Oroville	Butte	8	Yuba Consolidated Gold Fields	Dredge.
6	Capital dredge	Folsom	Sacramento	5	Capital Dredging Co	Do.
7	Thurman & Wright dredge No. 4	Cosumnes River	do	15	Thurman & Wright	Do.
8	La Grange dredge No. 4	La Grange	Stanislaus	9	La Grange Gold Dredging Co	Do.
9	Upper and lower Comanche dredges	Camanche	San Joaquin	6	Gold Hill Dredging Co	Do.
10	Tuolumne gold dredge	La Grange	Stanislaus	4	Tuolumne Gold Dredging Co	Do.
11	Merced dredge No. 1	Snelling	Merced	24	Merced Dredging Co	Do.
12	Snelling dredge	do	do	35	Snelling Gold Dredging Co	Do.
13	Ancho-Erie	Washington	Nevada	16	Ancho-Erie Mining Co	Gold ore.
14	Original Sixteen to One	Alleghany	Sierra	10	Original Sixteen to One Mine, Inc	Do.
15	Thurman dredge	Redding	Shasta	13	Thurman Gold Dredging Co	Dredge.
16	Kister	Oroville	Butte	14	Gold Hill Dredging Co	Do.
17	Indian Creek placer	Deadwood	Siskiyou	73	French Gulch Dredging Co	Do.
18	Junction City	Junction City	Trinity	7	Junction City Mining Co	Do.
19	Mount Gaines	Hunter Valley	Mariposa	20	Mount Gaines Mining Co	Gold ore.
20	Tropico (including Standard Hill and others).	Mojave	Kern	26	Burton Bros., Standard Hill Mining Co., and others.	Do.
21	Brush Creek	Downieville	Sierra	23	Alfred L. Merritt	Do.
22	Lancha Plana dredge No. 4	Folsom	Sacramento	12	Lancha Plana Gold Dredging Co	Dredge.
23	General dredge	do	do	31	General Dredging Co	Do.
24	Yreka gold dredge	Klamath River	Siskiyou	21	Yreka Gold Dredging Co	Do.
25	Penn	Campo Seco	Calaveras	19	Shawmut Copper Mine Co	Zinc ore.

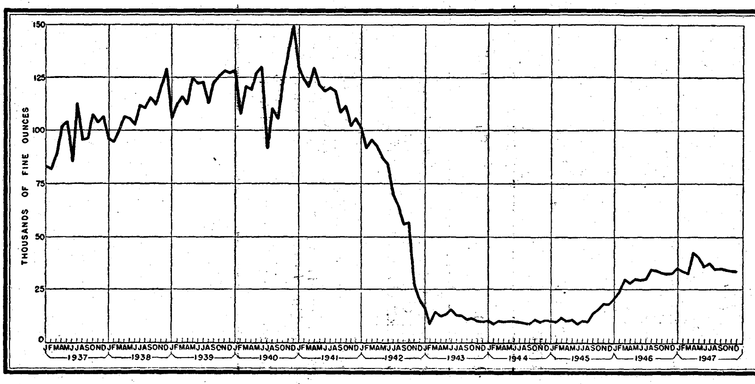

FIGURE 2.—Mine production of gold in California, 1937–47, by months, in terms of recovered gold.

Silver.—The 10 leading silver-producing mines listed in the accompanying table yielded 92 percent of the State total recoverable silver in 1947; the 3 leading mines yielded 78 percent. Of the 10 leading silver-producing mines, 6 derived their silver from argentiferous base-metal ores and 1 each from gold ore, silver ore, gold-silver ore, and old smelter flue dust.

The entire background for the trend in silver production shown by months in 1947 in the accompanying table is closely allied to operation of the Darwin group of mines, Coso district, Inyo County, operated by the Anaconda Copper Mining Co.

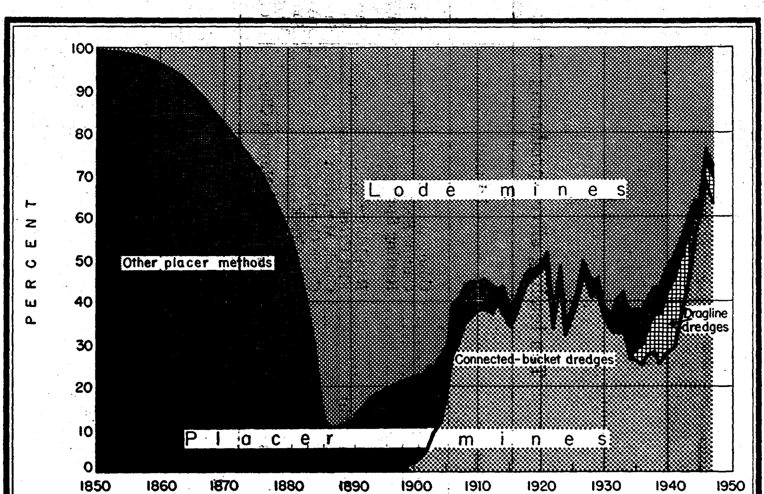

FIGURE 3.—Percentage of total California gold produced at lode and placer mines and by various methods of placer mining, 1850–1947.

Ten leading silver-producing mines in California in 1947, in order of putput

Rank	Mine	District	County	Rank in 1946	Operator	Source of silver
1	Darwin group	Coso	Inyo	1	Anaconda Copper Mining Co	Lead ore.
2	Penn	Campo Seco	Calaveras	2	Shawmut Copper Mine Co	Zinc ore.
3	Columbia No. 2	Resting Springs	Inyo	4	Finley Co., and Anaconda Copper Mining Co.	Lead ore.
4	Kelly	Randsburg	San Bernardino	5	F. W. Royer	Gold-silver ore.
5	Kennett smelter (Mammoth)	Flat Creek	Shasta	(1)	Wuensch & McNeil	Flue dust.
6	Carbonate King	Clark Mountain	San Bernardino	6	J. Q. Little	Zinc ore.
7	Santa Rosa	Cerro Gordo	Inyo	(1)	Santa Rosa Mining Co., and L. Warnken	Lead ore.
8	Hornet-Richmond	Flat Creek	Shasta	3	The Mountain Copper Co., Ltd	Zinc-copper ore.
9	Lane-Eagle	Coso	Inyo	41	L. D. Foreman	Silver ore.
10	Idaho Maryland-Brunswick	Grass Valley-Nevada City	Nevada	11	Idaho Maryland Mines Corp	Gold ore.

1 Did not produce in 1946.

Mine production of gold, silver, copper, lead, and zinc in California in 1947, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	34,975	186,018	253	969	450
February	34,029	180,475	212	1,078	521
March	32,874	164,042	243	1,395	674
April	42,537	167,640	354	1,286	909
May	40,541	147,123	334	969	797
June	36,025	146,539	303	841	736
July	37,663	92,474	273	613	501
August	34,827	99,475	263	633	317
September	35,017	114,548	111	752	306
October	34,764	83,237	41	505	102
November	34,134	113,770	10	544	77
December	34,029	102,101	10	495	25
Total: 1947	431,415	1,597,442	2,407	10,080	5,415
1946	356,824	1,342,651	4,240	9,923	6,877

Copper.—Copper production in California in 1947 dropped 43 percent below that for 1946. This marked reduction in output was due principally to suspension of mining operations in 1947 at the Penn mine, Camp Seco district, Calaveras County (Shawmut Copper Mine Co.), and the Newton mine, Ione district, Amador County (Pacific Mining Co.), and to the Mountain Copper Co., Ltd., closing its flotation plant (which treated ore from the Hornet-Richmond mine), Flat Creek district, Shasta County, in July 1947. These properties were the three leading producers of copper in the State and supplied 86 percent of the State total in 1947. The monthly copper-production figures given in the accompanying table reflect these mine shut-downs. Other copper-producing mines in the State in 1947 included: Pioneer-Lilyama mine, Mother Lode district, El Dorado County (Pioneer-Lilyama Mines); Darwin group, Coso district, Inyo County (Anaconda Copper Mining Co.); and Pine Creek Tungsten mine, Bishop Creek district, Inyo County (U. S. Vanadium Corp.). Union Mine (old tailings), Copperopolis district, Calaveras County, an important source of copper in 1946, was idle in 1947.

Lead.—The marked rise in lead production from 990,000 pounds in 1938 to 20,160,000 in 1947 (within 8 percent of the all-time record of 21,868,628 pounds in 1917) resulted in lead continuing as the second most valuable of the five metals produced in the State (in 1946 lead displaced copper as the second most valuable metal); output of lead in 1947 was 2 percent above that in 1946. The monthly lead-production figures given in the accompanying table follow a trend which closely parallels that for silver and is allied to operation of the Darwin group of mines, Coso district, Inyo County. The three leading producers of lead in the State, which in 1947 supplied 86 percent of the total output, were: Darwin group, Coso district, Inyo County (Anaconda Copper Mining Co.); Shoshone group, Columbia No. 2, Resting Springs district, Inyo County (Finley Co. and Anaconda Copper Mining Co.); and Kennett smelter flue-dust operation, Flat Creek district, Shasta County (Wuensch & McNeil).

Zinc.—Zinc production in California in 1947 dropped 21 percent from 1946, owing largely to suspension of operations at the Penn mine, Campo Seco district, Calaveras County, and the Hornet-Richmond mine flotation plant, Flat Creek district, Shasta County, in 1947; the shut-downs at these properties, for the most part, resulted from expiration of the Premium Price Plan for copper, lead, and zinc on June 30. Among the five leading zinc properties that furnished 97 percent of the State total output were: The Penn mine, Campo Seco district, Calaveras County (Shawmut Copper Mine Co.); the old Kennett smelter flue-dust operation, Flat Creek district, Shasta County (Wuensch & McNeil); and the Carbonate King Zinc Mine, Clark Mountain district, San Bernardino County (J. Q. Little under contract from Crystal Cave Mining Co.).

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in California in 1947, 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	8	11	2,016	$70,560	2,708	$94,780	4,724	$165,340
Butte	3	10	157	5,495	26,880	940,800	27,037	946,295
Calaveras	13	11	4,835	169,225	336	11,760	5,171	180,985
Colusa	1		6	210			6	210
El Dorado	13	12	385	13,475	2,609	91,315	2,994	104,790
Fresno	1	3	5	175	230	8,050	235	8,225
Humboldt		1			139	4,865	139	4,865
Inyo	41		1,974	69,090			1,974	69,090
Kern	16	6	6,154	215,390	74	2,590	6,228	217,980
Lassen	1		1	35			1	35
Los Angeles		4			48	1,680	48	1,680
Madera		4			197	6,895	197	6,895
Mariposa	15	5	5,705	199,675	658	23,030	6,363	222,705
Merced		3			16,422	574,770	16,422	574,770
Mono	2		41	1,435			41	1,435
Nevada	11	14	76,123	2,664,305	5,207	182,245	81,330	2,846,550
Placer	4	25	537	18,795	4,821	168,735	5,358	187,530
Plumas	4	7	422	14,770	124	4,340	546	19,110
Riverside	2	1	28	980	2	70	30	1,050
Sacramento		14			113,560	3,974,600	113,560	3,974,600
San Bernardino	24	2	2,081	72,835	2,328	81,480	4,409	154,315
San Diego	1		13	455			13	455
San Francisco		1			4	140	4	140
San Joaquin and Shasta [2]	6	7	579	20,265	17,677	618,695	18,256	638,960
Sierra	12	10	12,821	448,735	442	15,470	13,263	464,205
Siskiyou and Stanislaus [2]	9	24	753	26,355	38,388	1,343,580	39,141	1,369,935
Trinity	2	20	100	3,500	13,805	483,175	13,905	486,675
Tuolumne	19	5	4,125	144,375	107	3,745	4,232	148,120
Yuba	2	10	16	560	65,772	2,302,020	65,788	2,302,580
Total: 1947	210	210	118,877	4,160,695	312,538	10,938,830	431,415	15,099,525
1946	150	172	87,052	3,046,820	269,772	9,442,020	356,824	12,488,840

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Amador	11,223	$10,157	375	$339	11,598	$10,496
Butte	207	187	1,994	1,805	2,201	1,992
Calaveras	97,040	87,821	36	33	97,076	87,854
Colusa	3	3			3	3
El Dorado	1,644	1,488	395	357	2,039	1,845
Fresno			37	33	37	33
Humboldt			22	20	22	20
Inyo	1,235,998	1,118,578			1,235,998	1,118,578
Kern	7,671	6,942	15	14	7,686	6,956
Lassen	6	5			6	5
Los Angeles			6	5	6	5
Madera			57	52	57	52
Mariposa	1,848	1,672	85	77	1,933	1,749
Merced			1,505	1,362	1,505	1,362
Mono	7,323	6,627			7,323	6,627

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California in 1947, by counties, in terms of recovered metals—Continued

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Nevada	24,922	$22,554	822	$744	25,744	$23,298
Placer	254	230	553	500	807	730
Plumas	551	499	19	17	570	516
Riverside	15	14	-----	-----	15	14
Sacramento	-----	-----	6,203	5,614	6,203	5,614
San Bernardino	103,477	93,647	400	362	103,877	94,009
San Diego	6	5	-----	-----	6	5
San Francisco	-----	-----	-----	-----	-----	-----
San Joaquin and Shasta [2]	76,516	69,247	1,911	1,730	78,427	70,977
Sierra	2,449	2,216	52	47	2,501	2,263
Siskiyou and Stanislaus [2]	172	156	4,171	3,775	4,343	3,931
Trinity	96	87	1,581	1,431	1,677	1,518
Tuolumne	2,005	1,815	10	9	2,015	1,824
Yuba	2	2	3,765	3,407	3,767	3,409
Total: 1947	1,573,428	1,423,952	24,014	21,733	1,597,442	1,445,685
1946	1,322,830	1,068,847	19,821	16,015	1,342,651	1,084,862

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Amador	1,674,000	$351,540	-----	-----	-----	-----	$527,376
Butte	-----	-----	-----	-----	-----	-----	948,287
Calaveras	1,242,000	260,820	180,000	$25,920	4,700,000	$568,700	1,124,279
Colusa	-----	-----	-----	-----	-----	-----	213
El Dorado	112,000	23,520	4,000	576	12,000	1,452	132,183
Fresno	-----	-----	-----	-----	-----	-----	8,258
Humboldt	-----	-----	-----	-----	-----	-----	4,885
Inyo	232,000	48,720	17,980,000	2,589,120	1,404,000	169,884	3,995,392
Kern	-----	-----	-----	-----	-----	-----	224,936
Lassen	-----	-----	-----	-----	-----	-----	40
Los Angeles	-----	-----	-----	-----	-----	-----	1,685
Madera	-----	-----	-----	-----	-----	-----	6,947
Mariposa	4,000	840	-----	-----	-----	-----	225,294
Merced	-----	-----	-----	-----	-----	-----	576,132
Mono	18,000	3,780	34,000	4,896	-----	-----	16,738
Nevada	-----	-----	-----	-----	-----	-----	2,869,848
Placer	-----	-----	-----	-----	-----	-----	188,260
Plumas	28,000	5,880	-----	-----	-----	-----	25,506
Riverside	-----	-----	-----	-----	-----	-----	1,064
Sacramento	-----	-----	-----	-----	-----	-----	3,980,214
San Bernardino	92,000	19,320	316,000	45,504	1,300,000	157,300	470,448
San Diego	-----	-----	-----	-----	-----	-----	460
San Francisco	-----	-----	-----	-----	-----	-----	140
San Joaquin and Shasta [2]	1,396,000	293,160	1,634,000	235,296	3,414,000	413,094	1,651,487
Sierra	-----	-----	12,000	1,728	-----	-----	468,196
Siskiyou and Stanislaus [2]	-----	-----	-----	-----	-----	-----	1,373,866
Trinity	4,000	840	-----	-----	-----	-----	489,033
Tuolumne	12,000	2,520	-----	-----	-----	-----	152,464
Yuba	-----	-----	-----	-----	-----	-----	2,305,989
Total: 1947	4,814,000	1,010,940	20,160,000	2,903,040	10,830,000	1,310,430	21,769,620
1946	8,480,000	1,373,760	19,846,000	2,163,214	13,754,000	1,677,988	18,788,664

[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 output.

MINING INDUSTRY

The tonnage of material from lode mines in California treated in 1947 increased 13 percent compared with 1946, and the yardage at placer mines increased 22 percent. The output of lode gold increased 37 percent, but the gold from this source comprised only 28 percent of the State total, whereas production from placer mines advanced 16 percent and represented 72 percent of the total. The decrease in base-metal ore production was less than the increase in gold-ore output. The average recoverable gold content of gravel decreased 4 percent.

Dredges of the connected-bucket type washed 93 percent of the total gravel mined in the State in 1947 and recovered 87 percent of the total placer gold. Dragline dredging continued to increase during 1947; equipment of this type (used at 41 properties) washed 6 percent of the total gravel handled and recovered nearly 9 percent of the placer gold—the highest point reached by dragline dredging in yardage washed or gold recovered since 1942. Seven suction dredges operated in 1947. A greater number of hydraulic mines were operated in 1947 compared with 1946, and 4 percent more gold was recovered in 1947 from 25 percent less gravel than was handled in the previous year. Fewer drift mines were operated in 1947 than in 1946; however, the smaller quantity of gravel worked in 1947 yielded more gold than was produced by this method in 1946.

ORE CLASSIFICATION

Of the 648,789 tons of ore (including 20,565 tons of old tailings) sold or treated in 1947, 68 percent was gold ore, 14 percent lead, 8 percent zinc, 5 percent zinc-copper, 2 percent copper, 1 percent zinc-lead, and 2 percent silver and gold-silver ore. Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore and old tailings sold or treated in California in 1947, with content in terms of recovered metals

Source	Material sold or treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
Dry and siliceous gold ore	438,254	558	111,164	44,272	172,000	16,000	12,000
Dry and siliceous gold-silver ore	3,053		1,315	48,738	900	2,700	
Dry and siliceous silver ore	1,142	6,785	89	40,241	32,400	595,400	
	442,449	7,343	112,568	133,251	205,300	614,100	12,000
Copper ore	15,993		[1] 371	[1] 19,811	[1 2] 1,888,200	[1] 2,800	
Lead ore	83,947	3,966	1,752	1,213,277	165,600	17,611,500	1,315,400
Zinc ore	[3] 49,651		[4] 3,665	[4] 136,144	[4] 1,307,900	[4] 233,200	[4] 5,997,900
Zinc-copper ore	35,745		138	21,863	1,053,700	28,000	1,038,000
Zinc-lead ore	439	9,256	383	49,082	193,300	1,670,400	2,466,700
Total lode mines	[3] 628,224	20,565	[1 4] 118,877	[1 4] 1,573,428	[1 2 4] 4,814,000	[1 4] 20,160,000	[4] 10,830,000
Placers			312,538	24,014			
Total: 1947	[3] 628,224	20,565	[1 4] 431,415	[1 4] 1,597,442	[1 2 4] 4,814,000	[1 4] 20,160,000	[4] 10,830,000
1946	[3] 554,564	73,203	[1 4] 356,824	[1 4] 1,342,651	[1 4] 8,480,000	19,846,000	13,754,000

[1] Includes metal recovered from pyritic ore (residue).
[2] Includes 8,800 pounds from precipitates.
[3] Excludes tungsten ore.
[4] Includes metal recovered from tungsten ore.

METALLURGIC INDUSTRY

During 1947, 74 percent of the total ore and old tailings handled was treated at amalgamation and cyanidation mills, 14 percent was treated at concentrating mills, and 12 percent was shipped for direct smelting. Smelters also received 22,026 tons of flotation concentrates and 133 tons of gravity concentrates from California mine operators. Comparing 1947 with 1946, material treated at cyanidation mills increased 27 percent, and the quantity of material amalgamated increased 29 percent. The tonnage of crude ore and old tailings smelted increased 12 percent, whereas the quantity of ore and old tailings concentrated decreased 51 percent.

Companies producing most of California's lode gold in 1947 owned and operated their own metallurgical plants. Included with the few mills that did receive custom gold ore were: Burton Bros., Inc., Rosamond (treatment by cyanidation), and Butte Lode Mining Co., Randsburg, (amalgamation) both in Kern County. The Empire Star Mines Co. Ltd., Grass Valley, Nevada County, cyanided some lots of concentrates. The lead plant of the American Smelting & Refining Co. at Selby, Contra Costa County—the State's only smelter—operated throughout the year.

Mine production of metals in California in 1947, 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 old tailings amalgamated	471,238	67,030	12,326			
Ore, old tailings, and concentrates cyanided	31,598	36,205	24,439			
Concentrates smelted:						
Flotation	22,026	9,872	375,731	2,547,700	5,274,650	6,608,800
Gravity	133	1,191	985	3,400	5,100	
Ore and old tailings smelted	79,114	4,579	1,159,947	2,262,900	14,880,250	4,221,200
Total lode mines		118,877	1,573,428	4,814,000	20,160,000	10,830,000
Placers		312,538	24,014			
Total: 1947		431,415	1,597,442	4,814,000	20,160,000	10,830,000
1946		356,824	1,342,651	8,480,000	19,846,000	13,754,000

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in California in 1947, 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] (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
AMALGAMATION MILLS										
Amador	842		1,342	279	16	268	173			
Butte	717		83	16	15	74	191			
Calaveras	125,590		1,321	456	7,520	3,344	96,556	1,242,000	180,000	4,700,000
Colusa	85		6	3						
El Dorado	1,605		58	11	8	39	4			
Fresno	(2)		5							
Inyo	24		20	7	3	15	6			
Kern	2,948		788	222						
Mariposa	9,406		3,598	1,058	174	2,102	759			
Mono	30		7	1						
Nevada	272,156		[3]45,248	[3]7,578						
Placer	767		486	248						
Plumas	2,294		131	33	22	83	21			
Riverside	5		1	1						
San Bernardino	561		75	17						
San Diego	20		13	6						
Shasta	209	20	56	5						
Sierra	22,623	530	11,879	2,114	182	943	335		12,000	
Siskiyou	525		543	76	3	207	61			
Tuolumne	30,261	8	1,362	194	1,072	2,742	1,803	12,000		
Yuba	12		8	1						
Total: 1947	470,680	558	[3]67,030	[3]12,326	9,015	9,817	99,909	1,254,000	192,000	4,700,000
1946	361,410	3,780	45,838	8,355	10,684	6,465	111,852	1,655,100	320,000	6,602,000
CYANIDATION MILLS										
Inyo	(2)		3							
Kern	7,491		5,365	7,330						
Nevada	24,107		30,837	17,109						
Total: 1947	31,598		36,205	24,439						
1946	24,939		27,372	16,407						
Grand total:										
1947	502,278	558	103,235	36,765	9,015	9,817	99,909	1,254,000	192,000	4,700,000
1946	386,349	3,780	73,210	24,762	10,684	6,465	111,852	1,655,100	320,000	6,602,000

[1] Figures under "Ore" include both raw ore and concentrates amalgamated or cyanided, but not raw ore concentrated before amalgamation or cyanidation of concentrates.
[2] Clean-up.
[3] Includes gold and silver recovered by gravity concentration and sold as "natural gold."

Mine production of metals from concentrating mills in California in 1947, by counties, in terms of recovered metals

County	Material treated		Concentrates smelted and recovered metal [1]					
	Ore (short tons)	Old tailings (short tons)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Calaveras	10		1	5	5			
El Dorado	4,990		327	280	1,612	112,000	3,850	12,000
Inyo	49,481		7,853	572	252,568	99,800	5,055,900	783,800
Kern	20		2	1	119			
Mariposa	10		1	3	1			
Plumas	500		89	201	491	28,000		
San Bernardino	70		58	35	123	3,600		75,000
Shasta	35,745		4,808	138	21,863	1,053,700	28,000	1,038,000
Siskiyou	10		1	1	19			
Tuolumne	110		4	10	6			
Total: 1947	90,946		13,144	1,246	276,807	1,297,100	5,087,750	1,908,800
1946	121,893	64,558	27,497	2,431	220,102	4,372,200	3,200,800	4,269,500

[1] Includes concentrates and gold, silver, and copper from tungsten ore not included with material treated.

Gross metal content of concentrates produced from ores mined in California in 1947, by classes of concentrates

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	1,628	7,118	3,840	18,681	12,969	
Dry gold-silver	4	2	52	8	2,741	
Dry silver	2	1	119			
Copper	4,736	2,294	98,454	2,536,669	361,018	15,635
Lead	1,388	387	24,581	4,695	1,044,273	48,042
Zinc	8,086	1,088	26,895	46,805	11,794	5,950,421
Zinc-lead	6,315	173	222,775	33,640	4,111,566	1,019,365
Total: 1947	22,159	11,063	376,716	2,640,498	5,544,361	7,033,463
1946	38,181	8,896	331,954	6,215,959	3,774,783	11,250,053

Mine production of metals from California concentrates shipped to smelters in 1947, in terms of recovered metals

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Amador	16	268	173			
Butte	15	74	191			
Calaveras	7,521	3,349	96,561	1,242,000	180,000	4,700,000
El Dorado	335	319	1,616	112,000	3,850	12,000
Inyo	7,856	587	252,574	99,800	5,055,900	783,800
Kern	2	1	119			
Mariposa	175	2,105	760			
Plumas	111	284	512	28,000		
San Bernardino	58	35	123	3,600		75,000
Shasta	4,808	138	21,863	1,053,700	28,000	1,038,000
Sierra	182	943	335		12,000	
Siskiyou	4	208	80			
Tuolumne	1,076	2,752	1,809	12,000		
Total: 1947	22,159	11,063	376,716	2,551,100	5,279,750	6,608,800
1946	38,181	8,896	331,954	6,027,300	3,520,800	10,871,500
BY CLASSES OF CONCENTRATES						
Dry gold	1,628	7,118	3,840	13,700	12,000	
Dry gold-silver	4	2	52		2,700	
Dry silver	2	1	119			
Copper	4,736	2,294	98,454	2,460,400	201,250	12,000
Lead	1,388	387	24,581	4,000	1,011,500	34,000
Zinc	8,086	1,088	26,895	44,400	10,600	5,824,800
Zinc-lead	6,315	173	222,775	28,600	4,041,700	738,000
Total 1947	22,159	11,063	376,716	2,551,100	5,279,750	6,608,800

Gross metal content of California crude ore and old tailings shipped to smelters in 1947, by classes of material

Class of ore	Material shipped		Gross metal content [1]				
	Ore (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	2,205		1,430	2,334	48,914	627	
Dry gold-silver	3,010		1,312	48,511	1,056		
Dry silver	1,125	6,785	89	40,297	41,570	611,756	
Copper [1]	15,433		154	19,314	[2] 1,909,177	5,107	
Lead	34,536	3,966	1,192	965,968	164,859	12,825,509	752,276
Zinc	2,399		19	34,494	198	54,132	1,688,727
Zinc-lead	399	9,256	383	49,029	226,919	1,698,806	3,385,857
Total: 1947	59,107	20,007	4,579	1,159,947	[2] 2,392,693	15,195,937	5,826,860
1946	65,772	4,868	4,946	966,114	2,558,970	16,664,874	3,980,455

[1] Content of copper ore includes gold, silver, copper, and lead from pyritic ore (residue) not included with material treated.
[2] Includes 8,959 pounds contained in precipitates.

Mine production of metals from California crude ore and old tailings shipped to smelters in 1947, in terms of recovered metals

	Material shipped: Ore (short tons)	Material shipped: Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES							
Amador	15,324		406	10,771	[1] 1,674,000		
Calaveras	50		165	23			
El Dorado	5		8	17		150	
Inyo	35,132	9,643	1,364	983,417	132,200	12,924,100	620,200
Lassen	4		1	6			
Mariposa	38		2	30	4,000		
Mono		1,108	34	7,322	18,000	34,000	
Nevada	1		38	235			
Placer	116		51	6			
Plumas	3		7	6			
Riverside	8		27	14			
San Bernardino	8,304		1,971	103,337	88,400	316,000	1,225,000
Shasta [2]		9,256	385	54,648	342,300	1,606,000	2,376,000
Siskiyou	5		2	16			
Trinity	86		100	96	4,000		
Tuolumne	24		10	2			
Yuba	7		8	1			
Total: 1947	59,107	20,007	4,579	1,159,947	[1] 2,262,900	14,880,250	4,221,200
1946	65,772	4,868	4,946	966,114	2,452,700	16,325,200	2,882,500
BY CLASSES OF MATERIAL							
Dry gold	2,205		1,430	2,334	46,300	150	
Dry gold-silver	3,010		1,312	48,511	900		
Dry silver	1,125	6,785	89	40,297	32,400	595,400	
Copper [2]	15,433		154	19,314	[1] 1,856,900	2,800	
Lead	34,536	3,966	1,192	965,968	133,000	12,560,500	544,400
Zinc	2,399		19	34,494	100	52,900	1,222,900
Zinc-lead	399	9,256	383	49,029	193,300	1,668,500	2,453,900
Total 1947	59,107	20,007	4,579	1,159,947	[1] 2,262,900	14,880,250	4,221,200

[1] Includes 8,800 pounds contained in precipitates.
[2] Content of copper ore from Shasta County includes gold, silver, copper, and lead from pyritic ore (residue) not included with material treated.

REVIEW BY COUNTIES AND DISTRICTS

AMADOR COUNTY

East Belt District.—The Belden Amador Mines, Inc., operated the Belden mine throughout 1947, and Russell A. Donnelly worked the Peterson mine during the first 5 months of the year; gold ore from each mine was treated by amalgamation.

Ione District.—The Pacific Mining Co., operating under contract from the Winston Copper Co., worked the Newton mine from January 1 through August 1947, shipping 15,236 tons of copper smelting ore containing 131 ounces of gold, 10,696 ounces of silver, and 1,699,036 pounds of copper; in addition, 8,800 pounds of copper were recovered from precipitates. The mine was shut down as a result of the expiration of the Premium Price Plan for copper, lead, and zinc on June 30, 1947.

Mine production of gold, silver, copper, lead, and zinc in California in 1947, by counties and districts, in terms of recovered metals [1]

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold			Silver (lode and placer) [3] (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode (fine ounces)	Placer (fine ounces)	Total (fine ounces)					
Amador County:											
Camanche [4]		3			244	244	37				$8,573
East Belt [5]	3	2	923	693	338	1,031	337				36,390
Ione [6]	1	(7)	15,236	131	(7)	[8] 131	[8] 10,696	1,674,000			[8] 365,805
Mother Lode [9]	4	4	7	1,192	2,042	3,234	515				113,656
Butte County:											
Butte Creek	1	3	16	27	3,612	3,639	310				127,646
Centerville		(10)			113	113	12				3,966
Enterprise		(10)			112	112	11				3,930
Forbestown		(10)			113	113	11				3,965
Golden Summit		(10)			113	113	10				3,964
Magalia	1	(10)	1	16	113	129	18				4,531
Merrimac		1			115	115	12				4,036
Oroville		6			22,589	22,589	1,620				792,081
Yankee Hill	1		700	114		114	197				4,168
Calaveras County:											
Camanche [4]		2			11	11					385
Campo Seco	1		47,252	3,635		3,635	96,366	1,240,300	180,000	4,700,000	1,069,519
Copperopolis	(7)		(7)	(7)		(7)	(7)	(7)			(7)
East Belt [5]	5		137	173		173	34				6,086
Jenny Lind	1	1	853	441	13	454	311				16,171
Mother Lode [9]	5	8	108	76	312	388	48				13,624
Colusa County: Willow Springs	1		85	6		6	3				213
El Dorado County:											
East Belt [5]	(7)		(7)	(7)		(7)	(7)				(7)
Mother Lode [9]	10	7	6,313	251	1,815	2,066	1,848	112,000	4,000	12,000	99,530
West Belt	1	5	6	3	554	557	81				19,568
Undistributed		(10)			240	240	42				8,438
Fresno County:											
Copper King	1			5		5					175
Friant		3			230	230	37				8,083
Humboldt County: Orleans		1			139	139	22				4,885
Inyo County:											
Black Canyon	1		248	8		8	1,641	400	37,500		7,249
Bishop Creek	(7)		(7)	(7)		(7)	(7)	(7)			(7)
Cerro Gordo	4		8,272	29		29	33,373	46,200	940,000	10,000	177,490
Coso	9		64,464	574		574	1,093,709	88,400	13,102,500	1,205,400	3,061,074
Deep Spring	1		31	1		1	40		3,500		575
Fish Springs	8		172	168		168	598	600	15,000		8,707
Kearsarge	(7)		(7)	(7)		(7)	(7)				(7)
Modoc	6		1,106	28		28	9,601	3,000	278,500	49,800	56,429
Resting Springs	(7)		(7)	(7)		(7)	(7)	(7)	(7)	(7)	(7)

Olancha	1		2				147		3,000		565
Sherman	1			3		3					105
Slate Range	1		321	47		47	992	2,000	40,500	14,600	10,562
Sylvania	1		6				146				132
Ubehebe	2		259	3		3	764	700	62,000	17,800	12,025
Union	1		20	5		5	416	100	5,500		1,364
Wild Rose	2		340	24		24	6,860	300	180,500	5,400	33,756
Kern County:											
Greenhorn		(7)			(7)	(7)	(7)				(7)
Green Mountain	1		80	13		13	7				461
Keyes (Pioneer)	2		45	23		23	132				924
Long Tom		1			4	4	1				141
Mojave	1		7,491	5,365		5,365	7,330				194,409
Randsburg	12	3	2,843	753	67	820	215				28,895
Lassen County: Diamond Mountain	1		4	1		1	6				40
Los Angeles County:											
Newhall		(7)			(7)	(7)					(7)
San Gabriel		3			46	46	6				1,615
Madera County:											
Chowchilla River [11]		1			16	16	4				564
Dennis		1			169	169	50				5,960
Raymond		2			12	12	3				423
Mariposa County:											
East Belt [5]	4	2	464	108	372	480	69				16,862
Hunter Valley	5	1	8,820	5,527	11	5,538	1,776				195,437
Mother Lode [5]	6	2	170	70	275	345	88	4,000			12,995
Merced County:											
Chowchilla River [11]		1			29	29	3				1,018
Snelling		(7)			(7)	(7)	(7)				(7)
Mono County:											
Blind Spring	1		1,108	34		34	7,322	18,000	34,000		16,492
Chidago	1		30	7		7	1				246
Nevada County:											
French Corral		5			278	278	33				9,760
Grass Valley-Nevada City	6	2	243,811	68,331	52	68,383	24,032				2,415,154
North Bloomfield		(7)			(7)	(7)	(7)				(7)
Washington	3	5	28,326	7,742	154	7,896	923				277,195
You Bet	2	(10)	20	50	64	114	16				4,004
Undistributed		(10)			4,316	4,316	721				151,713
Placer County:											
Auburn		1			101	101	11				3,545
Dutch Flat		5			124	124	14				4,353
Forest Hill		9			3,560	3,560	346				124,913
Iowa Hill	1	4	15	6	55	61	13				2,147
Last Chance		2			74	74	8				2,597
Lincoln		1			406	406	97				14,298
Michigan Bluff		2			73	73	11				2,565
Ophir	2	(7)	752	480	(7)	[8] 480	[8] 246				[8] 17,023
Tahoe	1		116	51		51	6				1,790
Undistributed		(10)			240	240	39				8,435
Plumas County:											
Genesee	1	1	503	208	9	217	498	28,000			13,926
Granite Basin		(10)			19	19	6				670

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California in 1947, by counties and districts, in terms of recovered metals [1]—Con.

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold			Silver (lode and placer)[3] (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode (fine ounces)	Placer (fine ounces)	Total (fine ounces)					
Plumas County—Continued											
Greenville	1	1	2,239	193	4	197	47	----	----	----	$6,938
Johnsville	1	----	30	7	----	7	1	----	----	----	246
La Porte	----	1	----	----	28	28	3	----	----	----	983
Quincy	----	1	----	----	18	18	2	----	----	----	632
Rich	----	2	----	----	31	31	6	----	----	----	1,090
Seneca	----	(7)	----	----	(7)	(7)	(7)	----	----	----	(7)
Virgilia	1	----	25	14	----	14	6	----	----	----	495
Riverside County: Chuckawalla	2	1	13	28	2	30	15	----	----	----	1,064
Sacramento County:											
Cosumnes River	----	3	----	----	10,691	10,691	979	----	----	----	375,071
Folsom	----	10	----	----	102,121	102,121	5,136	----	----	----	3,578,883
Ione [6]	----	1	----	----	748	748	88	----	----	----	26,260
San Bernardino County:											
Arrowhead	1	----	29	18	----	18	29	----	----	----	656
Buckeye	1	----	1,572	534	----	534	1,602	42,200	----	----	29,002
Calico	1	----	60	16	----	16	6	3,300	----	----	1,258
Cima	2	----	122	14	----	14	857	22,600	----	----	6,012
Clark Mountain	4	----	3,242	29	----	29	41,683	12,800	299,000	1,225,000	232,707
Lead Mountain	1	----	60	10	----	10	414	200	17,000	----	3,215
Holcomb Valley	2	----	557	38	----	38	6	----	----	----	1,335
Newberry	1	----	76	1	----	1	9,581	200	----	----	8,748
Randsburg	2	2	3,010	1,312	2,328	3,640	49,022	1,200	----	75,000	181,092
Shadow Mountain	1	----	34	1	----	1	531	6,000	----	----	1,776
Signel	1	----	1	----	----	----	22	----	----	----	20
Slate Range	1	----	4	37	----	37	11	----	----	----	1,305
Solo	1	----	117	47	----	47	100	100	----	----	1,757
Summit Valley	1	----	10	19	----	19	6	----	----	----	670
Twenty-Nine Palms	2	----	4	5	----	5	6	----	----	----	180
Whipple Mountain	2	----	37	----	----	----	1	3,400	----	----	715
San Diego County: El Cajon	1	----	20	13	----	13	6	----	----	----	460
San Francisco County: San Francisco	----	1	----	----	4	4	----	----	----	----	140
San Joaquin County:											
Camanche [4]	----	(7)	----	----	(7)	(7)	(7)	----	----	----	(7)
Undistributed	----	(10)	----	----	8	8	1	----	----	----	281
Shasta County:											
Buckeye	1	----	20	18	----	18	2	----	----	----	632
Flat Creek	2	----	45,001	523	----	523	76,511	1,396,000	1,634,000	3,414,000	1,029,097
French Gulch	(7)	(10)	(7)	(7)	32	[12] 32	6	----	----	----	[12] 1,125
Igo	1	(10)	10	3	30	33	4	----	----	----	1,159
Old Diggings	----	(10)	----	----	29	29	3	----	----	----	1,018
Redding	----	4	----	----	7,193	7,193	793	----	----	----	252,473
Shasta	1	1	134	33	1,411	1,444	231	----	----	----	50,749
Sierra County:											
Alleghany	3	4	12,410	7,661	118	7,779	1,304	----	----	----	273,445
American Hill	1	(10)	530	40	10	50	9	----	----	----	1,758
Downieville	4	2	9,395	4,871	248	5,119	1,132	----	12,000	----	181,917

Pike	3	2	798	247	14	261	44				9,175
Poker Flat		1			40	40	6				1,405
Sierra City		1			12	12	5				425
Undistributed	1		20	2		2	1				71
Siskiyou County:											
Callahan		(7)			(7)	(7)	(7)				(7)
Deadwood		(7)			(7)	(7)	(7)				(7)
Humbug		2			214	214	36				7,523
Klamath River	1	7	5	2	11,293	11,295	1,617				396,788
Liberty	2	7	315	8	249	257	73				9,061
Quartz Valley	1	(10)	2	1	23	24	4				844
Salmon River	2	(10)	102	42	22	64	13				2,252
Scott Bar	2		106	684		684	120				24,049
Yreka	1	(7)	10	16	(7)	[8] 16	[8] 5				[8] 565
Stanislaus County: La Grange		(7)			(7)	(7)	(7)				(7)
Trinity County:											
Big Bar		(10)			15	15	2				527
Cinnabar		2			44	44					1,540
Coffee Creek		1			3,024	3,024	481				106,275
Hayfork	1	(10)	11	33	15	48	10				1,689
Helena		(10)			15	15	2				527
Junction City		3			6,060	6,060	560				212,607
Lewiston		1			2,160	2,160	258				75,833
New River	1	(7)	75	67	(7)	[8] 67	[8] 88	4,000			[8] 3,265
Salyer		2			60	60	5				2,105
Trinity Center		(7)			(7)	(7)	(7)				(7)
Weaverville		7			1,000	1,000	93				35,084
Tuolumne County:											
East Belt [5]	9		224	1,245		1,245	310	100			43,877
Mother Lode [9]	10	5	30,179	2,880	107	2,987	1,705	11,900			108,587
Yuba County:											
Browns Valley		(10)			22	22	2				772
Challenge	1	1	2	3	2	5					175
Dobbins	1	5	17	13	50	63	8				2,212
Smartville		(10)			1	1					35
Strawberry Valley		1			49	49	6				1,720
Yuba River		(7)			(7)	(7)	(7)				(7)
Other districts [13]	7	28	96,685	1,727	119,649	121,376	96,928	92,000	3,311,500	101,000	4,844,277
Total California	210	210	[14] 648,789	[15] 118,877	312,538	[15] 431,415	[15] 1,597,442	[15] 4,814,000	20,160,000	10,830,000	21,769,620

1 Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts listed in footnote 13 and their output grouped as "Other districts."

2 Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

3 Sources of total silver as follows: 1,573,428 ounces from lode mines and 24,014 ounces from placers.

4 Camanche district lies in Amador, Calaveras, and San Joaquin Counties.

5 East Belt district lies in Amador, Calaveras, El Dorado, Mariposa, and Tuolumne Counties.

6 Ione district lies in Amador and Sacramento Counties.

7 Included with "Other districts."

8 Exclusive of placer output, which is included with "Other districts."

9 Mother Lode district lies in Amador, Calaveras, El Dorado, Mariposa, and Tuolumne Counties.

10 Output from property not classed as a "mine."

11 Chowchilla River lies in Madera and Merced Counties.

12 Exclusive of lode output, which is included with "Other districts."

13 Includes following: Ione district [6] (placer) in Amador County; Copperopolis in Calaveras County; East Belt [5] in El Dorado County; Bishop Creek, Kearsarge, and Resting Springs in Inyo County; Green Mountain in Kern County; Newhall in Los Angeles County; Snelling in Merced County; North Bloomfield in Nevada County; Ophir (placer) in Placer County; Seneca in Plumas County; Camanche [4] in San Joaquin; French Gulch (lode) in Shasta County; Callahan, Deadwood, and Yreka (placer) in Siskiyou County; La Grange in Stanislaus County; New River (placer) and Trinity Center in Trinity County; and Yuba River district in Yuba County.

14 Excludes tungsten ore.

15 Includes metal recovered from tungsten ore.

Mother Lode District.—The Mountain Gold Dredging Co. operated a dragline excavator and floating washing plant on the Tom Burke ranch during the first 3 months of 1947; the equipment was later moved to the Ione district, Sacramento County. Earnest L. Lilly operated a dragline dredge on the Cosumnes River west of Plymouth from January 1 to October 16, 1947. The Argonaut Mining Co., Ltd. (one of the large producers of gold in California for many years prior to World War II), discontinued maintenance work at its Argonaut mine at Jackson and is liquidating the remaining assets of the property; operations, other than maintenance and clean-up, were suspended late in 1942 because of War Production Board Limitation Order L–208.

BUTTE COUNTY

Butte Creek District.—The Lancha Plana Gold Dredging Co. operated its connected-bucket dredge No. 5 (with 65 4½-cubic-foot buckets, electrically powered) on Butte Creek for 282 days of 1947. Placer Exploration Co. worked its dragline dredge on Drescher ranch during the first 3 months of 1947.

Oroville District.—Hoosier Gulch Placers operated a dragline dredge (boat No. 1) for 2 months in 1947. Yuba Consolidated Goldfields, Butte unit, operated two connected-bucket dredges on land adjoining the Feather River throughout the year; both dredges were of the Yuba type, electrically powered, one having 84 9-cubic-foot buckets and the other 87 9-cubic-foot buckets. The Kister dredge of the Gold Hill Dredging Co. operated on the east side of the Feather River, about 7 miles south of Oroville, throughout 1947; the electrically powered, connected-bucket dredge has 72 9-cubic-foot buckets.

Yankee Hill District.—The Surcease Mining Co. recovered gold and silver from ore produced during 1947 at the Surcease mine as the result of development work.

CALAVERAS COUNTY

Campo Seco District.—The Shawmut Copper Mine Co. worked the Penn mine during 9 months of the year, but suspended operations October 10, 1947, as a result of expiration of the Premium-Price Plan for copper, lead, and zinc on June 30, 1947; 47,252 tons of zinc ore were trucked to the Eagle Shawmut mill in Tuolumne County for treatment by amalgamation and selective flotation. Copper concentrate (3,055 tons, containing 1,796 ounces of gold, 74,966 ounces of silver, 1,277,629 pounds of copper, and 325,401 pounds of lead) and zinc concentrate (4,352 tons, containing 1,067 ounces of gold, 21,188 ounces of silver, and 4,795,744 pounds of zinc) were shipped to smelters. In addition, 772 ounces of gold and 212 ounces of silver were recovered by amalgamation.

Copperopolis District.—The Mountain King mine was operated by the open-cut method by the Mountain King Mill and Mine (a limited partnership) from March 1 through June 1947; gold ore was treated in the company 700-ton amalgamation-flotation plant, and concentrate was shipped to a smelter.

East Belt District.—A number of small lode-gold mines were intermittently active during 1947; these included the Dubois, Louise Margaret, and Roberts mines (Ernest H. Dubois); Lockwood (Atlas

Mining Co.); Mexican (E. B. Miles); New Champion (New Champion Mining Co.); and Oro-Y-Plata (California Gold Mines, Inc.).

Jenny Lind District.—Allen W. Doe and Jose Paltor, lessees, treated gold ore from the Royal mine by amalgamation and flotation during 1947; concentrate was shipped to a smelter.

Mother Lode District.—Among several placer mines operated by the dragline dredging method during 1947 were: The El Dorado Dredging Co. at Johnson Placer (Rathgeb property) and General Placers Corp. in July on San Antonio Creek (equipment was moved to Humbug Creek, Siskiyou County, in August 1947).

EL DORADO COUNTY

East Belt District.—Cosumnes Mines, Inc., operated the Cosumnes mine at Grizzly Flat throughout 1947, and treated gold ore in a 60-ton flotation plant; concentrate was shipped to a smelter.

Mother Lode District.—Pioneer-Lilyama Mines (O. H. Griggs) operated the Pioneer-Lilyama mine during 1947; copper concentrate (containing gold, silver, copper, lead, and zinc) from gold ore treated in the company 250-ton flotation mill and a small quantity of gold ore were shipped to a smelter. Volo Mining Co. worked the Shaw mine during 1947 and recovered gold and silver by amalgamation and from a small quantity of gold concentrate shipped to a smelter. Several dragline dredges operated during 1947, including Knight Placer Mining Co. on the Baldwin and Burks properties from September 1 to December 23; Greenhorn Dredging Co. on the Barkley lease from February 12 to August 9; the Marion G. Henness dredge on the Ostenrider ranch from January 1 to March 15, and Knight Placer Mining Co. from March 15 to April 1 (55,000 cubic yards of gravel worked by both operators yielded 411 ounces of gold and 32 ounces of silver).

West Belt District.—The El Dorado Dredging Co. worked the Galloway property from January 1 to January 10, 1947, and the Barrett property from March 1 to May 20, using a dragline dredge; 3,500 cubic yards from the Galloway property yielded 29 ounces of gold and 3 ounces of silver, and 17,000 cubic yards from the Barrett property yielded 150 ounces of gold and 29 ounces of silver. Hoosier Gulch Placers operated its boat No. 2 (dragline dredge) during June and July.

FRESNO COUNTY

Friant District.—Gold and some silver were recovered in 1947 as byproducts from commercial sand and gravel operations by Pacific Coast Aggregates, Inc., from its Rockfield plant 2 miles south of Friant.

HUMBOLDT COUNTY

Orleans District.—The Pearch hydraulic mine operated during March 1947; 125 ounces of gold and 20 ounces of silver were recovered.

INYO COUNTY

Black Canyon District.—Morris Albertoli and Partners shipped lead ore (248 tons containing 8 ounces of gold, 1,641 ounces of silver, 563 pounds of copper, and 38,038 pounds of lead) to a smelter from the Black Canyon mine during 1947.

Bishop Creek District.—The United States Vanadium Corp. produced, by flotation, a copper concentrate containing a substantial quantity of silver and some gold as a byproduct from ore treated primarily for tungsten.

Cerro Gordo District.—C. W. James shipped zinc ore (49 tons containing 232 ounces of silver, 198 pounds of copper, 6,930 pounds of lead, and 13,661 pounds of zinc) to a smelter during the last 4 months of 1947. The Santa Rosa Mining Co. and Louis Warnken, Jr., shipped a substantial tonnage of lead ore and some dump material to smelters for treatment from the Santa Rosa mine. L. D. Foreman shipped silver ore and slag to a smelter from the Cerro Gordo mine and dump.

Coso District.—The Darwin group of mines (the largest producer of silver and lead in the State) was operated by the Anaconda Copper Mining Co. throughout 1947. A total of 39,699 tons of lead ore was treated in the company 140-ton bulk flotation plant to produce 6,315 tons of zinc-lead concentrate (containing 173 ounces of gold, 222,775 ounces of silver, 33,640 pounds of copper, 4,111,566 pounds of lead, and 1,019,365 pounds of zinc), which was shipped to a smelter. In addition, 14,433 tons of lead ore and 3,664 tons of other lead-bearing material containing 331 ounces of gold, 844,091 ounces of silver, 52,386 pounds of copper, 8,591,831 pounds of lead, and 624,025 pounds of zinc were shipped for direct smelting. L. D. Foreman Co. shipped silver ore from the Wonder Ore Mines operation and Custer mine and dump material from the Lane-Eagle property to a smelter during 1947.

Modoc District.—The Combined Metals Reduction Co. made two shipments of zinc-lead ore to smelters for treatment in 1947. L. D. Foreman shipped lead ore and old slag, containing a substantial quantity of silver, to a smelter from the Modoc property, and Foreman & Skinner shipped lead ore containing a substantial quantity of silver from the Defense mine.

Resting Springs District.—Shoshone Mines (Columbia No. 2) was operated by the Finley Co. from January 1 through May 1947 and by the Anaconda Copper Mining Co. during the remainder of the year. Lead ore, and also lead concentrate produced at a recently constructed flotation mill on the property, were shipped to smelters for treatment.

Slate Range District.—Damon & Damon worked the Gold Bottom and Ophir mines during June 1947; lead ore was shipped to smelters for treatment. The operation was shut down because the Premium Price Plan expired June 30, 1947.

KERN COUNTY

Mojave District.—Burton Bros., Inc., operated its custom mill during 1947, cyaniding a substantial tonnage of gold ore from the Tropico mine and a lesser tonnage of gold and gold-silver ores from other properties (including the Standard Hill, Oro Fino, Paymaster, and Yellow Dog mines) in the Mojave and outlying districts.

Randsburg District.—Gold ore from a number of small mines worked in the district during 1947 (including the King Solomon, American Gold Coin, Big Gold and Tungsten, Big Dyke, G. B. Claim, Gunderson property, New Deal, Nine Spot, and Onyx group) was treated by amalgamation. T. B. Peterson, et al. operated the Lucky

Boy mine from January to September 9, 1947; 248 ounces of gold and 62 ounces of silver were recovered from 520 tons of gold ore treated by amalgamation in the Butte Lode Mining Co. mill. The Butte Lode Mining Co. operated the Butte Lode mine throughout most of 1947 and treated gold ore by amalgamation in the company mill, which also handled ore on a custom basis for neighboring mines, including the K. C. N. No. 1 mine operated by Hatton S. Lamley. Kern Placers, Inc., operated a dragline dredge (electrically operated) at Kern Placers near Randsburg from February 1 through December 1947; 28,000 cubic yards of gravel yielded 59 ounces of gold and 11 ounces of silver.

LOS ANGELES COUNTY

San Gabriel District.—The Azusa Rock & Sand Co. recovered gold and some silver as byproducts of its commercial sand and gravel plant operation on the San Gabriel River channel during 1947. The Consolidated Rock Products Co. similarly recovered a small quantity of gold and silver.

MADERA COUNTY

Dennis District.—A moderate quantity of gold and silver was recovered by the Ace Dredging & Manufacturing Co. et al., by suction dredging on the Heiskell property during 1947.

MARIPOSA COUNTY

East Belt District.—The Schroeder group was operated by Schroeder & Moss throughout 1947; 106 tons of gold ore treated by amalgamation yielded 67 ounces of gold and 9 ounces of silver.

Hunter Valley District.—The Mount Gaines Mining Co. operated the Mount Gaines mine throughout 1947 and amalgamated 8,780 tons of ore from which were recovered bullion (containing 3,406 ounces of gold and 1,010 ounces of silver) and 174 tons of flotation concentrate (including a small quantity of table concentrate) containing 2,102 ounces of gold and 759 ounces of silver. James H. Henry operated a ¾-cubic-yard dragline excavator and floating washing plant on Bull Creek from May through October 1947; the same equipment was used in the Mother Lode district during the early months of the year.

Mother Lode District.—James H. Henry operated a dragline dredge on Bear Creek at Bear Valley from February 10 to May 2; 34,915 cubic yards of gravel yielded 256 ounces of gold and 30 ounces of silver. The dredging equipment was subsequently moved to the Hunter Valley district and put in operation later in the year on Bull Creek.

MERCED COUNTY

Chowchilla River District.—Midstate Equipment & Dredging Co. operated a dragline dredge near Le Grand during 2 months of 1947.

Snelling District.—The Merced Dredging Co. operated its dredge No. 1 (electrically powered and equipped with 60 9½-cubic-foot buckets) on the Merced River ¾ mile from Snelling throughout the year. The Snelling Gold Dredging Co. operated its two Yuba-type, electric, connected-bucket dredges (each with 66 7-cubic-foot buckets) adjacent to the Merced River near Snelling. One dredge was operated throughout 1947, and the other was worked 2½ months of the year.

NEVADA COUNTY

Grass Valley-Nevada City District.—The Empire Star Mines Co., Ltd., operated the company mill at Grass Valley, Nevada County, throughout 1947, treating ore from the Empire, North Star, and Pennsylvania mines at Grass Valley and the company properties at Browns Valley in Yuba County (practically all production was from lessee operations) by amalgamation and cyanidation; concentrates from several neighboring mines also were treated at the plant. The Idaho-Maryland Mines Corp. worked the Idaho-Maryland and Brunswick mines throughout the year; 213,621 tons of ore were treated by amalgamation, followed by cyanidation of concentrates, yielding 50,090 ounces of gold and 13,646 ounces of silver. The Spring Hill Corp. operated the Spring Hill mine in 1947 and treated a substantial tonnage of gold ore by amalgamation.

North Bloom Field District.—Western Gold, Inc., hydraulicked the Relief Hill mine from March 21 to June 15, 1947. Frank M. Mellott hydraulicked the Waukashau mine from February 15 to June 20, 1947; 2,000 cubic yards of gravel yielded 17 ounces of gold and 1 ounce of silver.

Washington District.—The Ancho Erie Mining Co. operated the Ancho and Erie groups throughout 1947; 27,247 tons of gold ore were milled, from which 5,101 ounces of gold and 524 ounces of silver were recovered by amalgamation. In addition, 2,514 ounces of gold and 357 ounces of silver were recovered from 409 tons of flotation concentrate produced at the company's enlarged 200-ton mill and cyanided at its new 6-ton cyanide plant.

PLACER COUNTY

Foresthill District.—Horseshoe Bar Mines operated a dragline excavator and floating washing plant on the Middle Fork of the American River from January to November 15, 1947, when the mine was shut down and the equipment was sold. W. E. Wilson and Ernest Carlson worked the Volcano drift mine during 1947.

PLUMAS COUNTY

Rich District.—Lacey Mines, Ltd., operated a dragline excavator and a portable dry-land washing plant on the North Fork of the Feather River, 1 mile east of Twain, from June 1 to September 5, 1947.

SACRAMENTO COUNTY

Cosumnes River District.—Thurman & Wright operated an electric connected-bucket dredge (equipped with 86 6-cubic-foot buckets) 3 miles southeast of Sloughhouse throughout 1947. The Cosumnes Gold Dredging Co. operated its connected-bucket dredge near Sloughhouse during the last few months of 1947; the boat (equipped with 63 12-cubic-foot buckets) had been inoperative since October 20, 1942.

Folsom District.—The Capital Dredging Co. operated a Yuba electric connected-bucket dredge on its property 5 miles south of Folsom; the dredge was equipped with 100 18-cubic-foot buckets. Dredge No. 4 of the Lancha Plana Gold Dredging Co. operated for 363 days in 1947 on the American River 6 miles south of Folsom; the dredge had 84 6-cubic-foot buckets. The General Dredging Co. operated its 3-cubic-yard dragline excavator and floating washing plant on Alder Creek 4 miles west of Natoma throughout the year. The Natomas Co., the leading California gold producer in 1947, operated its fleet of seven electric connected-bucket dredges throughout the year. Recovery of gold as a byproduct of gravel-washing operations was reported by C. M. Craig at the Brighton Sand and Gravel Co. and Perkins Gravel Co. plants, by C. M. Craig and R. F. Echols at the Del Paso Rock Products Co. plant, and by the Fair Oaks Gravel Co. at its plant on the American River. The Fair Oaks Gravel Co. recovered 128 ounces of gold and 10 ounces of silver from 66,916 cubic yards of material handled.

Ione District.—The Mountain Gold Dredging Co. operated a dragline dredge on the Granless, Stanton, and Ryan properties from May 29 to December 31, 1947. The same equipment was operated in the Mother Lode district of Amador County earlier in the year.

SAN BERNARDINO COUNTY

Buckeye District.—Donald F. Love, lessee, shipped a substantial quantity of gold ore containing some silver and copper to smelters from the Roosevelt mine during 1947.

Clark Mountain District.—The Carbonate King zinc mine was operated throughout 1947 by J. Q. Little under contract from the Crystal Cave Mining Co.; zinc ore containing some silver and lead was shipped to a smelter. Mohawk Mines, Inc., worked the Mohawk mine throughout 1947; 712 tons of lead ore (containing 9 ounces of gold, 6,744 ounces of silver, 10,998 pounds of copper, and 227,489 pounds of lead) and 110 tons of zinc-lead ore (containing 1 ounce of gold, 622 ounces of silver, 3,850 pounds of copper, 11,171 pounds of lead, and 16,705 pounds of zinc) were shipped to smelters.

Randsburg District.—Frank W. Royer operated the Kelly mine during 1947 and shipped gold-silver ore to smelters. Hoefling Bros., operating the Atolia mine under lease option from the Atolia Mining Co., recovered a small quantity of zinc concentrate from ore treated primarily for its tungsten content; the concentrate was shipped to a smelter. The Surcease Mining Co. (formerly Hoefling Bros.) recovered 2,326 ounces of gold and 400 ounces of silver from 57,038 cubic yards of gravel, handled chiefly for scheelite, at the Spud Patch mine by dryland dredging throughout 1947; equipment used included two electric and one Diesel dragline excavators with 1½-cubic-yard buckets and two portable washing plants.

SAN JOAQUIN COUNTY

Camanche District.—The Gold Hill Dredging Co., working along the Mokelumne River, operated its lower Comanche connected-bucket dredge (with 76 8½-cubic-foot buckets) throughout the year and its upper Comanche dredge (with 64 7½-cubic-foot buckets) from January through March.

SHASTA COUNTY

Flat Creek District.—The Mountain Copper Co., Ltd., largest mining operation in Shasta County, worked the Hornet-Richmond mine throughout 1947. Zinc-copper ore was treated in the company

400-ton selective flotation mill to produce copper and zinc concentrates until July 1, when the plant was shut down following termination of premium prices for copper, lead, and zinc; concentrates produced were shipped to smelters. A small quantity of gold, silver, and copper was recovered from smelting cinder derived from burning pyrites in a sulfuric acid plant; the pyrites was produced at the Hornet mine. C. E. Wuensch & C. T. McNeil shipped flue dust from the abandoned Kennett smelter to a smelter during 3 months of 1947; 9,256 tons of material treated (originally from the Mammoth mine) contained 378 ounces of gold, 46,918 ounces of silver, 221,946 pounds of copper, 1,631,173 pounds of lead, and 3,281,073 pounds of zinc.

Redding District.—The Thurman Gold Dredging Co. operated its connected-bucket dredge (with 72 9-cubic-foot buckets) on Clear Creek throughout 1947.

Shasta District.—The Lincoln Gold Dredging Co. operated its 2-cubic-yard dragline excavator and floating washing plant at the Clark Jansen property on Clear Creek from July 1 through December 1947. The Yankee John mine was operated during 1947, a small quantity of gold ore being treated by amalgamation.

SIERRA COUNTY

Alleghany District.—The Original Sixteen to One Mine, Inc., operated its Original Sixteen to One mine throughout 1947, recovering a substantial quantity of gold and some silver by amalgamation and from gold concentrate shipped to a smelter.

Downieville District.—Alfred L. Merritt operated the Brush Creek mine throughout 1947 and treated a substantial tonnage of gold ore by amalgamation. Best Mines Co. worked the Gold Point, Oxford, and Gold Bluff mines during 1947 under limitations imposed by a labor shortage. Gold ore from the Gold Point mine was treated by amalgamation and flotation at the Oxford mill; gold concentrate was shipped to a smelter.

SISKIYOU COUNTY

Callahan District.—Yuba Consolidated Gold Fields (Siskiyou unit) operated its Yuba electric connected-bucket dredge (equipped with 72 9-cubic-foot buckets) on the Scott River from September 8 through December 1947.

Deadwood District.—The French Gulch Dredging Co. operated its electric connected-bucket dredge (with 72 4½-cubic-foot buckets) on Indian Creek near Fort Jones throughout 1947.

Humbug District.—General Placers Corp. operated a dragline dredge on Humbug Creek 8 miles west of Yreka from July through December 1947.

Klamath River District.—The Yreka Gold Dredging Co. operated its electric connected-bucket dredge (with 67 6-cubic-foot buckets) in Seiad Valley during 1947. Scandia Mines operated a dragline dredge on Horse Creek throughout 1947; 850,000 cubic yards of the gravel washed yielded 3,491 ounces of gold and 597 ounces of silver. Scandia Mines No. 3 worked its dragline dredge on the Klamath River from January 1 through September 1947, recovering 3,329 ounces of gold and 427 ounces of silver from 980,000 cubic yards of gravel handled.

Liberty District.—Hydraulicking was carried on during 1947 at the Farnsworth mine by E. A. McBroom, the Boulder Gulch mine by the Vest Mining Co., and at the Judge mine by Judge Hydraulic Mine. Alex Markon recovered 96 ounces of gold and 15 ounces of silver from 8,500 cubic yards of gravel hydraulicked at the Joubert mine.

Scott Bar District.—The Quartz Hill Syndicate worked the Quartz Hill mine (open pit) from January 15 to August 10, 1947; high-grade gold ore was treated in an amalgamation-concentration mill to recover 668 ounces of gold and 115 ounces of silver.

STANISLAUS COUNTY

La Grange District.—The La Grange Gold Dredging Co. operated its connected-bucket dredge No. 4 (with 62 10-cubic-foot buckets) on the Tuolumne River throughout 1947. The Tuolumne Gold Dredging Corp. operated its connected-bucket dredge throughout the year; the dredge is equipped with 100 12-cubic-foot buckets.

TRINITY COUNTY

Coffee Creek District.—Mires & Underseth operated a connected-bucket dredge (equipped with 82 6-cubic-foot buckets) on Coffee Creek during the latter half of 1947.

Junction City District.—The Junction City Mining Co. operated its electric connected-bucket dredge (with 75 10-cubic-foot buckets) along Trinity River throughout 1947. The Northern California Mines Co. property (Oak Hill, Evans & Bartlett, and Montezuma placers) was worked throughout the year by Gilzean Bros., and Hill, McCartney & Loft, lessees; gold was recovered by hydraulicking.

Lewiston District.—The Thomson Divide Mining Co. operated two dragline excavators and a floating washing plant on Trinity River near Lewiston from April 16 through December 1947. One of these dragline excavators was moved from the Trinity Center district, where it was operated earlier in the year.

New River District.—Fisher Mines, Ltd., operated the Fisher mine (including the Old Beartooth claims) 3 miles southeast of Denny until November 1947; gold ore containing some silver and copper was shipped to a smelter.

Trinity Center District.—The Carrville Gold Co. operated an electric connected-bucket dredge (Yuba-type with 77 12-cubic-foot buckets) on the Trinity River from January 1 to May 23, 1947. The Thomson Divide Mining Co. operated a dragline dredge at the Squirrel Gulch mine during January 1947; the equipment was subsequently moved to the Trinity River in the Lewiston district.

Weaverville District.—Placer Exploration Co. operated a dragline dredge on the Lorenz and Tout properties for 3 months in 1947, and the Donnalaine Dredging Co. operated similar equipment at the Golden Rock mine from April 8 to August 18, 1947. The Clear Creek Gold Dredging Co. worked a dragline excavator (with a 2-cubic-yard bucket) at the Lillie Jo mine for 7 weeks in 1947; 56,000 cubic yards of gravel yielded 95 ounces of gold and 9 ounces of silver. Bennett Mining Co. hydraulicked the Rex mine in 1947; this was the largest one of several placers worked in the district by this method during the year.

TUOLUMNE COUNTY

East Belt District.—Wayne Stobaugh worked the Fidelity pocket mine throughout 1947 and treated 10 tons of ore containing 440 ounces of gold and 36 ounces of silver by amalgamation. Edwin Harper recovered 52 ounces of gold and 12 ounces of silver from 7 tons of ore amalgamated at the Grizzly and Eureka pocket mines. Several other lode mines (mostly pocket mines) were worked on a small scale during 1947, including the Buckanan, Contention, Golden Star, Hidden Treasure, Lucky Strike, Wind Wheel, and Southern Cross; most of the gold from each property was recovered by amalgamation.

Mother Lode District.—Miller and Clemson (Eagle Shawmut Mine) operated the Eagle Shawmut mine the first 9 months of 1947, closing down operations in October; 28,279 tons of ore treated in the company 500-ton flotation mill yielded bullion containing 167 ounces of gold and 46 ounces of silver, and 1,068 tons of concentrate (containing 2,601 ounces of gold and 1,612 ounces of silver) which was shipped to a smelter. Several other mines were worked in the district during 1947 including the Alabama, Carlin, Hasloe, Gentry, Jumper, Red Devil, Yellow Pine, and Street; the ore was treated by amalgamation.

YUBA COUNTY

Strawberry Valley District.—The Fresno Mining Co. operated a suction dredge on the North Fork of the Yuba River from July 15 to September 15, 1947; 6,000 cubic yards of gravel yielded 49 ounces of gold and 6 ounces of silver.

Yuba River District.—Yuba Consolidated Gold Fields (Yuba unit) operated six connected-bucket dredges in the Yuba River Basin throughout 1947. The dredges are of the Yuba type, electrically operated, and had the following number and capacity of buckets: Two with 96 18-cubic-foot buckets; one with 92 18-cubic-foot buckets; one with 122 18-cubic-foot buckets; one with 88 18-cubic-foot buckets; and one with 132 18-cubic-foot buckets.

Colorado
Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By A. J. MARTIN

GENERAL SUMMARY

MINE production of gold, silver, copper, lead, and zinc in Colorado increased in 1947, although some mines producing mainly zinc closed after the Premium Price Plan expired June 30. The value of the output of the five metals totaled $23,868,179—an increase of $3,964,670 (20 percent) over 1946. Gold output, highest during June and July, increased 18 percent. Several placer operations shut down because of high labor and material costs, but the decline in placer-gold output was more than offset by increased lode-gold production, particularly in the Upper San Miguel, Cripple Creek, and Leadville districts. Colorado silver output (quantity) rose 14 percent—the production trend, in general, following that of lead. The copper output, largely a byproduct of the mining of other metals, rose 23 percent. Lead production increased 10 percent; the output rose materially after the Premium Price Plan expired, chiefly because several operators shifted work to higher-grade sections of their mines. Zinc production, relatively steady throughout the year, increased 7 percent over 1946. Labor was generally adequate, except in some gold districts.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Colorado ranked second among the States in total production of both gold and silver from the time of first recorded output through 1947. A comprehensive report of the mineral resources of the State was published in 1947.[1]

Mine production of gold, silver, copper, lead, and zinc in Colorado, 1943–47, and total, 1858–1947, 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
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
1946	235	28	1,463,496	142,613	4,991,455	2,240,151	1,810,042
1947	290	33	1,544,694	168,279	5,889,765	2,557,653	2,314,676
1858–1947			(1)	39,226,222	866,794,734	732,984,331	569,884,801

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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
1946	3,508,000	568,296	34,072,000	3,713,848	72,294,000	8,819,868	19,903,509
1947	4,300,000	903,000	37,392,000	5,384,448	77,490,000	9,376,290	23,868,179
1858–1947	(2) 252,861	67,188,369	(2) 2,480,578	244,296,311	(2) 1,377,943	212,636,678	1,960,800,893

1 Figure not available.
2 Short tons.

Gold.—Production of gold in Colorado increased from 142,613 fine ounces in 1946 to 168,279 ounces in 1947. The peak output was 1,391,364 ounces in 1900. The output in 1947 came largely from the Cripple Creek, Upper San Miguel, Animas, California (Leadville), and Alma Placers-Fairplay districts. Dry and siliceous ores yielded 77 percent of the State total gold, placers 10 percent, zinc-lead ore

Gold and silver produced at placer mines in Colorado, 1943–47, in fine ounces, in terms of recovered metals

Year	Small-scale hand methods 1		Hydraulic		Gravel mechanically handled: Nonfloating washing plants 2		Gravel mechanically handled: Dragline dredges		Gravel mechanically handled: Connected-bucket dredges		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1943	44	9	36	8	403	60			38	13	521	90
1944	66	8	28	8	249	74					343	90
1945	147	35	49	11	409	72			7,296	1,277	7,901	1,395
1946	89	15			1,047	169	(3)	(3)	(3) 19,036	(3) 3,514	20,172	3,698
1947	243	52			930	156	(3)	(3)	(3) 16,400	(3) 3,243	17,573	3,451

1 Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.
2 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."
3 Production by dragline dredges included with that by connected-bucket dredges; Bureau of Mines not at liberty to publish separately.

1 Vanderwilt, John W., and contributing authors, Mineral Resources of Colorado: Bull. State Min. Resources Board, Denver, Colo., 1947, 547 pp.

9 percent, and other classes of ore 4 percent. The leading gold-producing properties, in order of rank, were: Golden Cycle Corp. mines and dumps at Cripple Creek, Smuggler-Union group (Telluride Mines, Inc.) at Telluride, Shenandoah-Dives group in San Juan County, Cresson mine at Cripple Creek, and Resurrection group at Leadville.

Silver.—The Colorado output of silver was 2,557,653 fine ounces in 1947, compared with 2,240,151 ounces in 1946 and the peak of 25,838,600 ounces in 1893. In 1947 dry and siliceous ores yielded 55 percent of the State total silver; zinc-lead ore nearly 19 percent; zinc ore more than 10 percent; copper ore 8 percent, and lead, lead-copper, and zinc-lead-copper ores and placers 8 percent. The leading producers of silver were the Emperius Mining Co., Amethyst and other mines at Creede, Eagle mine at Red Cliff, Treasury Tunnel-Black Bear group (Idarado) in San Miguel County, Smuggler-Union group at Telluride, and Shenandoah-Dives group near Silverton.

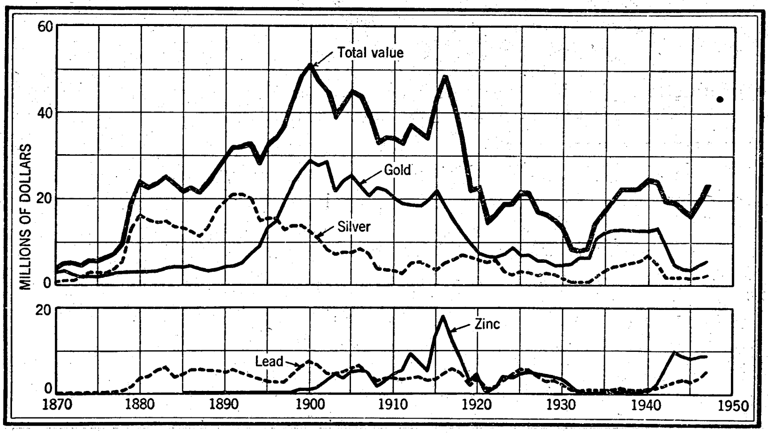

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Colorado, 1870–1947. The value of copper has been less than $2,000,000 annually, except in a few years.

Copper.—The output of copper in Colorado in 1947 (4,300,000 pounds) was derived mainly from ores mined for zinc, lead, or precious-metal content; copper ore yielded only 24 percent of the State total copper. From 1930 to 1941 copper ore (carrying also iron, silver, and gold) from Eagle County yielded the bulk of the State copper. The highest annual output was 28,342,000 pounds in 1938. In 1947 the only substantial producer of copper in the State was the Idarado Mining Co. in San Miguel County, which makes a copper concentrate from its complex gold-silver-copper-lead-zinc ore.

Lead.—The output of recoverable lead in Colorado was 37,392,000 pounds in 1947 compared with 34,072,000 pounds in 1946. The peak production was 164,274,762 pounds in 1900. Lake County (Leadville) contributed 23 percent of the total lead in 1947, San Juan County more than 15 percent, San Miguel 14 percent, Dolores 11 percent, Summit nearly 9 percent, and other counties 28 percent. Zinc-lead ore yielded 44 percent of the State total lead; gold, gold-silver, and silver ores 29 percent; lead, lead-copper, and zinc-lead-copper ores 14 percent; and copper and zinc ores 13 percent. The larger lead-producing mines, in order of rank, were: Resurrection group at Leadville, Rico-Argentine at Rico, Smuggler-Union at Telluride, Callahan Zinc-Lead Co., Inc., property at White Pine (Akron-Erie), and American Smelting & Refining Co. Kokomo unit.

Zinc.—Although some marginal mines closed when the Premium Price Plan expired, the State total output of recoverable zinc increased from 72,294,000 pounds in 1946 to 77,490,000 pounds in 1947. The peak production during World War II was 88,188,000 pounds in 1943, and the record high was 134,285,463 pounds in 1916. In 1947 Eagle County produced 45 percent of the State total zinc, Summit County 15 percent, Lake 12 percent, Dolores 9 percent, and other counties 19 percent. Zinc and zinc-lead ores yielded 91 percent of the State total zinc. The leading zinc-producing mines, in order of rank, were: Eagle mine at Red Cliff, American Smelting & Refining Co. Kokomo unit, Resurrection group at Leadville, Rico-Argentine group at Rico, and Callahan Zinc-Lead Co. Akron-Erie group at White Pine.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1947, 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	--------	2	387	$13,545	64	$58
Boulder	27	1	2,059	72,065	14,360	12,996
Chaffee	5	2	300	10,500	49,001	44,346
Clear Creek	34	--------	2,911	101,885	167,830	151,886
Custer	6	--------	35	1,225	27,472	24,862
Dolores	5	--------	104	3,640	124,199	112,400
Douglas	--------	1	3	105	--------	--------
Eagle	1	--------	936	32,760	233,351	211,183
Fremont	2	--------	8	280	592	536
Garfield	3	--------	129	4,515	1,841	1,666
Gilpin	9	7	302	10,570	4,470	4,045
Grand	--------	1	1	35	--------	--------
Gunnison	13	1	445	15,575	63,098	57,104
Hinsdale	1	--------	2	70	308	279
Jackson	1	--------	--------	--------	8	7
Jefferson	1	2	116	4,060	1,251	1,132
Lake	25	2	17,367	607,845	261,928	237,045
La Plata and Montezuma [1]	6	--------	892	31,220	968	876
Mineral	6	--------	245	8,575	317,712	287,529
Montrose	1	3	10	350	7,781	7,042
Ouray	18	--------	4,536	158,760	150,886	136,552
Park	12	7	15,123	529,305	20,890	18,905
Pitkin	5	--------	4	140	27,770	25,132
Rio Grande	1	--------	2,129	74,515	2,442	2,210
Saguache	10	--------	47	1,645	21,445	19,408
San Juan	20	--------	20,123	704,305	417,451	377,793
San Miguel	10	--------	39,567	1,384,845	440,676	398,812
Summit	31	4	2,340	81,900	192,999	174,664
Teller	37	--------	58,158	2,035,530	6,860	6,208
Total: 1947	290	33	168,279	5,889,765	2,557,653	2,314,676
1946	235	28	142,613	4,991,455	2,240,151	1,810,042

[1] Bureau of Mines not at liberty to publish county production figures separately.

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1947, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Adams							$13,603
Boulder	11,000	$2,310	161,700	$23,285			110,656
Chaffee	262,600	55,146	47,500	6,840	141,800	$17,158	133,990
Clear Creek	40,500	8,505	933,800	134,467	336,600	40,728	437,471
Custer	4,100	861	223,000	32,112	241,400	29,209	88,269
Dolores	217,100	45,591	4,084,500	588,168	6,866,800	830,883	1,580,682
Douglas							105
Eagle	481,500	101,115	1,847,000	265,968	34,750,000	4,204,750	4,815,776
Fremont	22,300	4,683	8,800	1,267	118,800	14,375	21,141
Garfield			26,500	3,816	70,800	8,567	18,564
Gilpin	5,100	1,071	140,000	20,160	60,000	7,260	43,106
Grand							35
Gunnison	46,600	9,786	3,011,000	433,584	3,374,600	408,326	924,375
Hinsdale	3,000	630	100	14			993
Jackson	1,600	336					343
Jefferson	138,000	28,980					34,172
Lake	219,000	45,990	8,599,000	1,238,256	9,618,000	1,163,778	3,292,914
La Plata and Montezuma [1]	1,200	252	10,400	1,498	8,000	968	34,814
Mineral	46,600	9,786	658,400	94,810	14,000	1,694	402,394
Montrose	119,200	25,032					32,424
Ouray	269,800	56,658	2,184,300	314,539	1,285,000	155,485	821,994
Park	20,800	4,368	160,300	23,083	764,600	92,517	668,178
Pitkin	700	147	220,400	31,738	23,000	2,783	59,940
Rio Grande	18,500	3,885	2,400	346			80,956
Saguache	24,200	5,082	793,900	114,322	236,400	28,604	169,061
San Juan	789,900	165,879	5,797,100	834,782	3,607,600	436,520	2,519,279
San Miguel	1,490,200	312,942	5,271,300	759,067	4,135,000	500,335	3,356,001
Summit	66,500	13,965	3,210,600	462,326	11,837,600	1,432,350	2,165,205
Teller							2,041,738
Total: 1947	4,300,000	903,000	37,392,000	5,384,448	77,490,000	9,376,290	23,868,179
1946	3,508,000	568,296	34,072,000	3,713,848	72,294,000	8,819,868	19,903,509

[1] Bureau of Mines not at liberty to publish county production figures separately.

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1947, by months, and in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	11,575	146,650	272,000	2,420,000	6,066,000
February	12,108	152,627	268,000	2,272,000	5,914,000
March	13,150	165,190	310,000	2,780,000	6,604,000
April	14,815	166,499	336,000	3,000,000	6,378,000
May	13,750	233,500	382,000	3,040,000	6,160,000
June	15,490	248,200	442,000	3,450,000	7,100,000
July	15,364	196,100	292,000	2,600,000	6,100,000
August	13,980	238,650	410,000	3,356,000	6,200,000
September	14,351	244,825	386,000	3,564,000	6,578,000
October	15,082	258,220	470,000	3,760,000	7,230,000
November	14,460	259,350	382,000	3,700,000	6,740,000
December	14,154	247,842	350,000	3,450,000	6,420,000
Total: 1947	168,279	2,557,653	4,300,000	37,392,000	77,490,000
1946	142,613	2,240,151	3,508,000	34,072,000	72,294,000

MINING INDUSTRY

Activity in mining and development continued at a fairly high level in 1947, despite the closing of some marginal zinc mines after Federal premiums were discontinued June 30. The rise in the market price of lead to an unprecedented high level, the higher Government price paid for silver since July 1, 1946, improvement in labor supply, and the strong demand for copper, lead, and zinc were factors contributing to the sustained activity. Ore sold or treated totaled 1,544,694 tons, compared with 1,463,496 tons in 1946. Several placer operations closed in the last part of the year because of high labor and material costs, and the recovery of placer gold decreased from 20,172 ounces in 1946 to 17,573 ounces in 1947.

At some properties exploration was stimulated by Government exploration premiums paid on metals produced before July 1. These premium allotments could be collected until December 31 if not previously exhausted. The Bureau of Mines and Geological Survey continued to investigate sources of strategic minerals. The work on copper, lead, and zinc included exploratory drilling and sampling of dumps in the Aspen district, Pitkin County; drilling in the Kokomo district, Summit County; field examinations in these and other counties; and metallurgical tests. Data on certain projects have been published.[2]

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Colorado in 1947, 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	804,673	111,716	394,595	434,119	5,146,827	2,178,283
Dry and siliceous gold-silver ore	161,581	17,301	468,977	1,594,082	4,651,765	4,078,919
Dry and siliceous silver ore	38,818	411	538,641	57,841	957,919	238,404
	1,005,072	129,428	1,402,213	2,086,042	10,756,511	6,495,606
Copper ore	16,572	859	203,389	1,017,995	88,106	
Lead ore	47,628	2,735	188,318	132,099	5,033,791	678,747
Lead-copper ore	6		254	679	2,460	
Zinc ore	223,753	3,173	269,733	345,277	4,859,577	48,406,074
Zinc-lead ore	247,881	14,411	475,291	585,243	16,536,984	21,807,792
Zinc-lead-copper ore	3,782	100	15,004	132,665	114,571	101,781
	539,622	21,278	1,151,989	2,213,958	26,635,489	70,994,394
Total lode mines	1,544,694	150,706	2,554,202	4,300,000	37,392,000	77,490,000
Placers		17,573	3,451			
Total: 1947	1,544,694	168,279	2,557,653	4,300,000	37,392,000	77,490,000
1946	1,463,496	142,613	2,240,151	3,508,000	34,072,000	72,294,000

METALLURGIC INDUSTRY

As the production of base metals rather than gold and silver was emphasized, as in recent years, the quantity of ore treated in amalgamation and cyanidation mills in Colorado decreased. There was, however, an increase in 1947 in the quantity of gold recovered by amalgamating jig concentrates caught in gold jigs in the ball mill-

[2] Ames, Edward W., Exploration of the Jewell Tunnel Zinc Property, Chaffee County, Colo.: Bureau of Mines Rep. of Investigations 3933, 1946, 12 pp.
Deshayes, E. V., and Young, W. E., Camp Bird Lead-Zinc Deposits, Ouray County, Colo.: Bureau of Mines Rep. of Investigations 4230, 1948, 19 pp.

classifier circuit of flotation mills. Ore treated in flotation mills recovering most or a large part of their gold output by amalgamating jig concentrates is included in the following table, which shows mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment). Ore treated in these mills before gold jigs were installed was included in the table showing production of metals from concentrating mills.

The Arkansas Valley smelter at Leadville purchases most of the State siliceous gold-silver and lead concentrates and silver, lead-copper, and lead ores shipped to smelters. The Golden Cycle mill at Colorado Springs offers a market for gold ores shipped for treatment. Smelters and custom mills in the Salt Lake Valley, Utah, are important as a market for Colorado zinc-lead ores and concentrates. Amarillo and Dumas, Tex.; Depue, Ill.; Palmerton, Pa.; and Anaconda and Great Falls, Mont., offer markets for zinc concentrates.

Mine production of metals in Colorado in 1947, 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	561,380	36,271	10,188			
Sands and slimes cyanided	420,026	44,698	6,127			
Concentrates smelted	146,366	66,451	2,188,742	3,412,617	35,436,379	77,399,865
Ore smelted	36,965	3,286	349,145	887,383	1,955,621	90,135
Placer		17,573	3,451			
Total: 1947		168,279	2,557,653	4,300,000	37,392,000	77,490,000
1946		142,613	2,240,151	3,508,000	34,072,000	72,294,000

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Colorado in 1947, in terms of recovered metals

BY COUNTIES

	Ore treated (short tons)	Recovered in bullion: Gold (fine ounces)	Recovered in bullion: Silver (fine ounces)	Concentrates smelted and recovered metal: Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Boulder	6,900	1,466	336	136	414	1,621		8,769	
Clear Creek	4,019	1,613	530	106	220	5,264	472	6,790	
Garfield	160	128							
Gilpin	76	6	1						
Gunnison	1,343	88	59	13	63	369		974	
Lake	74,253	4,268	2,508	15,414	7,831	120,334	175,966	5,799,757	7,176,326
Montezuma	673	200	43	8	65	79	100		
Ouray	25,529	2,546	748	3,045	1,825	99,930	176,498	1,014,143	850,053
Rio Grande	4,640	374	12	464	1,755	2,430	18,500	2,400	
San Miguel	244,532	12,121	5,218	21,287	24,078	362,737	1,365,835	4,853,334	4,130,899
Summit	9	1							
Teller	413,263	58,158	6,860						
Total: 1947	775,397	80,969	16,315	40,473	36,251	592,764	1,737,371	11,686,167	12,157,278
1946	360,750	61,321	14,322	3,841	5,611	141,424	187,916	1,096,484	1,032,731

BY CLASSES OF ORE TREATED

Dry and silliceous gold	603,113	69,018	11,744	15,766	23,213	186,800	112,253	3,028,722	1,195,935
Dry and siliceous gold-silver	99,031	7,763	2,071	9,328	5,221	285,748	1,449,443	2,859,796	3,785,017
Zinc-lead	73,253	4,248	2,500	15,379	7,817	120,216	175,675	5,797,649	7,176,326
Total 1947	**775,397**	**80,969**	**16,315**	**40,473**	**36,251**	**592,764**	**1,737,371**	**11,686,167**	**12,157,278**

Mine production of metals from concentrating mills in Colorado in 1947, 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	700	259	98	12,133	9,765	152,200	
Chaffee	563	183	20	1,844	3,460	16,041	141,800
Clear Creek	19,188	1,744	880	160,274	37,697	916,971	336,600
Custer	2,246	446	30	21,578	3,688	131,030	241,400
Dolores	35,345	10,383	103	123,846	216,838	4,064,613	6,866,800
Eagle	153,750	41,259	215	88,314	27,569	1,785,961	34,750,000
Fremont	2,062	189	8	592	22,300	8,800	118,800
Gilpin	2,525	348	238	4,357	4,416	140,000	60,000
Gunnison	11,229	7,836	273	60,712	46,387	2,949,915	3,374,600
Jefferson	5,430	292	97	1,245	138,000		
Lake	99,814	6,243	1,390	76,616	32,283	1,592,465	2,441,674
La Plata	88	13		405	1,000	10,400	8,000
Mineral	24,333	1,928	218	306,833	46,221	584,418	14,000
Ouray	11,932	1,638	153	45,582	93,050	1,075,416	434,947
Park	5,138	1,137	907	10,164	17,643	138,719	764,600
Pitkin	6,756	194	1	23,468	508	113,648	3,665
Saguache	3,007	1,527	46	20,885	22,583	777,660	236,400
San Juan	236,633	10,332	20,115	415,238	763,037	5,787,179	3,607,600
San Miguel	48,804	2,736	3,268	72,651	124,365	417,765	4,101
Summit	62,789	17,206	2,140	149,241	64,436	3,087,011	11,837,600
Total: 1947	732,332	105,893	30,200	1,595,978	1,675,246	23,750,212	65,242,587
1946	1,077,577	130,879	51,983	1,939,036	2,883,802	31,618,542	71,207,781

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	199,925	5,020	17,812	191,065	317,569	2,086,237	982,348
Dry and siliceous gold-silver	62,036	4,010	4,282	176,925	143,817	1,785,490	293,902
Dry and siliceous silver	37,596	2,575	321	477,685	56,527	893,380	238,404
Copper	5,632	331	102	1,615	154,400	1,600	
Lead	25,491	4,946	2,065	113,575	115,525	3,314,102	678,747
Zinc	223,337	60,138	3,172	267,914	345,277	4,836,677	48,335,274
Zinc-lead	174,533	28,593	2,346	352,195	409,466	10,718,155	14,612,131
Zinc-lead-copper	3,782	280	100	15,004	132,665	114,571	101,781
Total 1947	732,332	105,893	30,200	1,595,978	1,675,246	23,750,212	65,242,587

Gross metal content of concentrates produced from ores mined in Colorado in 1947, 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	748	2,399	5,339	26,373	21,592	
Dry gold-silver	1,570	1,477	52,100	54,284	159,497	53,580
Dry silver	6	4	1,119		223	
Copper	2,315	2,400	46,440	1,309,573	58,833	137,354
Lead	43,707	30,745	1,559,463	1,184,249	30,807,546	4,717,198
Lead-copper	3,706	10,404	187,451	485,248	2,368,374	350,078
Dry iron [1]	2,043	7,341	36,541	38,339	782,590	253,081
Dry iron-lead [2]	2,881	5,962	24,858	9,324	337,999	152,237
Total to copper and lead plants	56,976	60,732	1,913,311	3,107,390	34,536,654	5,663,528
Zinc	85,881	5,095	230,265	659,955	1,640,507	85,646,389
Zinc-lead	3,509	2,101	111,607	214,824	1,229,711	1,343,054
Total to zinc plants	89,390	7,196	341,872	874,779	2,870,218	86,989,443
Total: 1947	146,366	67,928	2,255,183	3,982,169	37,406,872	92,652,971
1946	134,720	58,756	2,137,717	3,599,455	34,681,097	85,794,873

[1] From zinc-lead, zinc, lead, silver, gold-silver and gold ores.

[2] From gold ore.

Mine production of metals from Colorado concentrates shipped to smelters in 1947, in terms of recovered metals

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Boulder	395	512	13,754	9,765	160,969	
Chaffee	183	20	1,844	3,460	16,041	141,800
Clear Creek	1,850	1,100	165,538	38,169	923,761	336,600
Custer	446	30	21,578	3,688	131,030	241,400
Dolores	10,383	103	123,846	216,838	4,064,613	6,866,800
Eagle	41,259	215	88,314	27,569	1,785,961	34,750,000
Fremont	189	8	592	22,300	8,800	118,800
Gilpin	348	238	4,357	4,416	140,000	60,000
Gunnison	7,849	336	61,081	46,387	2,950,889	3,374,600
Jefferson	292	97	1,245	138,000		
Lake	21,657	9,221	196,950	208,249	7,392,222	9,618,000
La Plata	13		405	1,000	10,400	8,000
Mineral	1,928	218	306,833	46,221	584,418	14,000
Montezuma	8	65	79	100		
Ouray	4,683	1,978	145,512	269,548	2,089,559	1,285,000
Park	1,137	907	10,164	17,643	138,719	764,600
Pitkin	194	1	23,468	508	113,648	3,665
Rio Grande	464	1,755	2,430	18,500	2,400	
Saguache	1,527	46	20,885	22,583	777,660	236,400
San Juan	10,332	20,115	415,238	763,037	5,787,179	3,607,600
San Miguel	24,023	27,346	435,388	1,490,200	5,271,099	4,135,000
Summit	17,206	2,140	149,241	64,436	3,087,011	11,837,600
Total: 1947	146,366	66,451	2,188,742	3,412,617	35,436,379	77,399,865
1946	134,720	57,594	2,080,460	3,071,718	32,715,026	72,240,512
BY CLASSES OF CONCENTRATES SMELTED						
Dry gold	748	2,399	5,339	20,973	20,728	
Dry gold-silver	1,570	1,477	52,100	38,046	153,116	
Dry silver	6	4	1,119		200	
Copper	2,315	2,400	46,440	1,270,203	35,380	
Lead	43,707	30,745	1,559,463	927,368	29,589,190	150,556
Lead-copper	3,706	10,404	187,451	390,198	2,274,196	10,219
Dry iron [1]	2,043	7,341	36,541	31,240	748,220	85,613
Dry iron-lead [2]	2,881	5,962	24,858	7,459	324,479	
Total to copper and lead plants	56,976	60,732	1,913,311	2,685,487	33,145,509	246,388
Zinc	85,881	3,618	163,824	544,531	1,082,412	76,181,043
Zinc-lead	3,509	2,101	111,607	182,599	1,208,458	972,434
Total to zinc plants	89,390	5,719	275,431	727,130	2,290,870	77,153,477
Total 1947	146,366	66,451	2,188,742	3,412,617	35,436,379	77,399,865

[1] From zinc-lead ore, Zinc ore, lead ore, silver ore, gold-silver ore, and gold ore. [2] From gold ore.

Gross metal content of Colorado crude ore shipped to smelters in 1947, 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	1,635	1,673	4,986	5,401	33,484	
Dry and siliceous gold-silver ore	514	95	4,233	1,015	6,793	
Dry and siliceous silver ore	1,222	90	60,956	1,814	67,479	
Copper ore	10,940	757	201,774	976,890	106,061	
Lead ore	22,137	670	74,743	20,601	1,791,270	28,824
Lead-copper ore	6		254	813	2,563	
Total to copper and lead plants	36,454	3,285	346,946	1,006,534	2,007,650	28,824
Zinc ore	416	1	1,819		23,488	97,694
Zinc-lead ore	95		380	120	21,546	26,797
Total to zinc plants	511	1	2,199	120	45,034	124,491
Total: 1947	36,965	3,286	349,145	1,006,654	2,052,684	153,315
1946	25,169	3,526	141,671	457,217	1,421,712	102,977

Mine production of metals from Colorado crude ore shipped to smelters in 1947, in terms of recovered metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Boulder	209	73	269	1,235	731	
Chaffee	2,263	41	47,127	259,140	31,459	
Clear Creek	217	198	1,762	2,331	10,039	
Custer	592	5	5,894	412	91,970	
Dolores	43	1	353	262	19,887	
Eagle	6,682	721	145,037	453,931	61,039	
Garfield	423	1	1,841		26,500	70,800
Gilpin	33	34	104	684		
Gunnison	178	14	1,956	213	60,111	
Hinsdale	9	2	308	3,000	100	
Jackson	12		8	1,600		
Lake	21,128	1,188	61,720	10,751	1,206,778	
La Plata	60	627	441	100		
Mineral	427	27	10,879	379	73,982	
Montrose	1,875	6	7,780	119,200		
Ouray	215	12	4,626	252	94,741	
Park	347	114	8,159	3,157	21,581	
Pitkin	618	3	4,302	192	106,752	19,335
Saguache	78	1	560	1,617	16,240	
San Juan	184	8	2,213	26,863	9,921	
San Miguel	4	100	70		201	
Summit	1,368	110	43,736	2,064	123,589	
Total: 1947	36,965	3,286	349,145	887,383	1,955,621	90,135
1946	25,169	3,526	141,671	436,282	1,356,974	53,488
BY CLASSES OF ORE						
Dry and siliceous gold ore	1,635	1,673	4,986	4,297	31,868	
Dry and siliceous gold-silver ore	514	95	4,233	822	6,479	
Dry and siliceous silver ore	1,222	90	60,956	1,314	64,539	
Copper ore	10,940	757	201,774	863,595	86,506	
Lead ore	22,137	670	74,743	16,574	1,719,689	
Lead-copper ore	6		254	679	2,460	
Total to copper and lead plants	36,454	3,285	346,946	887,281	1,911,541	
Zinc ore	416	1	1,819		22,900	70,800
Zinc-lead ore	95		380	102	21,180	19,335
Total to zinc plants	511	1	2,199	102	44,080	90,135
Total 1947	36,965	3,286	349,145	887,383	1,955,621	90,135

REVIEW BY COUNTIES AND DISTRICTS

ADAMS COUNTY

In 1947 gold and silver were recovered as byproducts from gravel washed for concrete aggregate by W. B. Kerkling at the Brannan Sand & Gravel Co. pit No. 10 and by Kerkling & Slensker at the Superior Sand & Gravel Co. pits, all near Lakewood.

BOULDER COUNTY

Central (Jamestown) District.—Several cars of gold ore from the John Jay-Last Chance group and of gold-silver ore from the Smuggler mine were shipped to the Golden Cycle mill at Colorado Springs in 1947. The Ozark-Mahoning Co. mill at Jamestown continued to recover lead concentrates (containing also some silver, gold, and copper) as a byproduct in the beneficiation of fluorspar.

Gold Hill District.—Most of the ore mined in the Gold Hill district in 1947 was gold ore and was shipped to the Golden Cycle mill. The largest shipper was Harrison S. Cobb, operating the Ingram and Emancipation mines. Other producers included James Pastore (American and Nil Desperandum mines), Arthur Sory (Big Horn), Henna Mines, Inc. (Cash), Griswold & Stromberg (Home Sweet Home), H. M. Williamson (Great Britain), Front Range Mines, Inc. (Melvina), Ross L. Benson (Parker No. 1), and Slide Mines, Inc. (Black Cloud).

Grand Island District.—Consolidated Caribou Silver Mines, Inc., completed reconditioning and enlarging the 1,500-foot Idaho tunnel and worked on driving an additional 2,000 feet to the Caribou mine. The company shipped some silver-lead-gold ore during the year. Merle C. Rugg operated the Enterprise mine from May 1 to December 1 and shipped gold ore.

Magnolia District.—Output of ore from the Magnolia district in 1947 comprised gold ore shipped to the Golden Cycle mill from the Pickwick-Magnolia group and the Sac and Fox mine dump by Elmer Hetzer and from the Senator Hill dump by C. H. Staley, Jr.

Sugar Loaf District.—The 272 tons of ore shipped from the Sugar Loaf district in 1947—all gold ore shipped to the Golden Cycle mill—came from the Alpine Horn, Nancy, Poorman, and Franklin (Wood Mountain) properties.

Ward District.—In 1947 the Utica Leasing Co. shipped two cars of gold-copper-silver ore, and the Risden Engineering Co. shipped a truckload of gold ore, all to the Leadville smelter. The Jenny Wren Mines, Inc., shipped about 100 tons of ore from the Columbia mine and dump to the Ruth mill at Idaho Springs.

CHAFFEE COUNTY

Granite District.—Small lots of gold-silver-lead ore were shipped from the Marion Bell and Millie G. No. 1 claims in 1947. The Good Hope Mining Co., Ltd., worked the Good Hope placer on Cache Creek from June 11 to October 19, using a power shovel, bulldozer, and sluices. Welch Industries, Inc., using similar equipment, operated the Lost Canyon placer from June through December.

Monarch District.—S. E. & W. E. Burleson operated the Garfield mine group throughout 1947. Shipments comprised 2,204 tons of copper-silver ore (containing a little lead and gold), sent to the Garfield, Utah, smelter, and 512 tons of ore containing zinc and silver as the principal ore metals, sent to the American Smelting & Refining Co. custom mill at Leadville. Geo. S. Daniel shipped 51 tons of lead-copper-silver ore from his Lilly mine. The Utze Lode Co. shipped some zinc-lead ore from the Madonna group.

CLEAR CREEK COUNTY

Alice District.—Lombard Mines, Inc., shipped a small lot of gold-silver-lead concentrates in 1947, continued development work at the Lombard group, and completed construction of a 100-ton mill. The Eclipse mine produced 13 tons of lead-silver-gold ore.

Argentine District.—The Lupton Mining Co. operated the Grizzly Gulch group, producing lead-silver-zinc-gold-copper ore, which was treated in the Commonwealth mill at Georgetown.

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Mine production of gold, silver, copper, lead, and zinc in Colorado in 1947, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ores 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		2			387	387		64	64				$13,603
Boulder County:													
Central (Jamestown)	3		237	216		216	4,285		4,285	8,600	138,000		33,116
Gold Hill	12		6,079	1,536		1,536	2,113		2,113	100	9,500		57,061
Grand Island	2		741	64		64	7,806		7,806	400	14,000		11,404
Magnolia	3	1	278	85	8	93		1	1				3,256
Sugar Loaf	4		272	87		87	25		25				3,068
Ward	3		202	68		68	130		130	1,900	200		2,751
Chaffee County:													
Granite	2	2	8	16	239	255	33	30	63		400		9,040
Monarch	3		2,818	45		45	48,938		48,938	262,600	47,100	141,800	124,950
Clear Creek County:													
Alice	2		113	23		23	233		233	200	2,700		1,447
Argentine	1		4,820	208		208	8,789		8,789	12,400	365,100	26,600	73,631
Cascade	1		25	6		6	129		129		800		442
Empire	4		689	269		269	464		464	9,200	1,100		11,925
Griffith	6		4,646	36		36	83,776		83,776	1,800	98,400	136,200	108,105
Idaho Springs	13		7,222	2,021		2,021	14,992		14,992	7,700	159,400	24,600	111,850
Montana	5		4,750	72		72	51,312		51,312	5,600	182,800	96,800	88,169
Trail Creek	2		1,159	276		276	8,135		8,135	3,600	123,500	52,400	41,902
Custer County: Hardscrabble	6		2,838	35		35	27,472		27,472	4,100	223,000	241,400	88,269
Dolores County: Pioneer	5		35,388	104		104	124,199		124,199	217,100	4,084,500	6,866,800	1,580,682
Douglas County		1			3	3							105
Eagle County: Red Cliff	1		160,432	936		936	233,351		233,351	481,500	1,847,000	34,750,000	4,815,776
Fremont County:													
Cotopaxi	1		202	5		5	370		370	16,400	1,600		4,184
Grape Creek	1		1,860	3		3	222		222	5,900	7,200	118,800	16,957
Garfield County:													
Defiance	1		7				22		22		3,600		538
Rifle Creek	2		576	129		129	1,819		1,819		22,900	70,800	18,026
Gilpin County: Southern	9	7	2,634	278	24	302	4,462	8	4,470	5,100	140,000	60,000	43,106
Grand County		1			1	1							35
Gunnison County:													
Bellevue Mountain	2		39	13		13	319		319		100		758
Elk Mountain	1		120	4		4	1,119		1,119		200		1,182
Gold Brick	3		1,987	350		350	1,177		1,177	800	18,700		16,176
Green Mountain	1		21	3		3							105
Quartz Creek	1		4				29		29		1,100		184
Taylor Park	3	1	344	1	7	8	2,284	2	2,286	1,000	74,200	6,400	14,018
Tomichi	2		10,235	67		67	58,168		58,168	44,800	2,916,700	3,368,200	891,952
Hinsdale County: Lake	1		9	2		2	308		308	3,000	100		993
Jackson County	1		12				8		8	1,600			343
Jefferson County	1	2	5,430	97	19	116	1,245	6	1,251	138,000			34,172

Lake County:													
Box Creek		1			2,564	2,564		730	730				90,401
California (Leadville)[1]	24	1	195,162	14,677	126	14,803	261,153	20	261,173	219,000	8,591,600	9,618,000	3,201,424
Weston Pass	1		33				25		25		7,400		1,089
La Plata County: California (La Plata) and Montezuma County[2]	6		821	892		892	968		968	1,200	10,400	8,000	34,814
Mineral County: Creede	6		24,760	245		245	317,712		317,712	46,600	658,400	14,000	402,394
Montrose County:													
La Sal	1		1,875	6		6	7,780		7,780	119,200			32,283
San Miguel River		3			4	4		1	1				141
Ouray County:													
Red Mountain	6		3,104	57		57	11,547		11,547	72,300	240,700	128,000	77,777
Sneffels and Uncompahgre[2]	12		34,572	4,479		4,479	139,339		139,339	197,500	1,943,600	1,157,000	744,217
Park County:													
Alma Placers-Fairplay[2]		4			11,775	11,775		2,358	2,358				414,259
Beaver Creek		1			9	9		2	2				317
Buckskin	4	1	3,709	847	3	850	7,981	1	7,982	15,000	104,700	648,600	133,682
Consolidated Montgomery	3		531	7		7	833		833	300	15,000	9,200	4,335
Freshwater	1		16				49		49	2,200			506
Mosquito	4		1,229	167		167	9,460		9,460	3,300	40,600	106,800	33,868
Tarryall		1			2,315	2,315		206	206				81,211
Pitkin County:													
Lincoln Gulch	1		1				13		13		400		70
Roaring Fork	4		7,373	4		4	27,757		27,757	700	220,000	23,000	59,870
Rio Grande County: Summitville	1		4,640	2,129		2,129	2,442		2,442	18,500	2,400		80,956
Saguache County: Kerber Creek	10		3,085	47		47	21,445		21,445	24,200	793,900	236,400	169,061
San Juan County:													
Animas	13		221,578	18,496		18,496	362,888		362,888	629,900	4,482,500	2,620,400	2,070,602
Eureka	6		14,880	1,614		1,614	51,144		51,144	156,900	1,260,300	964,200	433,875
Ice Lake Basin	1		359	13		13	3,419		3,419	3,100	54,300	23,000	14,802
San Miguel County:													
Iron Springs	4		22,692	1,412		1,412	48,136		48,136	38,300	152,800	1,000	123,150
Upper San Miguel	6		270,648	38,155		38,155	392,540		392,540	1,451,900	5,118,500	4,134,000	3,232,851
Summit County:													
Breckenridge	13	4	7,861	483	89	572	20,434	22	20,456	13,200	209,300	2,558,000	380,962
Green Mountain	1		525	31		31	37,117		37,117	400	17,100		37,222
Montezuma	9		3,800	82		82	28,945		28,945	6,600	650,900	106,600	137,080
Ten Mile (Kokomo, Robinson)	8		51,980	1,655		1,655	106,481		106,481	46,300	2,333,300	9,173,000	1,609,941
Teller County: Cripple Creek	37		413,263	58,158		58,158	6,860		6,860				2,041,738
Total Colorado	290	33	1,544,694	150,706	17,573	168,279	2,554,202	3,451	2,557,653	4,300,000	37,392,000	77,490,000	23,868,179

[1] Includes gold-silve ore from 1 mine in St. Kevin district, production from which may not be disclosed.
[2] Bureau of Mines not at liberty to publish production figures separately.

Cascade District.—A 25-ton lot of ore was shipped from the Kitty Emmet mine in 1947.

Empire District.—The producing mines in this district were the Bonus, the Tenth Legion-Laura Doone-Steuben group, and the Conqueror group. Gold and silver were recovered from a clean-up at the old Minnesota mill.

Griffith District.—Smuggler Mines (C. O. Parker, agent) operated the Smuggler mine in 1947, producing about 4,000 tons of ore. The ore, which carries silver, zinc, and lead as the principal metals, was treated in the Silver Leaf mill. The lead-silver concentrate was shipped to the Leadville smelter and the zinc concentrate to the Amarillo, Tex., smelter. Other producers were the Capital Prize dump, Dives-Pelican group, General Mining & Development Corp. property, Teagarden group, and Terrible-Dunderberg group.

Idaho Springs District.—The Dixie No. 4 mine was operated by LeRoy Giles & Co. throughout 1947. The yield from 3,157 tons of ore (treated in the leased Silver Leaf mill) was mill bullion, containing 1,377 ounces of gold and 413 ounces of silver, and 93 tons of concentrates, containing 205 ounces of gold, 5,227 ounces of silver, 464 pounds of copper, and 6,507 pounds of lead. The Frarklin Mining Co. and Arthur Portenier shipped lead-silver-gold-copper ore from the Franklin mine to custom mills. Other small producers included the Humboldt-Mary Foster group, Kitty Clyde mine, Lexington, M & E, Mattie, Old Settler, Shafter, Silver King, and Specie Payment. Stinson & Quinn operated the 65-ton mill at the old Clear Creek-Gilpin sampler on custom ore from Clear Creek and Gilpin Counties. The Ruth mill operated several months on custom ore.

Montana District.—Most of the output of metals from the Montana district in 1947 came from the Jo Reynolds mine, operated by the Elida Mining Co. The ore was treated in a custom mill at Idaho Springs.

Trail Creek District.—The Harrison-Croesus Mining Co. continued operations at the Ben Harrison mine and shipped 793 tons of lead-silver-zinc-gold-copper ore to custom mills. Lead-gold-silver-copper ore (366 tons) was shipped from the Turner mine.

CUSTER COUNTY

Hardscrabble District.—The Lady Franklin mine was operated by George L. Beardsley in 1947. The ore carried principally zinc, lead, and silver, with some gold and copper; 2,204 tons were shipped to the Leadville milling unit of the American Smelting & Refining Co. for concentration, and 18 tons were shipped crude to the Leadville smelter. Henning, Kettle & Walker shipped 438 tons of silver-lead ore from the Defender mine. Other small producers were the First Iowa, Keystone, Passiflora, and Wild Girl mines.

DOLORES COUNTY

Pioneer (Rico) District.—The Rico Argentine Mining Co., a large, steady producer from its Rico mine group since September 1939, operated continuously in 1947. Mine development during the year totaled 8,379 feet of drifts, 1,814 feet of raises, and 8,080 feet of diamond drilling. Ore milled (34,606 tons) averaged 13 percent zinc, 6.4 percent lead, 0.3 percent copper, and 3.96 ounces of silver to the ton with a trace of gold. The lead concentrate produced was shipped to the Leadville smelter and the zinc concentrate to the Amarillo, Tex., smelter. Other mines at Rico—the Forest, Woods Hole, and Yellow Jacket—shipped to the Midvale, Utah, concentrator. Several cars of ore were shipped from the Swan dump.

EAGLE COUNTY

Red Cliff (Battle Mountain) District.—In 1947 the Red Cliff district again ranked first among Colorado districts in total value of its production of the five metals. Output was predominantly zinc, followed by silver, lead, copper, and gold. The Empire Zinc Division of the New Jersey Zinc Co. operated its Eagle mine group and 600-ton underground selective-flotation mill continuously.

EL PASO COUNTY

The Golden Cycle mill at Colorado Springs treated 420,026 tons of ore in 1947, compared with 306,790 tons in 1946. Ore treated in 1947 comprised 413,263 tons of company and custom gold-silver sulfotelluride ores from mines and dumps in the Cripple Creek district (Teller County) and 6,763 tons of gold and gold-silver ores from various shippers in Boulder, Clear Creek, Garfield, Gilpin, Gunnison, Lake, and Summit Counties. About 75 percent of the ore received from Cripple Creek came from dumps. (See Teller County section for other details.)

FREMONT COUNTY

Cotopaxi District.—The Horseshoe Mining Co. shipped some copper-silver-gold-lead ore from the Cotopaxi mine in 1947.

Grape Creek District.—Zinc ore containing some copper and silver was mined at the Horseshoe property and treated in a flotation mill built by the Horseshoe Mining Co.

GARFIELD COUNTY

Defiance District.—A 7-ton lot of ore averaging 27 percent lead and 3 ounces of silver to the ton was shipped from the H. H. H. claim near Dotsero. The claim is developed by an open cut and a 50-foot shaft.

Rifle Creek District.—In 1947 Burney, Nall & Fischer continued operations at the Grandview mine until June 30. Shipments of ore (all to the Tooele, Utah, smelter) totaled 416 tons averaging 4.37 ounces of silver to the ton, 11.74 percent zinc, and 2.82 percent lead. The Gray Eagle Mining Co. drove 250 feet of drifts and 40 feet of raises at the Gray Eagle mine and shipped 160 tons of gold ore mined in development.

GILPIN COUNTY

Southern (Blackhawk, Central City, Nevadaville, Russell Gulch) Districts.—The Success Gold Mining & Milling Corp. operated the Pittsburg-Notaway group and 30-ton flotation mill part of 1947. The mill product was bulk lead-zinc-gold-silver concentrate, shipped to the Tooele, Utah, smelter. Concentrate of a similar type was recovered from ore produced by the Cash Mining & Milling Co. during a short period of operation on the Bullion-Gold Cup-Keystone group and by the Boodle Lease on the Boodle (or Griffith) mine. Ore was shipped to a custom mill at Idaho Springs from the Globe and Monmouth-Kansas properties. Other small lode producers included the Black Rock, Gum Tree Mining Syndicate, and West Notaway properties. Placers on Clear Creek and Gregory Gulch yielded a little gold.

GUNNISON COUNTY

Bellevue Mountain District.—Geo. W. Smith shipped a truckload of silver-lead ore from the Virginia claim, and J. W. Gramlich shipped about a car of gold ore from another property.

Elk Mountain District.—Forest Queen Mines, Inc., erected surface buildings and rebuilt a burned-out mill at the Forest Queen mine. Test runs in the mill yielded 6 tons of silver-gold-lead concentrate.

Gold Brick District.—In 1947 Carter Mines, Inc., operated its Carter gold mine and 130-ton mill from January 1 to April 8. Lessees at the Gold Links mine produced gold-silver-lead ore. The Ore & Chemical Co., which did exploration work and sampling at the Raymond group, shipped some lead-gold-silver-copper concentrate.

Green Mountain District.—Welch Industries, Inc., shipped 21 tons of gold ore from the Poor Boy's Friend mine.

Quartz Creek District.—A 4-ton lot of lead-silver ore was shipped from the Shady Side Property in 1947.

Taylor Park (Tin Cup) District.—John Lambertson worked the Star mine on a small scale and shipped high-grade lead-silver ore. Other small producers were the Bull Domingo and Thunder Bird lode mines and the Rainbow placer.

Tomichi District.—The Callahan Zinc-Lead Co., Inc., operated its Akron and Erie mines at White Pine throughout 1947. Shipments to the Leadville milling unit of the American Smelting & Refining Co. and the Midvale, Utah, concentrator totaled 10,235 tons, averaging 7.4 ounces of silver and 0.01 ounce of gold per ton, 22 percent zinc, 17 percent lead, and 0.4 percent copper. Development during 1947 totaled 2,310 feet of drifts, 498 feet of raises, and 349 feet of diamond drilling at the Akron mine and 100 feet of shaft, 1,200 feet of drifts, and 95 feet of raises at the Erie. New equipment purchased for the two mines included three underground locomotives and three compressors. Surface construction included a 100-ton mill, shop, drying house, and office. The mill began operations in December.

HINSDALE COUNTY

Lake District.—James Wells shipped 9 tons of copper-silver ore from the Gold Quartz lode in 1947.

JACKSON COUNTY

The Medicine Bow Mining Co. shipped 12 tons of 7-percent copper ore from the Kings Canyon property.

JEFFERSON COUNTY

Gowan Enterprises and R. M. Moore operated the Malachite copper-silver mine 3½ miles northwest of Morrison part of 1947. The ore was concentrated in the company mill at Dumont. Some placer gold and silver were recovered from the Lee Ranch gravel pit and the Tresize placer.

LAKE COUNTY

Box Creek District.—The General Gold Corp. assumed the lease on the Mount Elbert placers April 1, 1947, and began operations June 8 with two dragline dredges. Gravel washed during the season, which lasted to November 30, totaled 437,691 cubic yards. The recovery was 2,564 fine ounces of gold and 730 fine ounces of silver, valued at $90,401.

California (Leadville) District.—The principal producing mine in the Leadville district in 1947 was the Resurrection Mining Co. group, equipped with a 600-ton flotation mill. The mine is opened by a 1,323-foot vertical shaft, six levels, and a 4-mile tunnel (old Yak) which intersects the shaft. The mill operated largely on company ore but also treated custom ore from Clear Creek, Lake, Park, Saguache, and Summit Counties.

The John Hamm Mining & Milling (Ltd.) mill treated 87,703 tons of zinc-lead-silver-gold ore from the Wolftone, Maid of Erin, Waterloo, and Henriett dumps. During the year the company added 18 Humphrey spirals to the concentrating equipment. The Cloud City mill in Big Evans Gulch treated 1,000 tons of gold-silver-lead ore obtained in sampling and testing mine fill from the St. Louis mine.

Mines producing substantial tonnages of direct-smelting ore or milling ore shipped to custom mills were the Dolly B, Fortune, Garabaldi, Ibex, New Monarch, and Valley. Other producers included the A. Y. & Minnie dump, Breece and Commerce mines, Elgin dump, Fanny Rawlings mine, and Gonabrod, Iron Hill, and Ponsarden dumps. The American Smelting & Refining Co. continued to ship slag from the American smelter dump to the company Arkansas

Valley smelter. Placer gold was shipped to the Denver Mint from the Key placer, operated part of the year.

The American Smelting & Refining Co. Leadville milling unit operated throughout 1947 on company ore from its Kokomo unit in Summit County and custom ore from mines in Chaffee, Clear Creek, Custer, Gunnison, Lake, Mineral, Park, Pitkin, Saguache, San Juan, and Summit Counties.

The Arkansas Valley smelter of the American Smelting & Refining Co. at Leadville treats lead, lead-copper, and gold and silver ores and concentrates, most of which are purchased from operators in Colorado; other sources of material treated include mines in nearby States and in some foreign countries and residues and secondary material received from other smelters. Receipts totaled 113,929 tons in 1947, compared with 67,805 tons in 1946.

St. Kevin District.—Markus Thuren, operating the Lakewood mine during the summer, shipped gold-silver ore to the Leadville smelter.

Weston Pass District.—In 1947 the Little Ruby Mines shipped 33 tons of lead-silver ore.

LA PLATA COUNTY

California (La Plata, Hesperus) District.—Bert Thompson operated the Bessie G. mine on a small scale in 1947 and shipped gold ore. Other small intermittent producers included the Excelsior and Idaho mines.

MINERAL COUNTY

Creede District.—The Emperius Mining Co., operating four groups of mines at Creede, was the largest individual producer of silver in the State in 1947. Ore mined comprised 9,408 tons from the Amethyst group, 7,595 tons from the Del Monte-Aspen (Volunteer), 3,044 tons from the New York, and 892 tons from the Commodore. Company ore treated in the 100-ton Emperius mill at Creede (including 2,545 tons of dump ore) totaled 23,182 tons. The concentrates produced averaged 0.11 ounce of gold and 163.67 ounces of silver per ton, 1.53 percent copper, and 15.04 percent lead. An additional 248 tons of high-grade ore was shipped crude to the Leadville smelter. The New Ridge Mining Co. operated the Ridge mine (Mexico group) 7 months in 1947; part of the ore produced was shipped to the Leadville smelter and part to custom mills.

MONTEZUMA COUNTY

In 1947 the Ute Mining Co. operated the Red Arrow mine 9 miles northeast of Mancos from April 7 to December 24; the ore was treated in the company 25-ton amalgamation-flotation mill.

MONTROSE COUNTY

La Sal District.—The New Cashin Mines, Inc., operated the Cashin group from January through April and shipped copper fluxing ore to the Garfield, Utah, smelter.

OURAY COUNTY

Red Mountain District.—The American Zinc, Lead & Smelting Co. worked the Koehler-San Antonio property in Ouray and San Juan Counties in 1947. The ore was treated in the company flotation mill at Ouray and yielded lead-copper, lead, and zinc concentrates. Roy Van Houten operated the Beaver-Belfast mine and shipped 665 tons of zinc-lead-silver-copper ore. Other shippers included Harry E. Larson (Ida L. mine), Earl A. Alexander and Ben Simpson (Lost Day), and Geo. O. Baumgardner (Paymaster dump and Monte Cristo mine). The 300-ton Idarado Mining Co. mill treated ore from the claims of the Treasury Tunnel property in San Miguel County.

Sneffels District.—The Camp Bird mine, operated by King Lease, Inc., was again the leading producer of the five metals in Ouray County. Development during the year included 981 feet of raises, 985 feet of drifts, and 195 feet of diamond drilling. The ore was treated in the company 125-ton amalgamation-flotation mill. The Atomic Silver Mines, Inc., operating the Atomic Silver (Terrible No. 1) mine from June 1 to December 15, 1947, drove 215 feet of tunnel and shipped 80 tons of lead-silver ore. The Trust Ruby, Altoona, and Atlas mines shipped zinc-lead-silver ore to the American No. 1 custom mill at Ouray.

Uncompahgre District.—The American Zinc, Lead & Smelting Co. operated the Bachelor group throughout 1947 and the Portland from January through May. The company also operated its 300-ton American No. 1 custom mill at Ouray, treating ore from company mines and custom ore from about 17 other mines in Ouray and San Juan Counties. The Bachelor group, producing 4,191 tons of zinc-lead-silver ore, was the largest shipper to the mill. Development on this group included 425 feet of raises, 884 feet of drifts, and 1,242 feet of diamond drilling. Other Uncompahgre district custom shippers to the mill were the Black Girl, Hoosier-Portland-Yellow Medicine, Mickey Breen, and Mineral Farm mines.

PARK COUNTY

Alma Placers-Fairplay District.—The South Platte Dredging Co. operated throughout 1947 its electrically powered connected-bucket dredge (108 12-cubic-foot buckets) on the Lee Andrews and Gold Pan placers; gravel washed totaled more than 3,800,000 cubic yards.

The Timberline Dredging Co. operated its dragline dredge on the Snowstorm Placers from May 3 through October 8 and handled 582,577 cubic yards of gravel. Art Discoe & Co. operated 20 days in October on the Snowstorm Placers and ground-sluiced about 800 cubic yards of gravel.

Thomas & Hambelton washed 10,766 cubic yards of bench gravel and old tailings in a stationary washing plant on South Platte River and recovered 304 fine ounces of gold and 62 ounces of silver.

Buckskin District.—The Buckskin Joe Mines, Ltd., operated its Phillips group of mines throughout 1947. Shipments comprised 3,155 tons of ore (sent to the Resurrection mill at Leadville) averaging 0.24 ounce of gold and 2.25 ounces of silver per ton, 0.27 percent copper, 1.99 percent lead, and 15.41 percent zinc and 49 tons of direct-smelting ore averaging 1.02 ounces of gold and 4.71 ounces of silver per ton. Niagara Mines, Ltd., operating the Sweet Home mine from January 1 to July 15, produced about 500 tons of ore, part of which was treated in a custom mill at Leadville and part in the Alma mill. Other small shippers were the Buckskin Gulch and Zulu Chief mines.

Consolidated Montgomery District.—Shipments in 1947 comprised small lots of lead-silver ore from the Cole and Ten Forty mines and 510 tons of zinc-lead-silver ore from the Iron Duke.

Freshwater District.—Welch Industries, Inc., shipped 16 tons of copper-silver ore from the Welch No. 1 mine.

Mosquito District.—M. J. Krolicki worked the Orphan Boy mine throughout 1947, shipping 365 tons of zinc-lead-gold-silver-copper ore to the Resurrection mill at Leadville. The Weston Lease, while doing engineering and prospecting work on the Hock Hocking property, sent some dump ore to the Alma mill for concentration and shipped 243 tons of direct-smelting silver-lead-gold-copper ore from the Evening Star mine. A 6-ton lot of silver-lead-gold ore was shipped from the Free Silver claim. The London Mines & Milling Co. and the London Extension Mining Co. jointly purchased the London Butte property and did some work on road construction and reconditioning the Butte tunnel and surface plants.

Tarryall District.—Cooley Bros. operated a dragline dredge from May through September 1947 on the Kline property on Tarryall Creek.

PITKIN COUNTY

Lincoln Gulch District.—A ton of lead-silver ore was shipped from the Ruby mine in 1947.

Roaring Fork (Aspen) District.—The Midnight Mining Co. operated its Midnight mine and 50-ton flotation mill. Ore treated in 1947 totaled 4,056 tons, which yielded 95 tons of concentrate averaging 238 ounces of silver per ton and 40 percent lead. The company continued prospecting (core drilling and drifting) near the main ore-body stopes and in a new area. Herron Bros. continued operations on the Smuggler properties, milling dump ore and some mine ore in the Herron 150-ton jig and table mill. Small lots of clean-up material and crude ore were shipped from two other properties. The Bureau of Mines sampled mine dumps at Aspen by drilling and bulldozing and made metallurgical tests on material saved.

RIO GRANDE COUNTY

Summitville District.—The Summitville Mining Co., operating the Summitville mine and mill in 1947, shipped gold-silver-copper concentrate and mill bullion.

SAGUACHE COUNTY

Kerber Creek (Bonanza) District.—The Superior Mines Division of the Conejos Corp. operated the Superior-Erie group most of 1947 and shipped both mine and dump ore. Wm. J. Costello worked the

Rawley mine throughout the year, shipping lead-silver-zinc-copper ore containing a little gold. Other shippers were Tom Raymond & Sons (Little Jenny and Vallejo mines), Pratt-Bonanza Mining & Milling Co. (St. Louis group), Nicholas Keserich (Warwick), and Walter J. Timney (Cora). From June 15 through December S. E. & W. E. Burleson did rehabilitation work in the Antoro mine, built roads and surface buildings, and shipped one lot of zinc-lead-silver ore. Some ore was shipped by S. F. Wickham (Wheel of Fortune mine) and the Marvisa Mining Co.

SAN JUAN COUNTY

Animas District.—The Shenandoah-Dives Mining Co. operated continuously its Shenandoah-Dives consolidated group of claims and the leased Silver Lake group on King Solomon Mountain. The two groups were operated as a unit. Mine development and exploration in 1947 included 2,915 feet of drifts, 47 feet of crosscuts, 645 feet of raises, and 1,212 feet of diamond drilling. The mine is connected with the company 700-ton mill near Silverton by a 1½-mile aerial tram. Company ore milled in 1947 totaled 172,125 tons and custom ore 10,210 tons. The yield of concentrates from the 182,335 tons of ore treated was 2,445 tons of flotation lead concentrate, 1,502 tons of flotation zinc concentrate, and 693 tons of iron-gold-silver-lead table concentrate containing in aggregate 15,605 ounces of gold, 197,239 ounces of silver, 365,839 pounds of copper, 2,872,291 pounds of lead, and 2,113,043 pounds of zinc.

Highland Mary Mines, Inc., produced 17,238 tons of ore from its Highland Mary mine. The ore (treated in the company 100-ton mill) yielded 805 tons of combined bulk flotation and jig concentrates averaging 1.90 ounces of gold and 89.65 ounces of silver per ton, 2.55 percent copper, and 25.14 percent lead. The Denver Equipment Co., as agent, operated the Pride of the West group and Green Mountain mines and the Pride 100-ton flotation mill.

The United States Coal Corp. operated the Lark mine from January through August; the operating name was then changed to the United States Oil & Development Co., and ore shipments to custom mills were resumed in October. The Osceola Mine, a partnership that acquired ownership of the Osceola mine in January 1947, shipped 2,969 tons of ore during the year. The ore averaged 2.03 ounces of silver and 0.02 ounce of gold per ton, 3.13 percent lead, 2.66 percent zinc, and 0.72 percent copper. Other shippers included H. A. Ruether (Garry Owen mine), John Gilheany Lease (Little Fannie), Barnes Mining Co. (Little Ida), North Star Lease (Jennie Parker and Sultan dumps), Little Nation Lease, Bonaventura & Gifford (Aspen dump), Valley Forge Lease, and Topaz Mining Co.

Eureka District.—The Lead Carbonate Mines operated the Lead Carbonate mine in 1947 and built a 40-ton flotation mill, which began treating ore in October. From January to October the company shipped about 2,000 tons of ore to the Midvale, Utah, custom mill. The Foursome Mining Co. shipped 8,376 tons of zinc-lead ore from the Columbus and Silver Coin mines. Other shippers to custom mills at Silverton or Ouray were the Mountain Queen Lease, Great Eastern

Mining Co., and K. E. Knapp (Burrows mine). Part of the output from the Koehler-San Antonio group (see Ouray County) comes from claims in San Juan County.

Ice Lake Basin District.—The Esmeralda Lease (Bandora mine) shipped 359 tons of ore averaging 0.09 ounce of gold and 12.09 ounces of silver per ton, 0.78 percent copper, 9.37 percent lead, and 6.02 percent zinc.

SAN MIGUEL COUNTY

Iron Springs District.—The Silver Bell Mines Co. operated the Silver Bell group throughout 1947, carrying on an expanded program of exploration and development in conjunction with the mining of ore. The ore was milled in the 150-ton mill built in 1946. Treatment comprises two-stage crushing, ball-mill grinding in closed circuit with mineral jig through classifier, and bulk flotation. Other small producers were the Belisle Bros., Slide and New Dominion mines, and the Butterfly property.

Upper San Miguel District.—The Upper San Miguel district, with an output of 38,155 ounces of gold in 1947, ranked second among Colorado districts in gold production. Telluride Mines, Inc., operating the Smuggler-Union and Montana groups of mines and the company 550-ton mill, was the leading district producer of gold. Part of the company gold output was recovered by amalgamating concentrates from jigs in the ball mill-classifier circuit, and part was recovered in iron, lead, copper, and zinc concentrates shipped to smelters. The company, accelerating underground development, drove 384 feet of raises, 5,046 feet of drifts, and 1,639 feet of tunnel during the year.

The production of the Idarado Mining Co. came from claims in San Miguel County, although the property is developed and worked through the 12,000-foot Treasury tunnel, with its portal in Ouray County. During 1947 the Idarado Mining Co. operated its Treasury Tunnel-Black Bear group continuously. In mining and further developing the property, the company drove 2,229 feet of drifts, and 1,590 feet of raises and diamond-drilled 1,453 feet during the year. Additions were made to mill buildings, and equipment was purchased to expand the daily mill capacity from 300 tons to 500 tons. The mill products were gold-silver amalgam (recovered mostly from gold jig concentrate), flotation copper-gold-silver concentrate, lead-silver-gold-copper concentrate, and zinc concentrate.

In 1947 Alta Mines, Inc., operated the Alta-St. Louis mine from January through October and from December 16 to 31. Mine development included 2,000 feet of drifts. The ore was concentrated by gravity and flotation in the company mill (daily capacity, 140 tons at end of 1947). The Tomboy Gold Mines, Inc,. shipped some zinc-lead-silver ore to the American No. 1 custom mill at Ouray.

SUMMIT COUNTY

Breckenridge District.—The Country Boy mine, operated by the Garvie London Gold Mining Co., was the leading district producer in 1947. The mine is opened by a 1,434-foot adit. Development during the year comprised 434 feet of drifts, 548 feet of cross cut, and 1,176 feet of raises. The ore, containing zinc as the chief metal, with some gold, silver, lead, and copper, was shipped to the Resurrection mill at Leadville. The Wellington mine was worked by Kaiser & Davenport from January 1 to September 27 and by Davenport & Cox from October 8 to December 20. Ore output was 701 tons averaging 2.4 ounces of silver and 0.044 ounce of gold per ton, 14.7 percent zinc, and 7.5 percent lead. F. P. Lilly and T. C. Moran shipped 1,594 tons of zinc-silver ore from the Sally Barber mine. Other producers included the Briar Rose (dump), Carbonate, Fredonia, Jessie, Jumbo, Minnie B, Monte Christo, and Morning Star. Placer gold worth $1,376 was recovered by a dragline dredge that operated 2 months on the Louis D placer and handled about 28,000 cubic yards of gravel. At the Sisler placer 11,152 cubic yards of gravel, moved by hydraulicking, yielded $1,031 in placer gold.

Green Mountain District.—The Big Four mine produced 525 tons of 70.7-ounce silver ore carrying some gold, lead, and copper.

Montezuma District.—The Florado Mining Co. operated the Pinnacle lead-silver mine and 100-ton flotation mill about 8 months in 1947. Max L. Bunker worked the Ida Belle mine under split-check lease with Ulibarri & Jeffrey from June through December and shipped 791 tons of lead-silver-zinc ore. The Summit Mining & Milling Co. 60-ton flotation mill treated 347 tons of zinc-lead-silver ore from the leased Silver King mine. Other district producers comprised the Bullion, Clara, Cross, New York, Quail and Revenue mines.

Ten Mile (Kokomo, Robinson) District.—The American Smelting & Refining Co. Kokomo unit (Lucky Strike group, Victory, and Wilson mines) was the largest producer of zinc, lead, silver, gold, and copper in Summit County in 1947. All the ore produced, except minor tonnages of high-grade ore sent direct to the Leadville smelter, was trucked to the company Leadville milling unit for concentration. The Wilfley Leasing Co., operating the Wilfley mine, shipped to the Resurrection mill at Leadville 3,946 tons of ore averaging 3.8 ounces of silver and 0.62 ounce of gold per ton, 15.5 percent zinc, and 1.7 percent lead. The Clark Mackey Development Co. operating the Snowbank mine, the Kokomo-Kimberly Mines, Inc., (Kimberly property) and the Colonel Sellers Tunnel Leasing Co. shipped substantial tonnages of ore. Other small producers were the Cove Springs, Yukon, and Zulu King properties.

TELLER COUNTY

Cripple Creek District.—The Cripple Creek district, major gold-producing district in Colorado, produced 35 percent of the State total gold output in 1947—the same percentage as in 1941, the last full year of production before wartime restrictions, which lasted until July 1, 1945, were placed on gold mining. The bulk of the output in 1947 came from mines and dumps worked by the Golden Cycle Corp., the Cresson Consolidated Gold Mining & Milling Co., the United Gold Mines Co., and lessees on the Stratton Estate. The entire district output of ore was treated in the Golden Cycle mill (see El Paso County).

Operations of the Golden Cycle Corp. are described in the following abstract from the company annual report to stockholders:

Golden Cycle Mill.—Although total ore tonnage treated in 1947 was greater than in 1946, the average value per ton ($5.95) was 48 cents less and was the lowest in the mill's history. Owing to a shortage of mine ore from the Cripple Creek district, in order for the mill to operate at near capacity, it was necessary to treat a large tonnage of dump ore. Dump ore handled totaled 314,200 tons, with an average per ton gross value of approximately $3.00. Of the total mine and dump ore handled (420,026 tons), 55 percent (232,400 tons) was treated in the flotation plant. Concentrates were mixed with higher-grade mine ores and treated by roasting. Operating costs for the year were reduced to an all-time low. Basic wage rates were increased August 1, raising costs which were offset somewhat by further mechanization and betterments in over-all efficiency. Ore treated per 8-hour man-shift in 1947 was 16.7 tons compared with 13.0 tons in 1946.

Metal Mining Operations.—During 1947 Cripple Creek mines and dumps shipped to the Golden Cycle mill a total of 413,263 tons of ore, with an aggregate total gross value of $2,430,843. The Golden Cycle Corp., produced 75,613 tons of ore, with a total gross value of $699,801. Besides this tonnage, the corporation shipped as lessee 235,071 tons of dump ore, with a total gross value of $695,065.

Production of the Ajax mine (company and lessees) was 20,209 tons of ore, with a total gross value of $496,152. A total of 1,986 feet of drifts, crosscuts, and raises were driven, and some new ore bodies were opened. The development included a raise from the Carlton drainage tunnel to the bottom of the Ajax shaft. The raise will be enlarged, and when completed the Ajax shaft will be about 3,000 feet deep at the tunnel level.

At the Anchoria Leland mine five sets of split-check lessees shipped 3,905 tons of ore, with a total gross value of $63,909. A total of 1,295 feet of drifts, crosscuts, and raises were driven.

Lessees at the Index mine shipped 389 tons of dump ore, with a gross value of $1,533.

The Cresson mine of the Cresson Consolidated Gold Mining & Milling Co. was worked throughout 1947 by the company and split-check lessees. Mine development on both company and lessee account totaled 2,787 feet of drifts and crosscuts and 1,040 feet of raises and winzes during the year. The company erected a new storeroom and a combination blacksmith, steel, and welding shop, completing construction work necessary to restore surface plant buildings lost in the cave-in that occurred in 1946. Other data abstracted from the annual company report to stockholders for the calendar year 1947 follow.

Since the Carlton drainage tunnel was completed the company has planned to drive a lateral from the tunnel to drain the Cresson mine. Driving on the Carlton tunnel level from the bottom of the Portland No. 2 shaft of the United Gold Mines Co. into Cresson ground has begun. This lateral will be about 4,000 feet in length and when completed should drain the Cresson mine to the level of the Carlton tunnel approximately 700 feet below the present Cresson water level.

Production of Cresson Consolidated Gold Mining & Milling Co., 1903–1947

Period	Dry short tons	Gross value [1]	Freight and treatment	Net value
1903–1946	3,235,332	$46,671,057	$15,427,554	$31,243,503
1947:				
Company ore	14,921	86,775	47,190	39,585
Lessee ore	33,072	468,384	170,523	297,861
1903–1947	3,283,325	47,226,216	15,645,267	31,580,949

Period	Royalties received by company	Amount paid lessees	Average gross value per ton	Average net value per ton	Dividends
1903–1946	(2)	(2)	$14.43	$9.66	$13,564,673
1947:					
Company ore			5.82	2.65	
Lessee ore	$155,911	$141,950	14.16	9.01	
1903–1947	(2)	(2)	14.38	9.62	[3] 13,564,673

[1] Settlement value.
[2] Figure not available for publication.
[3] Represents 28.72 percent of gross value and 42.95 percent of net value.

Data abstracted from the annual report of the United Gold Mines Co. for the year ended December 31, 1947, follow:

Net profit for 1947 was $528 compared with a net loss in 1946 of $62,007. Taxes of all kinds were $16,351 in 1947 and $11,427 in 1946. It has been impossible yet to secure the number of lessees necessary to operate the company properties successfully.

Production of company ore by United Gold Mines Co. in 1947

Mine	Net tons	Gross value [1]	Company ore cash receipts	Average gross value per ton [1]
Vindicator	665	$3,094	$937	$4.65
Portland	118	560	189	4.74
Dump ore	241,674	749,686	85,173	3.10
Total	242,457	753,340	86,299	3.11

[1] Gross value calculated at settlement value.

Production of lessee ore of United Gold Mines Co. in 1947

Group	Net tons	Gross value [1]	Royalties received	Lessees' receipts	Average gross value per ton [1]
Vindicator	12,306	$105,046	$21,475	$32,755	$8.54
Rose Nicol	531	3,178	169	1,049	5.99
Portland	3,623	88,760	34,723	33,727	24.50
Bull Hill	2,891	27,605	2,563	11,395	9.55
	19,351	224,589	58,930	78,926	11.60

[1] Settlement value.

Production of properties of United Gold Mines Co. before and after organization of the company (May 15, 1902) to December 31, 1947

	Net tons	Gross value [1]
Ore mined before consolidation	26,310	$456,806
Production under operation of United Gold Mines Co	3,030,377	27,794,471
Total to Dec. 31, 1947	3,056,687	28,251,277

[1] Settlement value.

The producing mines on the Stratton estate were the Orpha May and Proper, operated by lessees throughout 1947, and the Logan, operated by a lessee 5½ months. Output from the three mines totaled 2,069 tons of ore with an average value of $15.91 a ton. Other mines and dumps producing substantial quantities of gold, in approximate order of output, were the Joe Dandy (mine and dump), Free Coinage, Tenderfoot (Markley), Acacia, El Paso (dump), Empire Lee, School Section 16 (dump), Le Clair, Gold King, Strong and Mary Cashen (Front Range), and Rittenhouse. El Paso Mines, Inc., continued until November 22, 1947, its development and exploration campaign begun in January 1946 on a large group of claims on Beacon Hill. Work in 1947 included 7,834 feet of drifts and 3,828 feet of diamond drilling.

East of the Mississippi River[1]
Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By SAMUEL A. GUSTAVSON

GENERAL SUMMARY

PRODUCTION of copper, lead, and zinc from mines in States east of the Mississippi River was relatively steady throughout 1947. The ending of the Premium Price Plan on June 30, 1947, caused several operators in Northern Illinois and Wisconsin to cease mining; but, in general, output from mines in other States in the region was not seriously affected. Substantial increases in the market price of the base metals softened the effect of ending the Premium Price Plan. Since 1943, nearly all gold and silver in States east of the Mississippi River has been recovered as a byproduct of base-metal mining.

During 1947 the total production from the region, in terms of recoverable metal, was 1,997 fine ounces of gold, 137,780 fine ounces of silver, 36,875 short tons of copper, 9,026 short tons of lead, and 181,792 short tons of zinc. These figures compare with 1946 outputs of 1,432 ounces of gold, 79,266 ounces of silver, 34,513 tons of copper, 11,127 tons of lead, and 161,876 tons of zinc.

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, 1943–47

Year	Gold[1] (per fine ounce)	Silver[2] (per fine ounce)	Copper[3] (per pound)	Lead[3] (per pound)	Zinc[3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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, 1943 to June 30, 1946: $0.71111111; July 1, 1946 to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Annual figures for the 5 years ended with 1947 are given in the accompanying table. The figures for tonnage of ore sold or treated

[1] The chapters in the Minerals Yearbook—Mineral Resources series titled "Eastern States—Gold, Silver, Copper, Lead, and Zinc," and "Central States—Silver, Copper, Lead, and Zinc" have not been continued in the 1947 volume. This chapter and a chapter titled, "Missouri, Oklahoma, Kansas, and Arkansas—Silver, Copper, Lead, and Zinc," initiated with this volume, have replaced those chapters.

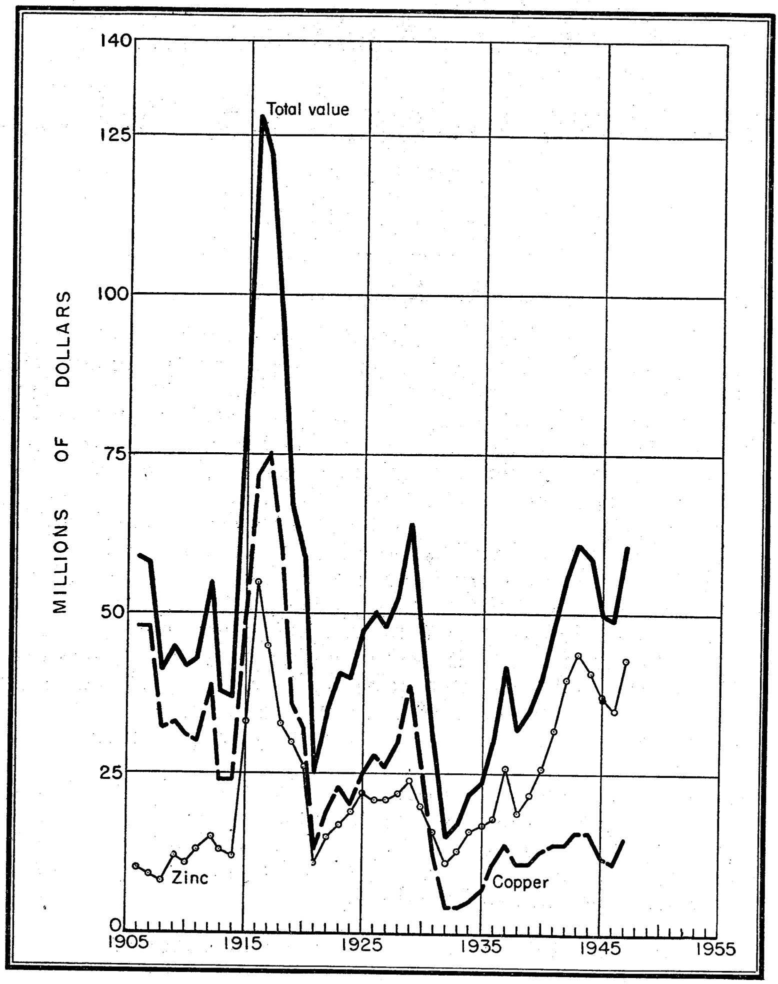

FIGURE 1.—Value of mine production of zinc and copper and total value of gold, silver, copper, lead, and zinc in States east of the Mississippi River, 1906–47.

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 States east of the Mississippi River in 1943–47, in terms of recovered metals

Year	Mines producing		Material sold or treated [1]		Gold (lode and placer) [2]		Silver (lode and placer)	
	Lode	Placer	Crude ore (short tons)	Old tailings (short tons)	Fine ounces	Value	Fine ounces	Value
1943	131	3	7,059,203	2,226,071	2,878	$100,730	178,761	$127,119
1944	123	2	7,162,687	3,256,812	2,595	90,825	180,661	128,470
1945	111		6,335,831	3,820,946	1,857	64,995	106,044	75,409
1946	108	5	5,463,610	3,763,871	1,432	50,120	79,266	64,047
1947	120		6,293,007	3,411,070	1,997	69,895	137,780	124,691

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in States east of the Mississippi River in 1943–47, in terms of recovered metals—Continued

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1943	122,018,000	$15,862,340	16,092,000	$1,206,900	440,804,000	$43,797,726	$61,094,815
1944	114,940,000	15,516,900	19,644,000	1,571,520	398,958,000	41,256,192	58,563,907
1945	85,712,000	11,571,120	20,138,000	1,731,868	360,644,000	37,052,932	50,496,324
1946	69,026,000	11,182,212	22,254,000	2,425,686	323,752,000	35,472,314	49,194,379
1947	73,750,000	15,487,500	18,052,000	2,599,488	363,584,000	42,810,934	61,092,508

1 Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.
2 Includes placer gold as follows: 1943, 12 ounces; 1944, 5 ounces; 1945, none; 1946, 22 ounces; 1947, none.

Mine production of gold, silver, copper, lead, and zinc in States east of the Mississippi River, 1906–47, in terms of recoverable metal

	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
1906	11,452	311,310	121,761	(1)	70,641
1907	11,605	388,380	119,037	4,342	81,771
1908	12,536	309,276	121,584	4,482	88,137
1909	7,544	354,353	127,245	3,919	105,485
1910	8,975	424,201	120,303	4,825	96,652
1911	7,710	608,422	119,723	4,627	102,354
1912	10,763	629,707	118,702	4,158	116,762
1913	8,017	409,928	77,909	3,566	120,564
1914	8,397	516,355	91,955	2,304	129,715
1915	10,848	692,342	142,028	3,789	185,630
1916	3,114	822,647	145,398	4,937	206,422
1917	1,414	802,187	136,886	8,856	221,241
1918	694	624,223	122,326	9,304	182,251
1919	341	550,560	97,711	8,357	168,472
1920	412	590,565	85,917	6,325	135,396
1921	481	410,864	50,884	1,713	73,747
1922	620	463,950	68,594	2,844	108,259
1923	577	340,966	79,396	3,418	114,337
1924	800	236,900	77,556	5,105	123,105
1925	1,965	248,727	87,991	5,707	136,790
1926	694	214,771	98,474	5,509	134,813
1927	826	183,004	99,933	4,878	152,392
1928	1,698	122,819	104,001	7,946	162,571
1929	1,780	136,155	110,224	8,602	171,565
1930	2,256	133,207	103,807	10,253	180,811
1931	1,153	66,686	70,703	9,131	166,785
1932	1,057	101,893	32,634	5,401	124,336
1933	2,010	181,177	30,240	4,072	133,656
1934	6,705	105,332	34,275	4,003	157,385
1935	9,491	91,341	42,461	5,836	167,310
1936	10,377	85,130	59,438	7,244	170,104
1937	10,732	133,214	59,686	6,905	196,561
1938	19,928	189,155	57,283	8,496	174,896
1939	17,414	196,636	54,633	7,067	188,102
1940	18,456	196,248	57,943	7,144	190,681
1941	21,982	187,187	60,006	9,396	207,173
1942	14,699	167,085	59,881	7,929	219,031
1943	2,878	178,761	61,009	8,046	220,402
1944	2,595	180,661	57,470	9,822	199,479
1945	1,857	106,044	42,856	10,069	180,322
1946	1,432	79,266	34,513	11,127	161,876
1947	1,997	137,780	36,875	9,026	181,792

1 Data not available.

Mine production of gold, silver, copper, lead, and zinc in States east of the Mississippi River, 1943–47, by months

[In terms of recovered metals]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Gold, fine ounces:													
1943	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	2,878
1944	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	2,595
1945	162	155	181	180	143	121	132	138	191	139	154	161	1,857
1946	159	60	161	106	125	130	100	122	127	124	114	104	1,432
1947	161	138	135	147	130	164	186	192	171	178	180	215	1,997
Silver, fine ounces:													
1943	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	178,761
1944	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	180,661
1945	10,789	10,890	13,317	10,018	7,296	6,916	6,490	6,382	12,330	7,562	6,511	7,543	106,044
1946	7,869	7,431	8,324	8,125	10,768	8,581	5,127	4,779	5,050	4,710	4,134	4,368	79,266
1947	11,366	10,158	11,320	10,734	12,636	11,427	11,121	11,535	11,184	14,138	11,096	11,065	137,780
Copper, short tons:													
1943	4,899	4,708	5,166	5,847	5,740	5,288	5,013	4,838	4,725	5,241	4,937	4,607	61,009
1944	4,545	4,698	4,862	4,784	5,448	5,031	4,445	5,374	5,272	4,484	4,363	4,164	57,470
1945	3,869	3,517	4,091	3,783	4,010	4,105	3,851	3,428	3,212	3,032	3,120	2,838	42,856
1946	2,963	2,546	3,199	3,265	2,303	2,290	2,897	3,063	3,097	2,976	3,042	2,872	34,513
1947	2,861	2,744	3,105	3,160	3,038	3,022	3,163	3,141	3,209	3,351	2,881	3,200	36,875
Lead, short tons:													
1943	650	552	596	693	641	705	759	751	665	692	658	684	8,046
1944	713	776	804	877	765	793	827	725	848	778	1,082	834	9,822
1945	907	788	822	1,000	966	814	755	724	714	936	855	788	10,069
1946	972	965	1,206	1,153	698	921	931	1,007	959	781	784	750	11,127
1947	684	668	763	799	777	742	825	721	770	841	664	772	9,026
Zinc, short tons:													
1943	16,902	15,806	19,451	18,681	18,291	18,537	19,238	18,262	18,008	18,893	19,383	18,950	220,402
1944	17,794	18,298	18,781	17,376	17,132	15,946	15,993	17,960	14,982	15,991	14,841	14,385	199,479
1945	16,866	14,121	15,722	14,696	15,563	15,581	13,734	14,400	14,467	16,664	15,216	13,292	180,322
1946	15,453	13,267	14,467	14,607	14,615	11,267	8,753	11,251	14,145	15,464	14,376	14,211	161,876
1947	16,154	14,103	14,929	15,422	15,401	16,005	15,837	14,654	14,285	15,621	14,215	15,166	181,792

[1] Monthly figures not available.

Gold.—Gold produced from mines in States east of the Mississippi is chiefly recovered as a byproduct, the Calhoun gold mine in Georgia being the only mine operated primarily to recover gold in 1947. All other gold was recovered as a byproduct from magnetite-pyrite-chalcopyrite ore from the Cornwall mine, Lebanon County, Pa.; copper ore from the Elizabeth mine, Orange County, Vt.; and copper-iron-zinc ore from the Tennessee Copper Co. mines, Polk County, Tenn. Total gold production, in terms of recoverable metal from mines in this region, was 1,997 fine ounces in 1947 compared with 1,432 fine ounces in 1946. No placer gold was reported in 1947. Output of gold in the Southern Appalachian States from 1799 to 1947 is estimated as follows:

Mine production of gold in the Southern Appalachian States, 1799–1947

State	Period	Fine ounces	Value	State	Period	Fine ounces	Value
Alabama	1830–1947	49, 495	$1, 198, 985	Tennessee	1831–1947	21, 268	$492, 010
Georgia	1830–1947	870, 623	18, 087, 652	Virginia	1828–1947	167, 558	3, 577, 509
Maryland	(1)–1947	6, 102	163, 940				
North Carolina	1799–1947	1, 164, 588	24, 327, 843	Total	1799–1947	2, 598, 435	55, 410, 064
South Carolina	1829–1947	318, 801	7, 562, 125				

1 Year of first production not recorded; no production since 1939.

Silver.—Output of recoverable silver from mines in States east of the Mississippi totaled 137,780 fine ounces in 1947 compared with 79,266 fine ounces in 1946; all was byproduct. Illinois zinc-lead-fluorspar and lead-fluorspar ores accounted for 1,790 fine ounces in 1947; Michigan copper ore, 3,089; New York zinc-lead ores, 22,409 fine ounces; Tennessee copper-iron-zinc ores, 79,147 fine ounces; Vermont copper ores, 21,469 fine ounces; Pennsylvania iron-magnetite-pyrite-chalcopyrite ore, 9,863 fine ounces; and Georgia gold ores, 13 fine ounces.

Copper.—Production of copper in States east of the Mississippi totaled 73,750,000 pounds in 1947 compared with 69,026,000 pounds in 1946, an increase of 7 percent. The value in 1947 was $15,487,500 compared with $11,182,212, in 1946, an increase of 39 percent. The States producing copper were (in order of output) Michigan, Tennessee, Pennsylvania, Vermont, and Virginia.

Lead.—Lead is produced in States east of the Mississippi River chiefly as a byproduct or coproduct of zinc or fluorspar mining. In 1947 production totaled 9,026 tons of recoverable metal valued at $2,599,488 compared with 11,127 tons valued at $2,425,686 in 1946, a decrease of 19 percent in quantity but an increase of 7 percent in value. The Austinville mine in Virginia was the largest single producer in the region, followed by the Balmat mine, New York; together these mines accounted for 57 percent of the region's lead output in 1947. Most of the decrease in the production of lead in 1947 from 1946 can be attributed to the closing of small zinc-lead mines in the northern Illinois-Wisconsin district and a smaller output from mines in southern Illinois and the Austinville mine in Virginia.

Zinc.—The output of zinc increased in all the producing States east of the Mississippi River except Virginia and Wisconsin. Production in 1947 was 181,792 tons of recoverable metal valued at $42,810,934, an increase of 12 percent in quantity and 21 percent in value over 1946.

The ending of the Premium Price Plan on June 30, 1947, had very little effect on the major eastern producers, as the increase in market price compensated for the discontinued subsidies. Many mines in the Wisconsin and Northern Illinois area were receiving high premiums and closed when, or shortly after, the plan ceased. Of the total zinc produced in States east of the Mississippi River, mines in New Jersey contributed 42 percent; New York, 19 percent; Tennessee, 17 percent; Virginia, 9 percent; Wisconsin, 7 percent; and Illinois and Kentucky together, 6 percent.

MINING INDUSTRY

In general the availability of labor improved in 1947 and there were virtually no work stoppages at any of the major operations. The effect on mining of the ending of the Premium Price Plan on June 30, 1947, was substantially offset by increasing market prices for the base metals, particularly lead and copper. Zinc mines in Wisconsin and Northern Illinois were those most affected by the ending of the plan. In these States three mills and several mines were closed.

Considerable development and exploratory drilling were reported by operating companies, particularly in Wisconsin, Northern and Southern Illinois, Kentucky, and Michigan. The New Jersey Zinc Co. of Pennsylvania planned to reopen its zinc mine in the Friedensville district near Bethlehem, Pa. There was virtually no activity in gold mining.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in States east of the Mississippi River in 1947, with content in terms of recovered metals

Source	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Gold ore: Georgia	130	76	13			
Total	130	76	13			
Copper ore:						
Michigan	5,129,774		3,089	48,368,000		
Tennessee	1,050,810	303	79,147	[1] 25,372,000		(2)
Vermont	145,661	100	21,469	(1)		
Virginia	(3)			10,000		
Total	6,326,245	403	103,705	[4] 73,750,000		(2)
Magnetite-pyrite-chalcopyrite ore: Pennsylvania	(5)	1,518	9,863	(1)		
Total	(5)	1,518	9,863	(1)		
Lead ore:						
Illinois	35,594		40		868,000	94,000
Kentucky	801				176,000	
Tennessee	400				44,000	
Total	36,795		40		1,088,000	94,000
Zinc ore:						
Illinois	70,310				4,000	4,901,000
New Jersey	499,067					153,742,000
New York	114,995					17,340,000
Tennessee	1,097,670					[2] 62,424,000
Wisconsin	313,111				70,000	8,504,000
Total	2,095,153				74,000	[2] 246,911,000
Zinc-lead ore:						
Illinois	213,199		1,750		3,778,000	15,151,000
Kentucky	18,999				252,000	1,016,000
New York	322,898		22,409		2,992,000	50,892,000
Virginia	505,759				7,606,000	33,576,000
Wisconsin	184,899				2,262,000	15,944,000
Total	1,245,754		24,159		16,890,000	116,579,000
Grand total	[6] 9,704,077	1,997	137,780	73,750,000	18,052,000	363,584,000

1 Data for copper in Pennsylvania and Vermont included with Tennessee; Bureau of Mines not at liberty to publish separate figures.
2 Zinc from copper ore included with that of zinc ore; Bureau of Mines not at liberty to publish separate figures.
3 Mine water precipitates.
4 Includes copper produced in Pennsylvania from magnetite-pyrite-chalcopyrite ore.
5 Bureau of Mines not at liberty to publish separate figures for ore.
6 Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

METALLURGIC INDUSTRY

Most of the ore mined in States east of the Mississippi River is concentrated in mills at or near the mines before it is shipped to smelters, refineries, or oxide plants. Of the 9,704,077 tons of ore and tailings mined in 1947 (exclusive of pyrite ore from Pennsylvania), only 16,420 tons were shipped for direct smelting. All ore mined in Pennsylvania was concentrated. Comparable figures for 1946 show that of the 9,227,481 tons of ore mined, 125,240 tons were shipped for direct smelting. In 1947, 130 tons of gold ore was treated by amalgamation and none by cyanidation; amalgamation and cyanidation mills had been idle in 1946.

The methods of treatment used in the mills and other operating details, including the tonnage and grade of concentrates produced by some of the mills, are given in the Review by States that follows.

Active smelters and refineries in the States east of the Mississippi River that treated primary materials include copper plants at Hubbell, Mich., Carteret, N. J., Laurel Hill, N. Y., Copperhill, Tenn., Baltimore, Md., and Barber, N. J.; lead plants at Barber, N. J., East Chicago, Ind., and Federal, Ill.; and zinc plants at Hillsboro, Fairmont City, Danville, LaSalle, East St. Louis, and Depue, Ill.; Donora, Langeloth, Palmerton, and Josephtown, Pa.; Columbus, Ohio; and Meadowbrook, W. Va.

In the latter part of the year the American Metal Co. began to dismantle its zinc smelter at Langeloth, and the Hegeler Zinc Co. abandoned operation of its retort smelter at Danville, Ill.

REVIEW BY STATES

GEORGIA

The Calhoun gold mine in Lumpkin County was operated by the Calhoun Mines, Inc., for a short time in 1947. It was the only nonferrous metal mine in operation in the State during the year. Production totaled 76 fine ounces of gold and 13 fine ounces of silver.

ILLINOIS

In Illinois in 1947 the production of zinc, in terms of recoverable metal, was 10,073 short tons, an increase of 1,275 tons over that of 1946. The production of silver and lead decreased. In terms of recoverable metal, 1,790 fine ounces of silver and 2,325 tons of lead were produced, compared with 2,302 fine ounces of silver and 3,865 tons of lead in 1946.

During the year the Hegeler Zinc Co. suspended operations at its retort smelter at Danville, Ill., but continued its zinc rolling mill.

Drilling by the Bureau of Mines in 1944 and 1945 on the J. J. Shelby and H. McGuire properties, Pope County, failed to show any economic minerals other than traces of fluorite and minute quantities of sphalerite.[2]

Northern Illinois.—Production from the eight mines operated during 1947 in Northern Illinois totaled 139,389 short tons of zinc, zinc-lead, and lead ores from which 8,209 tons of zinc concentrates containing 5,134 tons of zinc and 871 tons of lead concentrates containing 652 tons of lead were made. The Vinegar Hill Zinc Co. also treated zinc-lead ore, from mines in Northern Illinois and Wisconsin, that had been stock-piled by the Office of Metals Reserve during 1942–46 and not previously credited as production in Minerals Yearbook.

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[2] Bishop, O. M., Fluorite and Zinc on the J. J. Shelby and H. McGuire Properties, Pope County, Ill.: Bureau of Mines Rept. of Investigations 4048, 1947, 9 pp.

Mine production of gold, silver, copper, lead, and zinc in States east of the Mississippi River in 1947, by States, in terms of recovered metals

State [1]	Mines producing: Lode	Mines producing: Placer	Ore and tailings (short tons)	Gold: Fine ounces: Lode	Gold: Fine ounces: Placer	Gold: Total value	Silver (all lode): Fine ounces	Silver (all lode): Value
Georgia	1		130	76		$2,660	13	$12
Illinois	23		[2] 319,103				1,790	1,620
Kentucky	12		[2] 19,800					
Michigan	11		5,129,774				3,089	2,796
New Jersey	1		499,067					
New York	3		437,893				22,409	20,280
Pennsylvania	1		(3)	1,518		53,130	9,863	8,926
Tennessee	13		2,148,880	303		10,605	79,147	71,628
Vermont	1		145,661	100		3,500	21,469	19,429
Virginia	2		505,759					
Wisconsin	52		498,010					
Total: 1947	120		[3] 9,704,077	1,997		69,895	137,780	124,691
1946	108	5	[3] 9,227,481	1,410	22	50,120	79,266	64,047

State [1]	Copper: Pounds	Copper: Value	Lead: Pounds	Lead: Value	Zinc: Pounds	Zinc: Value	Total value
Georgia							$2,672
Illinois			4,650,000	$669,600	20,146,000	$2,437,666	3,108,886
Kentucky			428,000	61,632	1,016,000	122,936	184,568
Michigan	48,368,000	$10,157,280					10,160,076
New Jersey					153,742,000	[4] 17,420,052	[4] 17,420,052
New York			2,992,000	430,848	68,232,000	8,256,072	8,707,200
Pennsylvania	(5)	(5)					[5] 62,056
Tennessee	25,372,000	5,328,120	44,000	6,336	62,424,000	7,553,304	[5] 12,969,993
Vermont	(5)	(5)					[5] 22,929
Virginia	10,000	2,100	7,606,000	1,095,264	33,576,000	4,062,696	5,160,060
Wisconsin			2,332,000	335,808	24,448,000	2,958,208	3,294,016
Total: 1947	73,750,000	15,487,500	18,052,000	2,599,488	363,584,000	42,810,934	61,092,508
1946	69,026,000	11,182,212	22,254,000	2,425,686	323,752,000	35,472,314	49,194,379

[1] Total for 1946 includes 1 ounce of placer gold ($35) from Alabama; no production in Alabama in 1947.
[2] 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.
[3] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania, from which gold, silver, and copper are recovered; Bureau of Mines not at liberty to publish figures for ore and copper separately.
[4] Estimated smelting value of recoverable zinc content of ore after freight, haulage, smelting, and manufacturing charges are added.
[5] Data for copper in Pennsylvania and Vermont included with Tennessee; Bureau of Mines not at liberty to publish separate figures.

The quantity of stock-piled ore milled during 1947 by the Vinegar Hill Zinc Co. and credited to Northern Illinois was 3,374 short tons, from which 418 tons of zinc concentrates containing 259 tons of zinc and 16 tons of lead concentrates containing about 12 tons of lead were made. The accompanying table shows the total quantity, average assay, and content of ore stock-piled from mines in Northern Illinois.

Ore from Northern Illinois mines stock-piled by Office of Metals Reserve, 1942–46

Year	Crude ore (short tons)	Average assay		Gross metal content	
		Zinc (percent)	Lead (percent)	Zinc (short tons)	Lead (short tons)
1942	5,865	11.87	0.53	696	31
1943	1,307	7.57	.12	99	2
1944					
1945	436	4.48	3.70	20	16
1946	3,800	5.21	.55	198	21
Total	11,408	8.88	.61	1,013	70
Milled in 1947	3,374	8.39	.44	283	15
Calculated balance	8,034	9.09	.68	730	55

The larger mines operated during 1947, in order of production, were the Bautsch (largest producer of zinc in the State) and Gray mines of the Tri-State Zinc, Inc.; the Big Six (North Unity) mine, operated by the Big Six North Unity Mining Co.; Little Giant mine, operated by the Little Giant Mining Co.; the Bennett (South Unity) mine, operated by the Bennett Mining Co.; and the Eversoll Hutchings and Red Bird mines. Operations by the Big Six North Unity Mining Co. and the Bennett Mining Co. ceased with the ending of the Premium Price Plan June 30, 1947.

Southern Illinois.—In 1947 the Ozark-Mahoning Co. operated its fluorspar-zinc-lead mines near Cave in Rock and a 320-ton flotation mill at Rosiclare. It was the largest producer of silver and lead and the second-largest producer of zinc in the State. Producing shafts in 1947 were the W. L. Davis-Deardorf, West Green, East Green, Mahoning mine shaft No. 3 and Deardorf No. 2. The company mill operated continuously throughout the year, treating company and custom ores from Illinois and Kentucky. Mill products were fluorspar concentrates, zinc concentrates averaging 63.09 percent zinc, and lead concentrates averaging 70.86 percent lead. During 1947 the company installed additional equipment in the mill and began operations at Deardorf No. 2 shaft in Illinois and the Goering mine near Salem, Ky. The Minerva Oil Co. operated its Minerva fluorspar-zinc mine and 200-ton flotation mill throughout the year. Mill changes were made to reduce dust and increase flotation capacity for fluorspar. In the mine, drill jumbos and an endless-tread tractor-mounted loading machine were placed in operation. The Blue Diggings, Argo Vein, and Good Hope No. 4 mines were operated during the year by the Fluorspar Division of the Aluminum Ore Co. through two shafts 700 feet deep; the ore is concentrated by heavy-media separation followed by flotation. Alco Lead Corp. mined lead ore at its Patrick open pit. The company operated its old jig mill from January 1 to April 30 and its newly completed flotation plant from September 1 to December 10. The Inland Steel Co. operated its Hillside fluorspar-lead mine and 100-ton mill. The mill operated from January 1 to September 5. The Rosiclare Lead & Fluorspar Mining Co. operated its Rosiclare mine.

KENTUCKY

Production of lead and zinc, chiefly a byproduct of fluorspar mining, was, respectively, 214 and 508 short tons of recoverable metal in 1947 compared with 95 and 314 short tons in 1946. The principal producers were the Ozark-Mahoning Mining Co. operating the Mineral Ridge, Babb, and Goering mines. Operation of the Goering mine near Salem, Ky., began in 1947; its shaft is 132 feet deep. K. T. Dome Mining Syndicate operated its mine from January through October. The United States Coal & Coke Co. operated the Tabb No. 1 and produced byproduct zinc and lead concentrates in its fluorspar mill at Mexico, Ky. Other fluorspar producers shipped material containing zinc, lead, and fluorspar to the Ozark-Mahoning mill at Rosiclare, Ill. Small lots of lead concentrates from various mines were also sold.

MICHIGAN

Michigan mines produced 48,368,000 pounds of recoverable copper and 3,089 fine ounces of silver in 1947 compared with 43,326,000 pounds of copper and no silver in 1946. A total of 1,962,258 tons of ore and 3,167,516 tons of tailings was treated during 1947. Operating companies in 1947 include the Calumet & Hecla Consolidated Copper Co., Copper Range Co., Isle Royale Copper Co., and the Quincy Mining Co.

The Calumet & Hecla Consolidated Copper Co. produced ore throughout the year from its Ahmeek, Douglass, Iroquois, North Kearsarge, Peninsula, Allouez, Centennial, and Seneca No. 2 mines, all of which was treated at the Ahmeek 6,000-ton concentration mill. The company Lake Linden reclamation plant operated from January 1 to November 9, and its Tamarack reclamation plant the entire year. All concentrates were shipped to the company smelter at Hubbell.

The Isle Royale Copper Co. operated its mine and mill throughout 1947. The mill treated 316,195 tons of ore compared with 346,743 tons in 1946. Concentrates are shipped to the Calumet & Hecla Co. smelter at Hubbell.

The Copper Range Co. operated throughout the year, producing copper from the Champion mine, the White Pine mine, and its tailings plant. Production from the White Pine was incidental to exploration and development. The company annual report to stockholders for 1947 states that:

> The exploration and development program at the White Pine property was carried on through July when all exploration work was discontinued. Twelve

surface holes were drilled during the year along the northern property line and on the northeast section of the ore body. Since 1937 a total of 139 diamond drill holes have been put down on the property. Final calculations of ore reserves have not been completed but preliminary estimates reviewed by Ira B. Joralemon indicate the following tonnage and copper content.

	Tons	Copper per ton, pounds
Developed ore:		
Parting shale	44, 720, 000	26. 0
Total ore	94, 200, 000	21. 4
Probable ore:		
Parting shale	62, 050, 000	25. 1
Total ore	105, 410, 000	23. 0
Combined developed and probable ore:		
Parting shale	106, 770, 000	25. 3
Total ore	199, 610, 000	22. 3

Furthermore the assays indicate that the ore body will average about 0.20 ounce of silver per ton.

The Quincy Mining Co. reclamation plant treated 1,098,405 tons of sand yielding 4,750,000 pounds of fine copper.

NEW JERSEY

Zinc recovered as metal or in oxide totaled 76,871 short tons in 1947, an increase of 12,417 short tons over 1946. The chief reason for this increase was steady operations throughout the year. In 1946 zinc mines in New Jersey were idle during a labor strike from June 17 to August 17. The operating mines in both years were the Mine Hill at Franklin and the Sterling Hill at Ogdensburg, Sussex County. The commercial ore minerals comprise chiefly franklinite (zinc-iron-manganese oxide) 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, presented earlier in this chapter, is the combined value of the zinc recoverable in both metal and oxide after freight, haulage, smelting, and manufacturing charges are added.

NEW YORK

New York 1947 production of silver, lead, and zinc increased 42, 39, and 5 percent, respectively, over that of 1946. Silver output, all byproduct, was 22,409 fine ounces compared with 15,786 fine ounces in 1946. In terms of recoverable metal, lead production was 1,496 short tons in 1947 compared with 1,073 short tons in 1946, and zinc production was 34,116 short tons in 1947 compared with 32,515 short tons in 1946. The producing mines were the Balmat and the Edwards, operated by the St. Joseph Lead Co., and the Hyatt, operated by the

Universal Exploration Co., in St. Lawrence County, east and southeast of Gouverneur. Ore from the Balmat mine contains zinc, iron, and lead sulfides, with some silver associated with the lead; it is treated at the 1,200-ton Balmat flotation mill. Both the mine and mill were operated throughout the year. Development in the mine included 1,223 feet of drifting and 19,933 feet of diamond drilling. A new primary and secondary crushing plant was built at the mill. An information circular on diamond drilling blast holes at the Balmat mine was published [3] by the Bureau of Mines.

The Edwards mine (which yields a zinc ore) and its 600-ton mill also operated throughout the year. Development in the mine included 1,401 feet of drifting and 5,266 feet of diamond drilling. The zinc concentrates from both operations are sent to the company's Josephtown, Pa., smelter, and the lead concentrates to the Herculaneum, Mo., smelter. The Hyatt mine and 200-ton flotation mill of the Universal Exploration Co. operated steadily throughout the year. Formerly only zinc concentrates were made from the ore, but in 1947 lead concentrates also were recovered. Development at the mine included 185 feet of drifts and 6,180 feet of diamond drilling.

PENNSYLVANIA

Gold, silver, and copper are produced in Pennsylvania by treating magnetite-pyrite-chalcopyrite ore from the Cornwall mine of the Bethlehem Steel Co. in Lebanon County. Production of gold, silver, and copper in Pennsylvania increased in 1947 over 1946 by 32, 25, and 27 percent, respectively.

Zinc smelters at Donora, Josephtown, and Palmerton treat most of the zinc concentrates produced in New York, Pennsylvania, and Tennessee, as well as large tonnages from other States and from foreign countries. The zinc smelter at Langeloth was closed in the latter part of the year.

NORTH CAROLINA—SOUTH CAROLINA

There was no production of gold, silver, copper, lead, or zinc from mines in North Carolina or South Carolina in 1947.

TENNESSEE

In 1947, 13 mines operated by 5 companies produced, in terms of recoverable metal, 303 fine ounces of gold, 79,147 fine ounces of silver, 22 tons of lead, 31,212 tons of zinc, and a quantity of copper that was 2 percent below that of 1946. In 1946, 14 mines operated by 6 companies produced 95 fine ounces of gold, 18,016 fine ounces of silver, 125 tons of lead, 24,614 tons of zinc, and a tonnage of copper.

The Tennessee Copper Co. operated the Burra Burra, Eureka, Boyd, Mary, and Calloway mines near Copperhill, Polk County. The

[3] Mosier, McHenry, Diamond drilling blast holes, Balmat mine, St. Lawrence County, N. Y.: Bureau of Mines Inf. Circ. 7408, 1947, 6 pp.

sulfide ore, containing iron, copper, and zinc and small quantities of gold and silver, was concentrated in the London and Isabella mills, which together have a daily capacity of 3,000 tons of ore. Three concentrates are made—copper, iron, and zinc. During 1947 the mills were operated 6.5 days and 19.5 shifts per week. Copper concentrates and some crude ore used as a flux are reduced to blister copper in the company smelter at Copperhill; part of the blister copper is shipped to an electrolytic plant and the remainder is used to manufacture copper sulfate. Development in the mines in 1947 included sinking 511 feet of shaft, driving 3,156 feet of drift, and diamond-drilling 2,364 feet.

The American Zinc Co. of Tennessee operated the Grasselli, Jarnagin, and Mossy Creek mines in Jefferson County and the Mascot No. 2 and Graves mines in Knox County, and its 4,000-ton mill throughout 1947. Development in these mines was 1,551 feet of drifts, 17,292 feet of diamond drilling, and 837 feet of churn drilling in the Mascot No. 2; 1,235 feet of drifts, 6,251 feet of diamond drilling, and 14,883 feet of churn drilling in the Grasselli mine; 769 feet of drifts, 13,581 feet of diamond drilling, and 4,485 feet of churn drilling at Jarnagin; and 499 feet of drifts and 765 feet of diamond drilling at Mossy Creek. Concentrates were sent to plants of the American Steel & Wire Co., Donora, Pa.; American Zinc Oxide Co., Columbus, Ohio; and E. I. du Pont de Nemours & Co., New Castle, Pa.

The Universal Exploration Co. operated the Davis-Bible group of claims and its 800-ton flotation mill near Jefferson City throughout the year. Development in the mine included 399 feet of shaft and 1,436 feet of drift, 17,556 feet of diamond drilling and 4,146 feet of churn drilling. The zinc-ore mined is treated to recover zinc concentrate averaging in 1947, 64.44 percent zinc. The concentrate was sold to American Steel & Wire Co., Donora, Pa. Some zinc-lead ore was produced by the Tennessee Zinc Co. from the Embree mine during the year.

VERMONT

The Vermont Copper Co. continued operations at its Elizabeth mine and 500-ton flotation mill in Orange County throughout 1947. The production of recoverable copper was about 25 percent less in 1947. Gold and silver production also decreased. The ore minerals are chalcopyrite and pyrrhotite, carrying some silver and a little gold. The concentrates produced averaged 25.81 percent copper and 0.010 ounce gold and 2.24 ounces silver per ton. The concentration ratio was about 15:1.

VIRGINIA

Virginia mines produced in terms of recoverable metal 5 tons of copper, 3,803 tons of lead, and 16,788 tons of zinc in 1947. In 1946, 4,381 tons of lead, 16,905 tons of zinc, and no copper were produced.

The Austinville zinc-lead mine operated continuously during 1947:

the ore is treated in a 2,000-ton flotation mill at the mine. The Toncrae Mining Co. produced a small quantity of copper from its leaching operation at the Toncrae mine in Floyd County.

WISCONSIN

Production of both lead and zinc from mines in Wisconsin decreased in 1947 from that of 1946. Total production of these two metals in terms of quantities recoverable and including ore milled from the Government stock pile was 1,166 short tons of lead and 12,224 short tons of zinc. In 1946 production was 1,588 short tons of lead and 14,276 short tons of zinc. The Vinegar Hill Zinc Co. custom flotation mill at Cuba City—principal producer of concentrates in the district—maintained a steady production rate throughout the year by treating ore from the Office of Metals Reserve stock pile after shipments from the mines decreased. The metal output from the stock-piled ore has been credited to the year in which the ore is milled, regardless of when mined. Other Wisconsin mills making finished concentrates were the Dodgeville Mining Co., W. E. Faithorn, and Inland Lead & Zinc Co. (Coker) mine mills; and the Chestnut Hill Zinc Co. and Northwest Zinc Co. tailing mills. Mills of the Dodgeville Mining Co. and the Chestnut Hill Zinc Co. operated throughout the year; the other three were closed soon after the Premium Price Plan expired, on June 30, 1947.

The principal Wisconsin shippers to the Vinegar Hill mill in 1947 (many of which shut down when the Premium Price Plan expired or soon thereafter) included the following mining companies: Alderson, C. F. & H. (Mulcahy mine), Consolidated, Cuba (Andrews), Deuce (New Harty, Deuce No. 2), D. H. & S., Double Dick, Hofer (Boyle, DeRocher), Kittoe, Little Benny (Monroe, Penna Benton), Little Giant, Little Grant (Arensdorf & Murray), Meloy & Baker (Crawhall), Mifflen (Defense), Murray and Richards (James), Harold Reinke Partnership (Federal), Virgil Chadwick Partnership, and Whitechurch & Farr (Little Mullen mine).

During the period 1942–46 the Metals Reserve Company (and its successor, the Office of Metals Reserve) purchased and stock-piled in Wisconsin some of the crude ore mined in Northern Illinois and Wisconsin. Material stock-piled from mines in northern Illinois is shown in the section of this chapter on Illinois. A table showing the quantity, assay, and content of the ore purchased and stock-piled from mines in Wisconsin is presented here.

In 1947 the Vinegar Hill Zinc Co. milled 46,725 tons of MRC stock-piled ore, of which 43,351 tons, yielding (in terms of recoverable metal) 112 short tons of lead and 2,341 short tons of zinc, have been credited to mines in Wisconsin. This portion of the stock-piled ore milled and its recoverable metal content have been credited as 1947 mine production.

Ore from Wisconsin mines stock-piled by Office of Metals Reserve, 1942–46

Year	Crude ore (short tons)	Average assay		Gross metal content	
		Zinc (percent)	Lead (percent)	Zinc (short tons)	Lead (short tons)
1942	15,090	10.01	0.18	1,511	27
1943	25,138	6.70	.22	1,685	55
1944	29,345	6.43	.36	1,888	105
1945	33,479	7.42	.66	2,483	221
1946	43,617	5.94	.57	2,590	249
Total	146,669	6.93	.45	10,157	657
Milled in 1947	43,351	6.55	.33	2,838	143
Calculated balance	103,318	7.08	.50	7,319	514

Activity in leasing and exploratory drilling in the Wisconsin area was sustained throughout the year. Companies participating included the Calumet Corp. (subsidiary of Calumet & Hecla Consolidated Mining Co.), the St. Joseph Lead Co., the American Metal Co., Ltd., the American Zinc, Lead & Smelting Co., and local operating companies. The Bureau of Mines did diamond drilling on zinc-lead properties in the Rodham area and test pitting in other areas considered to be favorable for shallow lead deposits. Previous work done by the Bureau of Mines in Wisconsin was published in 1947.[4]

[4] Lincoln, Francis Church, Crow Branch Lead-Zinc Diggings and vicinity, Grant County, Wis.: Bureau of Mines Rept. of Investigations 4027, 1947, 5 pp. Last Chance zinc mine, Grant County, Wis.: Bureau of Mine Rept. of Investigations 4028, 1947, 5 pp. Berliner, M. Howard, Coughlin and Galena Level zinc mines area, Lafayette County, Wis.: Bureau of Mines Rept. of Investigations 4047, 1947, 10 pp. Apell, G. A., Zinc deposits of the Tennyson district, Grant County, Wis.: Bureau of Mines Rept. of Investigations 4083, 1947, 13 pp. Smith, M. Clair, Copper deposits of Douglas County, Wis.: Bureau of Mines Rept. of Investigations 4088, 1947, 7 pp. Renwick, M. O., and Zinner, Paul, Winskell-Andrews-Lyne zinc deposits, Lafayette County, Wis.: Bureau of Mines Rept. of Investigations 4090, 1947, 5 pp.

Idaho

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By C. E. NEEDHAM AND PAUL LUFF

GENERAL SUMMARY

AFTER dropping uninterruptedly for several years, Idaho's silver and lead outputs rose sharply in 1947. The silver output increased from 6,491,104 fine ounces in 1946 to 10,345,779 in 1947 (a 59-percent gain) and lead from 119,974,000 pounds to 157,888,000 (a 32-percent gain). Marked increases in the output of each of the other three metals—gold from 42,975 fine ounces to 64,982 (a 51-percent gain), copper from 2,076,000 pounds to 3,280,000 (a 58-percent gain), and zinc from 143,014,000 pounds to 166,138,000 (a 16-percent gain)—resulted in one of the highest production years in peacetime. The total value of the five metals rose from $37,610,123 in 1946 to $55,164,670 in 1947 (47 percent). The total value of the gold was $2,274,370—4 percent of the State total value; silver, $9,362,930—17 percent; copper, $688,800—1 percent; lead, $22,735,872—41 percent; and zinc, $20,102,698—over 36 percent. In 1947 the State remained the largest producer of silver and zinc in the United States and the second largest producer of lead (exceeded only by Missouri). About 89 percent of the State silver production, 80 percent of the copper, more than 92 percent of the lead, and 95 percent of the zinc came from the Coeur d'Alene region of Shoshone County; the rest of the silver, copper, lead, and zinc came largely from the Warm Springs district in Blaine County and the Bayhorse district in Custer County.

More than 58 percent of the State gold production came from two lode mines—one in the Yellow Pine district in Valley County and the other in the Middle Boise (Atlanta) district in Elmore County. The remainder came largely from dredging operations in the Boise Basin district in Boise County, Gibbonsville district in Lemhi County, Yankee Fork district in Custer County, Kirtley Creek district in

Lemhi County, and Elk City and Ten Mile (Golden) districts in Idaho 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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946 to Dec. 31, 1947: $0.905.

[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Idaho, 1943–47, and total, 1863–1947, in terms of recovered metals

Year	Mines producing: Lode	Mines producing: Placer	Ore (short tons)	Gold (lode and placer): Fine ounces	Gold (lode and placer): Value	Silver (lode and placer): Fine ounces	Silver (lode and placer): Value
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
1946	139	71	2,882,187	42,975	1,504,125	6,491,104	5,244,812
1947	183	99	3,717,697	64,982	2,274,370	10,345,779	9,362,930
1863–1947			(1)	7,905,731	179,839,988	530,831,191	368,394,923

Year	Copper: Pounds	Copper: Value	Lead: Pounds	Lead: Value	Zinc: Pounds	Zinc: Value	Total value
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
1946	2,076,000	336,312	119,974,000	13,077,166	143,014,000	17,447,708	37,610,123
1947	3,280,000	688,800	157,888,000	22,735,872	166,138,000	20,102,698	55,164,670
1863–1947	[2] 109,427	33,645,879	[2] 6,019,328	678,614,140	[2] 1,376,741	231,331,323	1,491,826,253

[1] Figure not available. [2] Short tons.

Gold produced at placer mines in Idaho, 1943–47, by classes of mines and by methods of recovery

Class and method	Mines producing	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:					
1943–44					
1945	1	250,000	1,593	$55,755	$0.223
1946	7	3,766,746	17,448	610,680	.162
1947	8	3,381,351	14,112	493,920	.146
Dragline dredges:					
1943–45					
1946	6	364,260	2,272	79,520	.218
1947	12	1,021,490	5,171	180,985	.177
Suction dredges:					
1943–46					
1947	5	19,590	103	3,605	.184
Sluicing and hydraulicking:					
1943	29	29,050	249	8,715	.300
1944	16	13,767	118	4,130	.300
1945	23	19,600	168	5,880	.300
1946	53	44,450	381	13,335	.300
1947	67	43,167	370	12,950	.300
Underground placers:					
Drift:					
1943	1	700	6	210	.300
1944	4	2,100	18	630	.300
1945	3	933	8	280	.300
1946	5	2,567	22	770	.300
1947	7	2,333	20	700	.300
Grand total placers:					
1943	30	29,750	255	8,925	.300
1944	20	15,867	136	4,760	.300
1945	27	270,533	1,769	61,915	.229
1946	71	4,178,023	20,123	704,305	.169
1947	99	4,467,931	19,776	692,160	.155

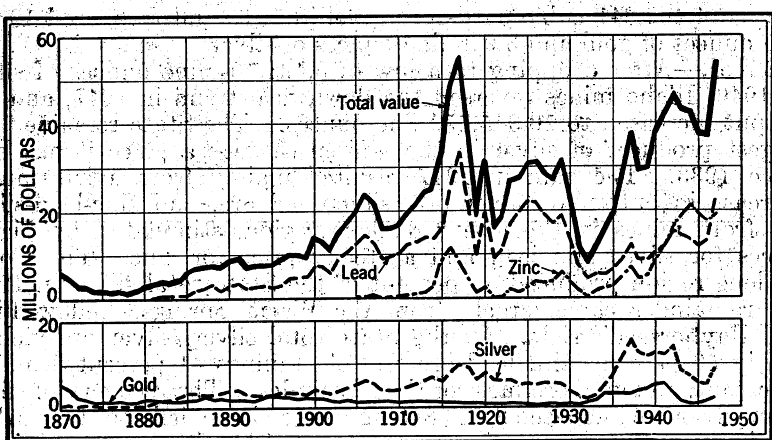

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Idaho, 1870–1947. The value of copper has been less than $2,000,000 annually, except in a few years.

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1947, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	2,910	751,000	232,000	12,700,000	13,500,000
February	2,650	725,000	250,000	11,670,000	11,800,000
March	4,170	795,000	264,000	12,500,000	12,700,000
April	5,740	969,000	296,000	12,600,000	14,200,000
May	6,070	757,000	256,000	12,700,000	15,750,000
June	6,825	768,000	258,000	13,450,000	16,370,000
July	7,110	766,000	288,000	13,000,000	13,890,000
August	6,560	933,000	274,000	13,700,000	13,800,000
September	5,910	840,000	254,000	12,840,000	11,938,000
October	6,400	1,191,000	326,000	14,500,000	13,730,000
November	5,600	965,000	286,000	14,528,000	14,160,000
December	5,037	885,779	296,000	13,700,000	14,300,000
Total 1947	64,982	10,345,779	3,280,000	157,888,000	166,138,000

Gold.—Despite a 51-percent increase in output of recoverable gold from mines in Idaho in 1947 compared with 1946, it was far below that of prewar years. The yield of gold from lode mines increased from 22,852 ounces in 1946 to 45,206 in 1947, but that from placer properties declined slightly from 20,123 ounces to 19,776. This marked gain in gold production from lode mines resulted principally from increased mining and milling operations at the Yellow Pine mine in Valley County. This mine was by far the largest producer of gold in Idaho in 1947; it was followed by a lode property at Atlanta worked by the Talache Mines, Inc., two bucket dredges near Centerville operated by Baumhoff-Marshall, Inc., a bucket dredge at Idaho City worked by the Idaho-Canadian Dredging Co., a bucket dredge at Sunbeam worked by the Snake River Mining Co., Triumph mine at Triumph, and a bucket dredge near Gibbonsville worked by the Idaho-Warren Dredging Co. Of the total gold produced in Idaho in 1947, 61 percent came from gold ore, 22 percent from bucket dredging, 8 percent from dragline dredging, and most of the remainder from zinc-lead ore. Eight bucket dredges and 12 dragline dredges treated 4,402,841 cubic yards of gravel in 1947 and recovered 19,283 fine ounces of gold and 3,999 fine ounces of silver.

Silver.—After dropping to a low of 6,491,104 fine ounces of silver in 1946, Idaho mines reversed the downward trend in 1947, and the output increased to 10,345,779 fine ounces. The State remained the largest producer of silver in the United States—a place it has held since 1933. The gain in 1947 resulted mainly from a substantial increase in output of silver ore, silver-lead ore, and zinc-lead-silver ore from mines in the Coeur d'Alene region, stimulated by higher prices for silver and lead and a steady price for zinc. The Coeur d'Alene region produced 89 percent of the State total silver in 1947; the remainder came largely from the Warm Springs, Yellow Pine, and Bayhorse districts. Of the State total silver, silver ore yielded nearly 50 percent, zinc-lead ore and old tailings 41 percent, lead ore 6 percent, and gold ore most of the remainder. The recovery of silver from silver ore increased 2,510,840 ounces, owing chiefly to the marked rise in output of ore from property operated by the Sunshine Mining Co.; the recovery of silver from zinc-lead ore increased 802,221 ounces, that from lead ore 373,136 ounces, and that from gold ore 194,159 ounces.

Ten mines—the Sunshine, Polaris, Bunker Hill & Sullivan, Silver Dollar, Page, Triumph, Sherman, Yellow Pine, Star, and Osburn tailing plant—produced 75 percent of the silver output of the State in 1947. All but the Triumph and Yellow Pine are in the Coeur d'Alene region.

Copper.—The output of copper in Idaho increased to 3,280,000 pounds in 1947, a 58-percent gain over 1946. About 78 percent of the State copper output in 1947 was recovered as a byproduct in the treatment of zinc-lead ore, silver ore, and silver-copper-antimony ore from mines in the Coeur d'Alene region; the remainder was recovered largely from zinc-lead ore produced in the Warm Springs district, copper ore in the Alder Creek district, and silver-tungsten ore in the Blue Wing district.

The Sunshine mine near Kellog in the Coeur d'Alene region was the largest producer of copper in Idaho in 1947. It was followed by the Mineral Point (Coeur D'Alene Mines Corp.), Polaris, Triumph, Silver Dollar, and Bunker Hill & Sullivan properties.

Lead.—In 1947 the mines in Idaho made a notable recovery in lead output after the production dropped each year since 1942. The output increased to 157,888,000 pounds in 1947 from 119,974,000 pounds in 1946. However, the lead output still is less than the zinc output; but the value of the lead in 1947 was 13 percent greater than the value of the zinc, owing to the difference in price. Higher prices for silver and lead in 1947 and a steady price for zinc caused a greater output of silver-lead ore and zinc-lead-silver ore from mines in the Coeur d'Alene region, the chief source of silver, lead, and zinc in Idaho. In 1947 more than 92 percent of the State total lead came from the Coeur d'Alene region; most of the remainder was produced in the Bayhorse, Warm Springs, and Alder Creek districts. Zinc-lead ore and old tailings (2,627,653 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 13 percent; the remainder came largely from zinc-lead ore in the Warm Springs district and from old zinc slag in the Coeur d'Alene region. Lead recovered from zinc-lead ore and old tailings increased 30,508,084 pounds, that from lead ore 7,786,025 pounds, and that from silver ore 694,549 pounds; but lead from zinc ore and old slag decreased 1,056,433 pounds.

In 1947 the combined lead output of the six largest producing mines (each producing more than 7,000,000 pounds)—the Bunker Hill & Sullivan, Star, Page, Morning, Sherman, and Sidney—was 87,684,154 pounds or 56 percent of the State total. Other important producers in 1947 were the Bunker Hill & Sullivan mill tailing dump, Tamarack, Osburn tailing plant, Dayrock, Frisco, and Triumph properties.

Zinc.—Although Idaho's output of recoverable zinc increased to 166,138,000 pounds in 1947, it lacked 16,606,000 pounds of reaching the peak production in 1944, when 182,744,000 pounds were produced. However, the output in 1947 again exceeded the lead output by 8,250,000 pounds (5 percent), and the State continued to be the largest producer of zinc in the United States. More than 95 percent of the State total zinc in 1947 came from the Coeur d'Alene region, and most of the remainder from the Warm Springs, Bayhorse, and Alder Creek districts. Zinc-lead ore and old tailings concentrated yielded 92 percent of the State total zinc; old zinc slag smelted and fumed, 7 percent; and lead ore concentrated, zinc ore smelted, silver ore concentrated, and zinc-lead ore smelted nearly all the remainder.

Eleven properties (each producing more than 5,200,000 pounds of zinc)—the Star, Page, Sidney, Bunker Hill smelter slag dump, Morning, Frisco, Tamarack, Monitor, Bunker Hill & Sullivan mine, Osburn tailing plant, and Little Pittsburg—produced 75 percent of the State total zinc in 1947.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1947, 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	-	8	$280	505	$457
Blaine	29	-	2,588	90,580	443,347	401,229
Boise	6	18	8,136	284,760	2,695	2,439
Bonner	5	-	9	315	17,811	16,119
Bonneville	1	1	2	70	10	9
Boundary	1	-	3	105	5,358	4,849
Butte	5	-	5	175	2,273	2,057
Camas	2	-	45	1,575	231	209
Cassia	2	-	2	70	136	123
Clark	2	-	2	70	347	314
Clearwater	1	7	507	17,745	95	86
Custer	23	5	3,146	110,110	281,906	255,125
Elmore	4	4	6,800	238,000	42,779	38,715
Gem	6	4	118	4,130	2,505	2,267
Idaho	8	32	2,938	102,830	590	534
Jerome	-	3	21	735	-	-
Latah	1	1	722	25,270	927	839
Lemhi	15	12	5,938	207,830	41,010	37,114
Owyhee	4	3	69	2,415	673	609
Shoshone	61	4	2,808	98,280	9,234,906	8,357,590
Twin Falls	-	1	2	70	-	-
Valley	2	4	31,113	1,088,955	266,527	241,207
Washington	2	-	-	-	1,148	1,039
Total: 1947	183	99	64,982	2,274,370	10,345,779	9,362,930
1946	139	71	42,975	1,504,125	6,491,104	5,244,812

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Adams	42,000	$8,820	-	-	-	-	$9,557
Blaine	267,400	56,154	3,956,000	$569,664	5,749,000	$695,629	1,813,256
Boise	-	-	-	-	-	-	287,199
Bonner	1,400	294	88,500	12,744	22,600	2,735	32,207
Bonneville	300	63	-	-	-	-	142
Boundary	2,700	567	257,000	37,008	19,000	2,299	44,828
Butte	100	21	310,500	44,712	50,000	6,050	53,015
Camas	500	105	1,500	216	-	-	2,105
Cassia	200	42	14,500	2,088	-	-	2,323
Clark	17,300	3,633	23,000	3,312	-	-	7,329
Clearwater	-	-	-	-	-	-	17,831
Custer	224,700	47,187	6,629,000	954,576	1,490,000	180,290	1,547,288
Elmore	-	-	-	-	-	-	276,715
Gem	700	147	4,200	605	3,400	411	7,560
Idaho	800	168	-	-	-	-	103,532
Jerome	-	-	-	-	-	-	735
Latah	-	-	-	-	-	-	26,109
Lemhi	88,300	18,543	365,500	52,632	13,400	1,621	317,740
Owyhee	-	-	-	-	-	-	3,024
Shoshone	2,624,000	551,040	146,120,000	21,041,280	158,502,000	19,178,742	49,226,932
Twin Falls	-	-	-	-	-	-	70
Valley	9,000	1,890	118,000	16,992	288,600	34,921	1,383,965
Washington	600	126	300	43	-	-	1,208
Total: 1947	3,280,000	688,800	157,888,000	22,735,872	166,138,000	20,102,698	55,164,670
1946	2,076,000	336,312	119,974,000	13,077,166	143,014,000	17,447,708	37,610,123

MINING INDUSTRY

No labor strikes plagued Idaho's mining industry in 1947; and the higher average prices for silver, copper, and lead, the steady price for zinc, and an improvement in the labor supply during the year stimulated greater activity at mines in the Coeur d'Alene region, Shoshone County—the chief source of silver, copper, lead, and zinc in Idaho. As a result, the State had the highest value of the five metals in any peacetime year and the greatest output of ore in its history. Gold mining in Idaho, especially in the Yellow Pine district, Valley County, made a marked recovery in 1947, the output of gold ore increasing from 163,666 tons in 1946 to 618,877 tons in 1947. Material treated by bucket dredging and dragline dredging at placer properties was greater in 1947 than in 1946, but production of gold was slightly less. The number of bucket dredges increased from 7 in 1946 to 8 in 1947 and the number of dragline dredges from 6 to 12. The output of zinc-lead ore and old tailings (by far the chief ore output of the State) increased from 2,407,404 tons to 2,716,251, silver ore from 92,209 tons to 146,259, lead ore from 113,175 tons to 165,218, and copper ore from 903 tons to 3,303; but zinc ore and old slag declined from 104,585 tons to 67,133. More than 94 percent of the gold ore mined in Idaho in 1947 came from the Yellow Pine mine at Stibnite, Valley County, where the output increased from 147,505 tons in 1946 to 584,483 tons in 1947. About 85 percent of the silver ore, 83 percent of the lead ore, 97 percent of the zinc ore and old slag, and 97 percent of the zinc-lead ore and old tailings came from various properties in the Coeur d'Alene region and 72 percent of the copper ore from one mine in the Alder Creek (Mackay) district.

ORE CLASSIFICATION

Details on ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Idaho in 1947, 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	36	618,877	39,562	299,542	1,761	3,550	----------
Dry and siliceous gold-silver ore	7	629	92	3,504	3,307	4,988	----------
Dry and siliceous silver ore	17	146,259	117	5,121,229	1,441,487	4,697,849	394,670
	60	765,765	39,771	5,424,275	1,446,555	4,706,387	394,670
Copper ore	8	3,303	201	4,452	256,146	300	----------
Lead ore	59	165,218	295	637,415	102,946	16,073,661	1,031,676
Lead-copper ore	1	27	1	6,083	3,000	10,475	----------
Zinc ore	4	[1] 67,133	9	25,441	4,112	2,398,190	12,193,500
Zinc-lead ore	71	2,716,251	4,929	4,244,008	1,467,241	134,698,987	152,518,154
Total lode mines	[2] 183	[1] 3,717,697	45,206	10,341,674	3,280,000	157,888,000	166,138,000
Placers	99	----------	19,776	4,105	----------	----------	----------
Total: 1947	282	[1] 3,717,697	64,982	10,345,779	3,280,000	157,888,000	166,138,000
1946	210	[3] 2,882,187	42,975	6,491,104	2,076,000	119,974,000	143,014,000

[1] Includes 65,409 tons of old 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 92,072 tons of old lead-smelter slag.

METALLURGIC INDUSTRY

Of the 3,717,697 tons of ore produced in 1947 in Idaho, 3,591,511 tons (97 percent) were treated at concentration plants, 95,906 tons (more than 2 percent) were shipped crude to smelters, 27,780 tons (nearly 1 percent) were treated at amalgamation mills, and 2,500 tons were treated at one cyanide plant.

Concentration plants in 1947 treated principally zinc-lead ore and old tailings (2,714,252 tons), gold ore (588,218 tons), silver ore (145,725 tons), and lead ore (142,772 tons). Current hot zinc slag totaling 135,406 tons was fumed, and 65,409 tons of old dump lead-smelter slag were delivered for smelting and fuming in 1947. Metals recovered from the old dump slag were credited to the Bunker Hill smelter dump, and metals recovered from the hot slag were credited to various producers of the ores and concentrates that contributed during the year to the slag-making material.

The Bunker Hill & Sullivan Mining & Concentrating Co. operated its Bradley lead smelter and refinery at a greater rate than in 1946 on ore and concentrates, chiefly from mines and mills in the Coeur d'Alene region. The company also operated its antimony and cadmium plants, 1,700-ton flotation mill (including a 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. According to the company annual stockholders' report for 1947, the smelter produced 4,187 ounces of gold, 8,214,644 ounces of silver, 232,464 pounds of cadmium, 812 tons of copper, 1,481 tons of antimony, 14,780 tons of zinc, and 54,672 tons of lead. The slag-fuming plant yielded 21,429 dry tons of deleaded zinc fume and 3,157 dry tons of lead fume; the production of both lead and zinc in 1947 was less than in 1946. The Sullivan Mining Co. operated at capacity throughout the year its 100-ton electrolytic zinc plant near Bradley, producing 41,799 tons of high-grade slab zinc. This is the largest yield for any of its 20 years of continuous operation, according to the annual report of the Bunker Hill & Sullivan Mining & Concentrating Co. The Bradley Mining Co. operated its 1,800-ton flotation mill at Stibnite, Valley County, continuously on gold-silver-iron-antimony ore from the Yellow Pine mine. Tungsten concentrates and silver-copper-lead-iron concentrates continued to be produced in the Ima mill at Paterson, Lemhi County, but the mill was destroyed by fire in December.

Mine production of metals in Idaho in 1947, 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	27,780	3,099	1,830			
Old tailings cyanided	2,500	136	82			
Concentrates smelted	290,878	41,039	10,127,129	2,976,621	150,142,254	153,793,944
Ore smelted	95,906	932	212,633	303,379	7,745,746	12,344,056
Placer		19,776	4,105			
Total: 1947		64,982	10,345,779	3,280,000	157,888,000	166,138,000
1946		42,975	6,491,104	2,076,000	119,974,000	143,014,000

Gross metal content of Idaho ore treated at mills in 1947, by classes of ore and methods of treatment

Class of ore	Method of treatment	Ore (short tons)	Gross metal content of mill feed: Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	Amalgamation	27,780	7,685	47,559			
Do	Cyanidation	2,500	170	125			
Do	Concentration	588,218	45,398	324,909		3,000	
Dry and siliceous gold-silver.	do	500	16	500			
Dry and siliceous silver.	do	145,725	156	5,218,623	1,705,240	4,909,988	682,000
Lead	do	142,772	129	535,986	110,200	12,566,316	2,147,210
Zinc	do	44		30		1,839	21,108
Zinc-lead	do	2,714,252	8,574	5,139,509	2,428,405	164,967,932	183,328,744
Total: 1947		3,621,791	62,128	11,267,241	4,243,845	182,449,075	186,179,062
1946		2,773,520	30,248	7,528,840	3,157,776	143,999,128	160,202,379

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Idaho in 1947, by types of mills and by counties, in terms of recovered metals

County	Material treated (short tons)	Recovered in bullion: Gold (fine ounces)	Silver (fine ounces)	Concentrates smelted and recovered metal: Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
AMALGAMATION MILLS								
Boise	103	232	106					
Clearwater	2	4	3					
Elmore	27,541	2,666	1,652	757	4,028	40,821		
Idaho	119	162	42					
Lemhi	10	4	1					
Owyhee	5	31	26	3	6	303		
Total: 1947	27,780	3,099	1,830	760	4,034	41,124		
1946	15,707	2,919	1,766	411	2,289	22,376		
CYANIDATION MILLS								
Shoshone	2,500	136	82					
Total: 1947	2,500	136	82					
1946								
Grand total: 1947	30,280	3,235	1,912	760	4,034	41,124		
1946	15,707	2,919	1,766	411	2,289	22,376		

Mine production of metals from concentrating mills in Idaho in 1947, 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)
Blaine	56,502	13,482	2,514	427,839	261,485	3,772,897	5,661,650
Bonner	1,620	117	9	17,359	1,400	54,641	22,600
Boundary	8,075	161	2	3,864	2,400	190,432	15,060
Butte	1,020	259	4	1,539		183,750	23,428
Custer	27,448	3,095	79	133,205	24,820	2,320,263	900,420
Gem	41	6	17	241	164	3,042	3,400
Idaho	5	1	4				
Lemhi	23,895	721	858	33,442	54,400	70,500	
Shoshone	2,885,125	250,829	2,476	9,202,010	2,622,952	143,428,729	146,878,786
Valley	587,780	21,447	31,042	266,506	9,000	118,000	288,600
Total: 1947	3,591,511	290,118	37,005	10,086,005	2,976,621	150,142,254	153,793,944
1946	2,757,813	232,953	16,522	6,335,297	1,981,943	114,965,683	123,395,883

Gross metal content of concentrates produced from ores mined in Idaho in 1947, 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 gold	21,887	35,906	296,222		2,467	
Dry gold-silver	4	20	734			
Copper	620	13	224,784	311,362	2,916	4,500
Lead	96,591	1,948	3,790,671	1,093,794	124,799,752	14,816,087
Lead-copper	12,732	81	4,872,704	1,260,177	4,746,874	481,700
Zinc	141,465	1,281	560,913	536,942	10,776,578	143,580,117
Zinc-lead	12,624	304	367,036	93,680	12,485,020	3,177,233
Dry iron (from zinc-lead ore)	4,955	1,486	14,065	39,098	135,420	144,120
Total: 1947	290,878	41,039	10,127,129	3,335,053	152,949,027	162,203,757
1946	233,364	18,811	6,357,673	2,238,304	117,188,639	135,730,536

Mine production of metals from Idaho concentrates shipped to smelters in 1947, in terms of recovered metals

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Blaine	13,482	2,514	427,839	261,485	3,772,897	5,661,650
Bonner	117	9	17,369	1,400	54,641	22,600
Boundary	161	2	3,864	2,400	190,432	15,060
Butte	259	4	1,539		183,750	23,428
Custer	3,095	79	133,205	24,820	2,320,263	900,420
Elmore	757	4,028	40,821			
Gem	6	17	241	164	3,042	3,400
Idaho	1	4				
Lemhi	721	858	33,442	54,400	70,500	
Owyhee	3	6	303			
Shoshone	250,829	2,476	9,202,010	2,622,952	143,428,729	146,878,786
Valley	21,447	31,042	266,506	9,000	118,000	288,600
Total: 1947	290,878	41,039	10,127,129	2,976,621	150,142,254	153,793,944
1946	233,364	18,811	6,357,673	1,981,943	114,965,683	123,395,883
BY CLASSES OF CONCENTRATES						
Dry gold	21,887	35,906	296,222		1,500	
Dry gold-silver	4	20	734			
Copper	620	13	224,784	301,223	2,800	3,400
Lead	96,591	1,948	3,790,671	929,978	122,785,996	11,458,796
Lead-copper	12,732	81	4,872,704	1,137,200	4,643,100	370,670
Zinc	141,465	1,281	560,913	492,333	10,313,576	139,391,155
Zinc-lead	12,624	304	367,036	79,826	12,281,576	2,565,323
Dry iron (from zinc-lead ore)	4,955	1,486	14,065	36,061	113,706	4,600
Total 1947	290,878	41,039	10,127,129	2,976,621	150,142,254	153,793,944

Gross metal content of Idaho crude ore shipped to smelters in 1947, 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	379	415	1,105	1,846	2,937	120
Dry and siliceous gold-silver	129	78	3,073	3,395	7,611	
Dry and siliceous silver	534	14	8,847	1,921	28,209	3,253
Copper	3,303	201	4,452	263,503	500	
Lead	22,446	207	156,752	44,556	5,433,858	91,076
Lead-copper	27	1	6,083	3,535	10,768	830
Zinc	[1] 67,089	9	25,416	4,912	2,495,387	15,990,854
Zinc-lead	1,999	7	6,905	2,933	142,071	249,836
Total: 1947	[1] 95,906	932	212,633	326,601	8,121,341	16,335,969
1946	[2] 108,667	1,122	125,243	104,556	5,227,169	24,867,004

[1] Includes 65,409 tons of old lead-smelter slag smelted and fumed.
[2] Includes 92,072 tons of old lead-smelter slag smelted and fumed.

Mine production of metals from Idaho crude ore shipped to smelters in 1947, in terms of recovered metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Adams	124	8	505	42,000		
Blaine	1,490	74	15,508	5,915	183,103	87,350
Boise	54	30	1,136			
Bonner	31		452		33,859	
Bonneville	4	1	10	300		
Boundary	64	1	1,494	300	66,568	3,940
Butte	348	1	734	100	126,750	26,572
Camas	180	45	231	500	1,500	
Cassia	31	2	136	200	14,500	
Clark	218	2	347	17,300	23,000	
Clearwater	4	3	7			
Custer	22,428	377	147,164	199,880	4,308,737	589,580
Elmore	5	89	306			
Gem	74	100	2,264	536	1,158	
Idaho	24	14	22	800		
Latah	3		885			
Lemhi	1,256	100	7,157	33,900	295,000	13,400
Owyhee	8	23	334			
Shoshone	[1] 69,518	62	32,793	1,048	2,691,271	11,623,214
Washington	42		1,148	600	300	
Total: 1947	[1] 95,906	932	212,633	303,379	7,745,746	12,344,056
1946	[2] 108,667	1,122	125,243	94,057	5,008,317	19,618,117
BY CLASSES OF ORE						
Dry and siliceous gold ore	379	415	1,105	1,761	2,050	
Dry and siliceous gold-silver ore	129	78	3,073	3,307	4,988	
Dry and siliceous silver ore	534	14	8,847	1,664	18,449	
Copper ore	3,303	201	4,452	256,146	300	
Lead ore	22,446	207	156,752	31,085	5,173,253	5,174
Lead-copper ore	27	1	6,083	3,000	10,475	
Zinc ore	[1] 67,089	9	25,416	4,077	2,396,600	12,175,000
Zinc-lead ore	1,999	7	6,905	2,339	139,631	163,882
Total 1947	[1] 95,906	932	212,633	303,379	7,745,746	12,344,056

[1] Includes 65,409 tons of old lead-smelter slag smelted and fumed.
[2] Includes 92,072 tons of old lead-smelter slag smelted and fumed.

REVIEW BY COUNTIES AND DISTRICTS

ADAMS COUNTY

In 1947 lessees operated the Arkansaw-Decorah, Helena, and South Peacock properties north of Cuprum in the Seven Devils district and shipped a total of 124 tons of carbonate copper ore to a smelter in Utah.

BLAINE COUNTY

Lava Creek District.—Lessees worked the Paymaster mine, 32 miles southwest of Arco, most of the year and shipped 818 tons of zinc-lead-iron ore to a custom flotation mill at Midvale, Utah.

Little Wood River (Muldoon) District.—475 tons of ore was produced in the Little Wood River district in 1947. Most of it was zinc-lead ore (370 tons) and lead ore (48 tons) produced from the Eagle Bird claim and shipped to reduction plants in Utah.

Mineral Hill and Camas District.—Frank R. Plughoff continued to work the Red Elephant tailing dump near Hailey and shipped 873 tons of material, containing 5,298 ounces of silver, 1,737 pounds of copper, 24,404 pounds of lead, 74,760 pounds of zinc, and some iron. The rest of the district output comprised 320 tons of lead-silver ore from the Ada, Buena Vista, Croesus, Edres, Ohio, Point Lookout, and Valley View claims, 195 tons of silver ore from the Fourth of July and Minnie Moore waste dumps, 74 tons of gold-silver ore from the October claim, and 18 tons of zinc ore from the Chicago claim.

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1947, 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: Seven Devils	3		124	8		8	505		505	42,000			$9,557
Blaine County:													
Lava Creek	1		818	4		4	989		989	1,100	27,000	62,000	12,656
Little Wood River (Muldoon)	3		475	2		2	3,684		3,684	1,300	65,000	40,000	17,877
Mineral Hill and Camas	12		1,482	29		29	11,432		11,432	4,600	106,500	65,000	35,528
Warm Springs	13		55,217	2,553		2,553	427,242		427,242	260,400	3,757,500	5,582,000	1,747,195
Boise County:													
Banner		1			4	4							140
Boise Basin	2	15	25	30	7,864	7,894	10	1,453	1,463				277,614
Boise River		2			6	6							210
North Fork	1		29				1,126		1,126				1,019
Shaw Mountain	1		1	2		2							70
Summit Flat	2		102	230		230	106		106				8,146
Bonner County:													
Clark Fork	3		247				2,906		2,906		54,000	2,000	10,648
Lakeview	1		1,400	9		9	14,894		14,894	1,400	33,500	20,600	21,405
Pend d'Oreille	1		4				11		11		1,000		154
Bonneville County: Mount Pisgah	1	1	4	1	1	2	10		10	300			142
Boundary County: Port Hill	1		8,139	3		3	5,358		5,358	2,700	257,000	19,000	44,828
Butte County:													
Dome	4		1,363	5		5	2,242		2,242	100	310,100	50,000	52,929
Hamilton	1		5				31		31		400		86
Camas County:													
Beaver Creek	1		173	36		36	221		221	500	1,500		1,781
Skeleton Creek	1		7	9		9	10		10				324
Cassia County: Stokes	2		31	2		2	136		136	200	14,500		2,323
Clark County: Birch Creek	2		218	2		2	347		347	17,300	23,000		7,329
Clearwater County:													
Moose and Independence Creek		1			420	420		63	63				14,757
Pierce	1	6	6	7	80	87	10	22	32				3,074
Custer County:													
Alder Creek	4		9,130	260		260	58,990		58,990	154,800	2,205,500	565,000	480,951
Alta	1		3				73		73		500	400	186
Bayhorse	10		38,219	143		143	204,264		204,264	37,700	4,077,000	763,600	877,265
Boulder	1		1,295	12		12	7,684		7,684	1,600	280,500	138,000	64,800
Copper Basin	1		402	9		9	1,000		1,000	29,800			7,478
Loon Creek		1			3	3							105
Seafoam	4		322	16		16	7,905		7,905	800	65,500	23,000	20,097
Yankee Fork	2	4	505	16	2,687	2,703	453	1,537	1,990				96,406
Elmore County:													
Bear Creek	1		1	2		2	11		11				80
Black Warrior	1		1	3		3	10		10				114
Boise River		1			4	4							140
Middle Boise	2	1	27,544	6,778	1	6,779	42,758		42,758				275,961
Snake River		2			12	12							420
Gem County: West View	6	4	115	117	1	118	2,505		2,505	700	4,200	3,400	7,560

Idaho County:													
Burgdorf-Marshall Lake	1	3	15	3	297	300		53	53				10,548
Camp Howard		2			58	58		10	10				2,039
Dewey-Harpster	1		23	12		12	22		22	800			608
Dixie	1	1	71	145	1	146	32		32				5,139
Elk City		8			1,377	1,377		253	253				48,424
Florence and French Creek	1	4	20	9	20	29	10	10	20				1,033
Orogrande		2			8	8							280
Rabbit Creek		1			1	1							35
Ramey Ridge	1		1	1		1							35
Robbins	1		5	4		4							140
Salmon River		2			5	5							175
Simpson		5			47	47		10	10				1,654
Ten Mile		1			932	932		190	190				32,792
Warren	2	3	13	6	12	18							630
Jerome County: Snake River		3			21	21							735
Latah County: Hoodoo	1	1	3		722	722	885	42	927				26,109
Lemhi County:													
Blue Wing	1		20,195	9		9	33,094		33,094	54,400	69,000		51,625
Eureka	2	1	332	9	1	10	147		147	31,100	300		7,057
Fourth of July Creek	1		28	12		12	400		400				782
Gibbonsville		3			3,441	3,441		232	232				120,645
Junction	2		7				126		126		2,000		402
Kirtley Creek		2			1,519	1,519		178	178				53,326
Mackinaw		4			13	13							455
Mineral Hill	1		3,701	897		897	358		358		1,500		31,935
Nicholia	2		321	2		2	853		853	200	85,500	13,400	14,817
Salmon River		2			2	2							70
Texas	4		519	32		32	5,158		5,158	1,600	189,700		33,441
Unorganized (Reno)	1		51				116		116	600	14,000		2,247
Yellow Jacket	1		7	1		1	348		348	400	3,500		938
Owyhee County: Carson or French	4	3	13	60	9	69	663	10	673				3,024
Shoshone County:													
Beaver	5	1	111,015	120	100	220	110,927	21	110,948	92,000	5,232,300	9,811,000	2,068,010
Coeur d'Alene	1	2	30	19	10	29	10		10				1,024
Eagle	1		1,517	6		6	1,800		1,800	600	156,000	13,000	26,002
Evolution	13		1,043,786	303		303	5,673,484		5,673,484	1,653,300	15,541,700	12,678,000	9,264,344
Hunter	9		384,402	350		350	672,011		672,011	206,000	29,403,300	43,599,600	10,173,307
Lelande	7		198,514	226		226	452,758		452,758	118,600	15,018,700	11,718,400	4,023,181
Placer Center	6		156,258	191		191	243,327		243,327	56,000	9,792,500	8,000,800	2,616,873
Summit	5	1	6,992	215	24	239	1,968		1,968	3,500	429,500	175,000	93,904
Yreka	14		1,054,629	1,244		1,244	2,078,600		2,078,600	494,000	70,546,000	72,506,200	20,960,287
Twin Falls County: Snake River		1			2	2							70
Valley County:													
Deadwood Basin	1	1	3,297	36	1	37	11,463		11,463	9,000	118,000	288,600	65,472
North Fork of Payette River		1			1	1							35
South Fork of Salmon River		2			69	69		21	21				2,434
Yellow Pine	1		584,483	31,006		31,006	255,043		255,043				1,316,024
Washington County: Washington	2		42				1,148		1,148	600	300		1,208
Total Idaho	183	99	3,717,697	45,206	19,776	64,982	10,341,674	4,105	10,345,779	3,280,000	157,888,000	166,138,000	55,164,670

Warm Springs District.—Despite a decrease of 17,667 tons of ore from the Triumph-North Star-Independence groups in 1947 compared with 1946, the production of copper, lead, and zinc was greater, although gold and silver declined. The decrease in ore output resulted from destruction of the Triumph Mining Co.'s 300-ton gravity-flotation mill at Triumph by fire in January. The company reported that 3,790 tons of ore, containing 265 ounces of gold, 21,940 ounces of silver, 19,000 pounds of copper, 109,150 pounds of lead, and 198,200 pounds of zinc, were treated in its own mill, and that 48,379 tons of ore, containing 4,464 ounces of gold, 442,682 ounces of silver, 348,500 pounds of copper, 4,140,547 pounds of lead, and 6,161,211 pounds of zinc were shipped to milling plants in Utah. The property remained the most important producer of gold, silver, copper, lead, and zinc in southern Idaho. The rest of the district output comprised 821 tons of zinc-lead ore and 52 tons of lead ore from the Homestake mine, 1,063 tons of zinc-lead ore and 175 tons of silver ore from the Triumph waste dumps, 93 tons of zinc-lead ore and 46 tons of lead ore from the Baltimore mine, 589 tons of zinc-lead ore from the Boston-Idaho and Lucky Boy properties, 70 tons of gold ore from the Blackhawk and June Day mines, 113 tons of lead-silver ore from the Chloride Point, Duquette, and New Hope claims, and 26 tons of zinc ore from the Red Top claim.

BOISE COUNTY

Boise Basin District (Centerville, Placerville, Idaho City, Pioneerville, Quartzburg).—In 1947 placer properties in the Boise Basin district produced 7,864 fine ounces of gold and 1,453 fine ounces of silver, and lode mines 30 fine ounces of gold and 10 fine ounces of silver. Nearly all the placer gold and silver was recovered by three bucket dredges—Baumhoff-Marshall, Inc., operated all year two bucket dredges on Granite Creek near Centerville, which treated about 1,000,000 cubic yards of gravel, and the Idaho-Canadian Dredging Co. operated from June 7 to December 31 a 6-cubic-foot bucket dredge on Moores Creek near Idaho City, which treated 808,000 cubic yards of gravel. The Idaho-Canadian Dredging Co. abandoned its old 7½-cubic foot bucket dredge and during the spring months of 1947 moved to Idaho City a newer 6-cubic-foot bucket dredge from Bearmouth, Mont., which formerly operated on Bear Gulch. Hydraulicking and sluicing recovered 50 ounces of gold and 13 ounces of silver from the Belle Flower, Hoodoo, Moe, Ophir Creek, Fountain Spring, and Taku properties. The lode gold and silver were recovered principally from old mill cleanings at the Gold Hill & Iowa property.

Summit Flat District.—Gold ore (102 tons) was produced in 1947 from the Jessie and Rock Creek mines and treated in amalgamation mills.

BONNER COUNTY

Clark Fork District.—The most important work in the Clark Fork district in 1947 was development at the Elsie K. mine of the Hope Silver-Lead Mines, Inc., and the rebuilding of the company 150-ton flotation mill. The company mined no ore in 1947, but about 70 tons of lead-silver ore were milled for test purposes. Lessees operated the Whitedelf and Lawrence mines a few months in 1947 and mined a total of 177 tons of lead-silver ore.

Lakeview District.—The Idaho-Lakeview Mines Co. continued to develop its mine and treated (by flotation) about 1,400 tons of silver ore, containing a little copper, lead, and zinc.

BOUNDARY COUNTY

A 500-ton heavy-media separation plant was installed during the summer months at the Idaho-Continental property, 27 miles west of Porthill, by the Continental Mining Co. From August 1 to October 15 the company treated 7,964 tons of old jig tailings and 111 tons of ore, which contained 7,000 ounces of silver, 4,000 pounds of copper, 300,000 pounds of lead, and 50,000 pounds of zinc. The product from the heavy-media plant was treated in a 100-ton flotation mill, which yielded 161 tons of high-grade lead-silver concentrate. In addition, 64 tons of high-grade lead-silver ore were shipped direct to a lead smelter.

BUTTE COUNTY

In 1947 nearly all the output of Butte County was zinc-lead ore and lead ore from four mines near Howe in the Dome district. A lessee operated the Wilbert mine and shipped 1,020 tons of zinc-lead ore to a custom flotation mill at Bauer, Utah; 129 tons of similar ore were shipped from the Sentinel mine; and 214 tons of lead ore were shipped from the Great Western and Pick Up properties.

CLARK COUNTY

All the output in Clark County in 1947 came from two mines in the Birch Creek district—the Scott mine producing 137 tons of lead ore and the Valley View mine 81 tons of copper ore.

CLEARWATER COUNTY

Painter & Vincent operated a dragline on Moose and Independence Creeks from June 1 to December 31; 150,000 cubic yards of gravel were treated, which yielded 420 fine ounces of gold and 63 fine ounces of silver. The remainder of the county output was principally 80 fine ounces of placer gold and 22 fine ounces of placer silver recovered from claims in the Pierce district.

CUSTER COUNTY

Alder Creek District.—In 1947 a total of 9,130 tons of ore was produced from four mines in the Alder Creek district compared with 6,897 tons from three mines in 1946. The principal output was 4,979 tons of lead-silver ore and 1,680 tons of zinc ore from the Homestake mine near Mackay operated by the White Knob Mining Co. The Mackay Exploration Co. worked the Empire mine all year and shipped 2,370 tons of copper ore to a smelter in Utah. The rest of the district output was 101 tons of lead-silver ore from the Champion and Horseshoe properties.

Bayhorse District.—The Clayton mine, owned by the Clayton Silver Mines, continued to be the most important producer in the Bayhorse district. The company reported that 24,366 tons of zinc-lead ore were treated in 1947 in its 120-ton flotation mill, which yielded

1,687 tons of lead concentrate and 800 tons of zinc concentrate. The concentrates contained 49 ounces of gold, 120,011 ounces of silver, 25,907 pounds of copper, 2,070,892 pounds of lead, and 774,827 pounds of zinc. In addition, 135 tons of lead-silver ore were shipped direct to a smelter. According to the annual stockholders' report of the Clayton Silver Mines for 1947, two major development projects were carried on most of the year—the 200 north drift and the Ella north drift. Development comprised 1,995 feet of drifting, 535 feet of crosscutting, and 357 feet of raising. The remainder of the district output was mainly 12,030 tons of lead ore from the Red Bird mine and waste dumps, 1,262 tons of zinc-lead ore from the Pacific claim, 259 tons of lead ore from the South Butte mine, and 82 tons of zinc-lead ore and 38 tons of high-grade lead-copper-silver ore from the Ramshorn mine.

Boulder District.—The Livingston Mines, Inc., operated the Livingston mine most of the year and shipped 1,295 tons of ore, containing 14 ounces of gold, 8,712 ounces of silver, 2,640 pounds of copper, 314,550 pounds of lead, and 174,608 pounds of zinc, to a custom flotation mill at Midvale, Utah.

Copper Basin District.—A lessee worked the Hillside mine in 1947 and shipped 402 tons of copper-silver ore to a smelter in Utah.

Seafoam (Greyhound) District.—Years ago the Seafoam district northwest of Stanley was especially known for producing rich lead-silver ore. In 1947, 322 tons of ore, containing 18 ounces of gold, 8,008 ounces of silver, 1,107 pounds of copper, 69,899 pounds of lead, and 28,519 pounds of zinc, was shipped from four properties, including the Black Jack, Eagle, and Mountain King.

Yankee Fork District.—The principal output of the Yankee Fork district continued to be placer gold and silver recovered by bucket dredging at the Yankee Fork Placer by the Snake River Mining Co.; however, production of gold and silver in 1947 from this property was much less than that in 1946. The company operated its 8-cubic foot dredge from April 15 to October 12 and treated 715,390 cubic yards of gravel, which yielded 2,584 fine ounces of gold and 1,493 fine ounces of silver. Placer gold and silver were produced also from the Banjo Bill, Horse Trail, and Jordan Creek properties. About 500 tons of gold-silver ore from the Jordan claim were treated in a 50-ton flotation mill.

ELMORE COUNTY

In 1947 nearly all the output of Elmore County was gold ore produced from the Boise-Rochester-Monarch group in the Middle Boise (Atlanta) district. The Talache Mines, Inc., operated the group and its 400-ton amalgamation and concentration mill throughout the year; the mill treated 27,539 tons of gold ore, which yielded 6,692 fine ounces of gold and 42,471 fine ounces of silver. In addition, 3 tons of high-grade gold ore were shipped direct to a smelter.

GEM COUNTY

Six mines in the West View (Pearl) district produced 115 tons of ore in 1947; 44 tons of gold ore were produced from the Black Pearl, Lulu, and Old Man claims, 41 tons of zinc-lead ore from the New Deal mine, 20 tons of gold-silver ore from the Shamrock mine, and 10 tons of silver ore from the Valley View claim.

IDAHO COUNTY

Burgdorf-Marshall Lake District.—The Secesh Dredging Co. operated a bucket-line dredge on Secesh Meadows from May 15 to October 1 and treated about 50,000 cubic yards of gravel, which yielded 277 fine ounces of gold and 49 fine ounces of silver. The rest of the district output was largely placer gold recovered by hydraulicking and sluicing at the Golden Rule and Laughing Water properties.

Dixie District.—George Grebe worked the Mammoth mine and treated 70 tons of gold ore in a 15-ton amalgamation mill.

Elk City District.—In 1947 all the output of the Elk City district was placer gold and silver recovered from eight properties. The principal producers were the Tyee Mining Co., H. & H. Mines, and Little Moose Placer Co. The Tyee Mining Co. operated a dragline dredge on American River, which treated 250,000 cubic yards of gravel; the H. & H. Mines operated a bucket-line dredge on Red Horse Creek, which treated 138,673 cubic yards of gravel; and the Little Moose Placer Co. operated a dragline on Little Moose Creek, which treated 9,000 cubic yards of gravel.

Ten Mile District.—During the spring of 1947 the South Fork Placers placed a dragline and floating washing plant on the South Fork of the Clearwater River, 5 miles east of Golden. From June 1 to November 25 the plant treated 100,000 cubic yards of gravel, which yielded 932 fine ounces of gold and 190 fine ounces of silver.

LATAH COUNTY

Northwest Gold Fields operated a bucket-line dredge on the North Fork of the Palouse River in the Hoodoo district from April 12 to July 12, when operations ceased owing to exhaustion of available placer ground. The dredge treated 181,448 cubic yards of gravel, which yielded 722 fine ounces of gold and 42 fine ounces of silver. A little silver ore (3 tons) was hauled from a claim on Mess Paw Creek, also in the Hoodoo district, and treated in a local assay office.

LEMHI COUNTY

Blue Wing District.—The Ima mine on Patterson Creek was operated throughout the year by the Bradley Mining Co., but the 150-ton concentrator was destroyed by fire in December. The company reported that 20,195 tons of ore containing 1.96 ounces of silver to the ton, 0.164 percent copper, 0.279 percent lead, and 0.547 percent tungsten were treated by concentration; 147 tons of tungsten concentrate were recovered by gravity and flotation concentration, followed by magnetic separation; and 692 tons of lead-copper-silver concentrate were recovered by bulk sulfide flotation.

Eureka District.—Copper ore (322 tons) was produced from the old Pope Shenon mine near Salmon and gold ore (10 tons) from the Castle Rock claim.

Gibbonsville District.—All the output of the Gibbonsville district in 1947 was placer gold and silver, recovered chiefly by two dredges. The Idaho-Warren Dredging Co. operated a 4-cubic foot bucket dredge on Hughes Creek from April 20 to December 31 and treated 487,840 cubic yards of gravel; and Smith Bros. & Courtis, Inc., operated a dragline and floating washing plant on the Hagel Ranch ground from April 12 to September 10, and treated about 217,000 cubic yards of gravel.

Kirtley Creek District.—The Washington Iron Works operated a dragline and a dry-land washing plant on the Hagel Ranch ground from March 19 to September 26, when operations were abandoned. The plant treated 234,790 cubic yards of gravel, which yielded 1,518 fine ounces of gold and 178 fine ounces of silver.

Mineral Hill District.—About 3,700 tons of gold ore from the Monolith mine near Shoup were treated by concentration. The mine and 50-ton mill were operated most of the year by Gregor Mines, Inc.

Nicholia District.—Lessees worked the old Nicholia mine a few months in 1947 and shipped 187 tons of lead ore and 130 tons of zinc-lead ore to smelters in Utah.

Texas District.—Four mines in the Texas district produced 519 tons of ore in 1947. Most of it (511 tons) was oxide lead-silver ore from the Latest Out and Alex Stevens properties near Gilmore.

OWYHEE COUNTY

Six tons of rich gold ore were produced in 1947 from the Perseverance claim, small lots of gold-silver ore were produced from the South Central, Oriole, and Tango claims, and a little placer gold and silver was recovered from the Jordan Creek, Lewis, and Long Gulch properties—all in the Carson (Silver City) district.

SHOSHONE COUNTY—COEUR D'ALENE REGION

After dropping to a low point of production in 1946, the Coeur d'Alene region (Shoshone County)—the chief source of silver, copper, lead, and zinc in Idaho—made a marked recovery in production of these metals in 1947, resulting from an improvement in the labor supply and from an increase in the average prices of silver, copper, and lead. The output of gold increased 60, silver 63, copper 62, lead 29, and zinc 18 percent. The value of the metal output of the region was $49,226,932 (89 percent of the State value), the greatest value of any peacetime year and a 46-percent gain over 1946. The region remained the largest silver-producing area in the United States and ranked second in lead and zinc; it produced 89 percent of Idaho's silver, 80 percent of the copper, more than 92 percent of the lead, and 95 percent of the zinc. The chief producers of zinc in the region in 1947, according to rank, were the Star, Page, Sidney, Bunker Hill smelter-slag dump, Morning, Frisco, Tamarack, Monitor, and Bunker Hill & Sullivan properties. The chief producers of lead, according to rank, were the Bunker Hill & Sullivan, Star, Page, Morning, Sherman, and Sidney properties. The chief producers of silver, according to rank, were the Sunshine, Polaris, Bunker Hill & Sullivan, Silver Dollar, and Page properties.

Of the total material (2,957,143 tons) produced in 1947 in the Coeur d'Alene region, 89 percent was zinc-lead ore and old tailings, 5 percent silver-lead ore, 4 percent silver ore, and 2 percent zinc slag. Thirty-three mills, with an aggregate capacity of 13,075 tons of ore a day, operated in the region in 1947.

Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, 1946–47, and total 1884–1947, 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
	Lode	Placer							
1946	56	1	2,559,636	1,758	5,655,672	1,619,000	113,096,000	134,858,000	$33,673,731
1947	61	4	2,957,143	2,808	9,234,906	2,624,000	146,120,000	158,502,000	49,226,932
Total 1884–1947			(1)	395,874	441,522,330	(2) 66,676	(2) 5,605,127	(2) 1,276,117	1,172,152,314

[1] Figure not available.
[2] Short tons.

Beaver District.—The output of the Beaver district in 1947 was 111,015 tons of ore containing 194 ounces of gold, 137,683 ounces of silver, 127,200 pounds of copper, 6,193,296 pounds of lead, and 11,252,976 pounds of zinc. In addition, 100 fine ounces of placer gold and 21 fine ounces of silver were recovered by a dragline and dry-land washing plant, which handled 30,000 cubic yards of gravel at the Potosi property. The Monitor Mining Co.[1] operated the Amazon, Carlisle, and Interstate mines and hauled 63,730 tons of zinc-lead ore to the Carlisle and Hercules flotation mills near Wallace. Lessees worked the Parrott, Silver Tip, and Toughnut mines, owned by the Monitor Mining Co., and hauled 15,100 tons of zinc-lead ore to the Hercules and Dayrock mills. According to the annual stockholders' report of Day Mines, Inc., for 1947, development and exploration at the mines were at a much faster rate than in 1946, owing to a greater supply of underground labor. Known ore reserves increased during the year, although the ore is low-grade. The Sunset Lease continued to work the Sunset mine and hauled 32,185 tons of ore—averaging 2.30 ounces of silver to the ton, 4.28 percent lead, and 5.47 percent zinc—to the Golconda custom flotation mill near Wallace.

Eagle District.—Lessees worked the Crystal Lead group near Murray part of the year and hauled 1,517 tons of lead ore to the Galena (Zanetti Bros.) flotation mill in Lake Gulch.

Evolution District.—The output of the Evolution district in 1947 comprised 908,522 tons of zinc-lead old tailings, 114,878 tons of silver-lead ore, 18,198 tons of silver-copper-antimony ore, and 2,188 tons of lead old tailings. All the silver-lead ore came from the Chester vein, Silver Syndicate fault zone, Yankee Girl vein, and Sunshine vein, operated by the Sunshine Mining Co.; all the silver-copper-antimony ore from the Mineral Point mine, operated by the Coeur D'Alene Mines Corp.; and most (768,325 tons) of the old tailings from the Osburn dump, operated by the Hecla Mining Co. and Zanetti Bros. The Chester vein and Silver Syndicate fault zone (known as Rambo, Omega, and Rotbart areas) include property owned by the Sunshine Mining Co., Polaris Mining Co., Silver Dollar Mining Co., and Silver Syndicate, Inc.; and the Yankee Girl vein includes property owned by

[1] On October 1, 1947, Day Mines, Inc. came into corporate existence, being a statutory consolidation of 12 mining companies all owning mining properties in the Coeur d'Alene Region. The following companies produced ore in 1947: Dayrock Mining Co., Hercules Mining Co., Monitor Mining Co., Sherman Lead Co., and Tamarack & Custer Consolidated Mining Co.

the Sunshine Mining Co. and the Metropolitan Mines Corp.; but all exploration, development, mining, and milling of ore are done by the Sunshine Mining Co. The Sunshine Mining Co. reported that the total output of ore in 1947 was 114,878 tons (64,120 tons for Sunshine account and 50,758 tons for account of Polaris, Silver Dollar, Silver Syndicate, and Metropolitan) compared with 51,044 tons in 1946; the ore averaged 44.60 ounces of silver to the ton, 2.60 percent lead, and a little copper and zinc. The tailings averaged 0.76 ounce of silver to the ton and 0.06 percent lead; lead recovery was 98.1 percent and silver 98.5 percent. Lead-silver concentrates (13,376 tons) contained 5,034,160 ounces of silver, 1,249,555 pounds of copper, 5,881,796 pounds of lead, and 581,631 pounds of zinc, of which the net for Sunshine account was 2,446,263 ounces of silver, 644,869 pounds of copper, and 2,453,795 pounds of lead. The average operating costs for the year per ton were $9.52 for mining, $0.95 for ore treatment, $0.19 for depreciation, and $4.08 for general expense and overhead—a total of $14.74. According to the annual report of the Sunshine Mining Co., improved earnings in 1947 were due largely to an increase in the number of underground workers resulting from an easing of the labor shortage in the latter part of the year; however, labor turn-over continued at a high rate, with 1,308 hired and 1,232 separating. The underground force totaled about 250 by the end of the year. Development in 1947 comprised 1,487 feet of drifting, 1,560 feet of raising, and 889 feet of crosscutting. Total developed ore reserves reached an all-time high of 1,270,000 estimated tons above the 3,700-foot level. This estimate includes the total estimated reserves in areas in which other companies share in the production.

The Hecla Mining Co. operated its Osburn tailing plant (2,500-ton sink-and-float plant and 500-ton flotation mill) continuously throughout the year, but only at two-thirds its former output. The company reported that 604,534 tons of old tailings, containing an average of 0.74 ounce of silver to the ton, 0.96 percent lead, 0.60 percent zinc, and a little copper, were treated during the year in the sink-and-float plant; the resulting zinc-lead middling (313,929 tons) was treated in the Osburn and Hecla flotation mills, where it was separated into 4,036 tons of lead concentrate and 5,933 tons of zinc concentrate. Zanetti Bros. worked another part of the Osburn tailing dump during the year and hauled 163,791 tons of zinc-lead old tailings to the Polaris, Hecla, Galena (Zanetti), and Amy flotation mills. Zanetti Bros. also worked the De Block tailing dump at the mouth of Lake Gulch and hauled about 90,000 tons of zinc-lead old tailings to the Galena mill. Garrett, Doyle, and Randall leased the Silver Crescent flotation mill on Moon Gulch near Silverton and treated about 42,200 tons of zinc-lead old tailings deposited on the Pastore farm, 2½ miles west of Wallace.

The Coeur D'Alene Mines Corp. worked its Mineral Point mine near Osburn throughout the year, but the company 600-ton flotation mill ran only intermittently. The mill treated 18,198 tons of silver-copper-antimony ore, which yielded 500 tons of concentrate containing 13 ounces of gold, 190,516 ounces of silver, 300,134 pounds of copper, and 175,484 pounds of antimony. According to the corporation annual report, the ore mined in 1947 was too low-grade for profitable operations, but it carried sufficient values to pay all ore-breaking, maintenance, and overhead costs, in addition to a portion of the exploration and development expenses. Ore of the grade mined during the year could be more profitable if available in large quantities; however, the shoots from which the ore was mined are small and, in places, are not continuous, which prevents any large-scale operations. Development during the year failed to disclose adequate quantities of commercial ore. The remainder of the district output was principally 8,000 tons of zinc-lead old tailings from a dump near Osburn and 1,295 tons of silver-lead old tailings from the Western Union dump.

Hunter District (Mullan).—The output of the Hunter district in 1947 was 337,649 tons of zinc-lead ore and old tailings and 46,753 tons of lead ore. The Star mine of the Sullivan Mining Co. was the principal producer, and owing to a larger supply of labor during the last half of the year the mine produced nearly 50 percent more ore than in 1946. The company reported that 193,913 tons of zinc-lead ore were treated in its 1,000-ton flotation mill in 1947, yielding 10,596 tons of lead concentrate and 32,319 tons of zinc concentrate, which contained 222 ounces of gold, 247,136 ounces of silver, 120,580 pounds of copper, 17,473,433 pounds of lead, and 34,340,357 pounds of zinc. The mine continued as the largest producer of zinc in Idaho and ranked second in lead.

The Morning mine of the Federal Mining & Smelting Co. was operated continuously, but operations were handicapped by a shortage of labor throughout the year. The company reported that 70,946 tons of mine ore, containing an average of 1.9 ounces of silver to the ton, 6.0 percent lead, and 6.4 percent zinc, and 37,783 tons of waste-dump ore and old tailings, containing 2.5 ounces of silver to the ton, 3.2 percent lead, and 2.7 percent zinc, were treated in its 1,250-ton flotation mill at Mullan. According to the annual stockholders' report of the company for 1947, production and development were limited owing to a shortage of labor; the crew is still far below normal. Ore reserves at the end of the year, including the Morning and You-Like veins of the mine, are estimated at 478,000 tons, a decrease of 67,000 tons from the estimated tonnage at the end of 1946.

The Hunter Lease continued to work the Gold Hunter mine and 500-ton flotation mill; in 1947 the mill treated 38,985 tons of mine ore and 7,768 tons of waste-dump ore, which contained 107,060 ounces of silver, 10,000 pounds of copper, 2,075,000 pounds of lead, and 411,400 pounds of zinc. The remainder of the district output comprised 22,618 tons of old zinc-lead tailings from the Granada, Hultner, Mary D., and Moe properties, 11,257 tons of zinc-lead-silver ore from the Lucky Friday mine, and 1,132 tons of zinc-lead ore from the Ruth waste dump.

Lelande District (Burke, Mace, Frisco).—In 1947 seven properties in the Lelande district produced 104,302 tons of zinc-lead-silver ore, 82,470 tons of zinc-lead old tailings, and 11,742 tons of lead-silver ore. All of the old tailings, containing an average of about 1 ounce of silver to the ton, 1.82 percent lead, and 2.30 percent zinc, came from the Elgin property above Wallace operated by the Small Leasing Co. The lower levels of the Frisco mine at Gem were worked continuously by the Federal Mining & Smelting Co., and the upper levels by the Hull Lease. From the lower levels, 40,489 tons of ore (containing an average of 1.59 ounces of silver to the ton, 4.71 percent lead, and 6.25 percent zinc) were hauled to the Morning mill at Mullan for treatment. From the upper levels, the Hull Lease treated in its own 90-ton flotation mill 26,975 tons of ore, containing an average of 0.7 ounce of silver to the ton, 1.3 percent lead, and 9.1 percent zinc. According to the annual stockholders' report of the Federal Mining & Smelting Co., the Frisco vein gives no present indication of being a major producer, but at appropriate metal prices it may continue to earn substantially for a considerable period of time as there is a strong possibility of a tonnage larger than now estimated. Ore reserves at the end of 1947 were estimated at 183,000 tons of developed and probable ore.

The Sherman Lead Co. treated 33,678 tons of ore (containing 306,118 ounces of silver, 8,941,890 pounds of lead, and 1,815,000 pounds of zinc) in its 300-ton flotation mill in 1947, compared with 18,875 tons in 1946; the mill yielded 6,532 tons of zinc-lead-silver concentrate. Output of ore increased during the year as more underground workers became available. The rest of the district output comprised 11,163 tons of lead-silver ore from the Hercules (Fairview vein) mine, 3,160 tons of zinc-lead ore from the Mace property and Gem waste dump, and 579 tons of lead ore from the Hecla mine.

Placer Center District.—The output of the Placer Center district in 1947 was 109,895 tons of zinc-lead-silver ore and old tailings and 46,363 tons of lead-silver ore. The most important producer was the Tamarack mine operated by the Tamarack & Custer Consolidated Mining Co.; 65,518 tons of ore (containing 1.1 ounces of silver to the ton, 3.3 percent lead, and 4.7 percent zinc), and 20,059 tons of old tailings (containing 2.5 ounces of silver to the ton, 3.2 percent lead, and 3.7 percent zinc), were treated in the company 400-ton flotation mill. The mill yielded 3,485 tons of lead concentrate and 6,609 tons of zinc concentrate. In addition, lessees hauled 12,103 tons of zinc-lead waste-dump ore and 3,203 tons of mine ore to custom flotation mills near Wallace. According to the annual report of Day Mines, Inc., exploration and development in 1947 were at a faster rate than in 1946, owing to a larger supply of underground workers. However, the mine still needs more experienced miners.

Output of ore from the Dayrock mine increased to 46,363 tons in 1947. The ore, which contained 145,677 ounces of silver, 4,933,284 pounds of lead, and 686,028 pounds of zinc, was treated in the company 200-ton flotation mill. According to the annual report of Day Mines, Inc., the estimated ore reserves at the end of 1947 in the four principal mines of the company aggregated 1,033,918 tons compared with 906,264 tons at the end of 1946. This increase resulted chiefly from favorable development of ore in the Dayrock mine. The remainder of the district output was 7,596 tons of zinc-lead old tailings from the Haugus, Rex, and Woodland properties, and 1,416 tons of zinc-lead ore from the Success mine.

Summit District (Murray).—Leasing operations at the Orofino mine, 7 miles northeast of Murray, produced 3,927 tons of zinc-lead ore and 27 tons of high-grade lead ore. Zinc-lead ore (495 tons) was produced also from the Terrible Edith property. About 2,500 tons of old tailings from the Golden Chest dump were treated by cyanidation, which yielded 136 fine ounces of gold and 82 fine ounces of silver, and 19 tons of high-grade gold ore were shipped from the mine. In addition, 24 fine ounces of gold were recovered from sluicing 400 cubic yards of gravel. The rest of the district output was 24 tons of lead ore produced from the Giant Ledge mine.

Yreka District (Kellogg).—The value of the metal output of the Yreka district was $20,960,287 in 1947, more than double that of any other district in Idaho and a gain of $6,291,963 over 1946. The district remained by far the chief lead- and zinc-producing area in Idaho and ranked second in silver. In 1947 material produced from the district comprised 907,536 tons of zinc-lead-silver ore and old tailings, 65,409 tons of old zinc slag, 61,842 tons of old zinc-lead-iron-silver tailings, and 19,842 tons of lead ore and old tailings—a total of 1,054,629 tons compared with 906,317 tons in 1946. Of the total ore, old tailings, and old slag, 374,363 tons (containing 1,355 ounces of gold, 851,885 ounces of silver, 332,200 pounds of copper, 33,207,237 pounds of lead, and 58,866,170 pounds of zinc) were zinc-lead-silver ore from nine mines in the Pine Creek area of the district—the greatest output ever recorded in the area. However, the Bunker Hill & Sullivan mine at Kellogg, with an output of 246,601 tons of zinc-lead-silver ore and 17,000 tons of lead ore in 1947, continued to be the most important producer of ore in the district. The company main 1,700-ton flotation mill, equipped with a sink-and-float unit, treated 246,601 tons of zinc-lead-silver ore from the Bunker Hill & Sullivan mine and 284,292 tons of old zinc-lead tailings from the Bunker Hill & Sullivan mill tailing dump. The ore contained an average of 4.68 ounces of silver to the ton, 6.63 percent lead, and 1.71 percent zinc, and the old tailings 0.70 ounce of silver to the ton, 1.58 percent lead, and 0.72 percent zinc. John George continued leasing operations in the upper levels of the Bunker Hill & Sullivan mine and treated about 17,000 tons of lead ore in his mill. The Bunker Hill & Sullivan Mining & Concentrating Co. also treated 61,842 tons of old jig tailings (containing silver, lead, zinc, and iron) in its 300-ton gravity-flotation plant, which yielded 2,315 tons of zinc-lead-iron concentrate and shipped 65,409 tons of old Bunker Hill smelter slag (containing 0.37 ounce of silver to the ton, 1.89 percent lead, and 11.63 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 annual report to stockholders, there were produced and recovered from Bunker Hill & Sullivan mine ore (including lessee ore) 1,118,304 ounces of silver, 31,970,000 pounds of lead, and 7,648,000 pounds of zinc. An improvement in the labor supply during the year, especially in underground workers, resulted in more metals being produced in 1947 than in any of the three preceding years. No new extensive mine development was done in 1947 owing to a continued shortage of underground labor. Ore reserves fully developed and ready for mining January 1, 1948, totaled 2,870,945 tons of zinc-lead-silver ore. The increase of 284,484 tons over 1946 resulted from the opening and enlarging of stoped areas already known. With the exception of September, the zinc slag-fuming plant of the Bunker Hill & Sullivan Mining & Concentrating Co. at Bradley ran continuously. In 1947 the plant received 135,406 tons of current hot slag from the lead furnaces of the Bunker Hill smelter at Bradley; the resulting lead fume (3,157 tons) was sent to the Bunker Hill lead smelter, and the zinc fume (21,429 tons) was shipped to a smelter at Coffeyville, Kans. All of the lead and zinc produced at the plant in 1947 was credited to the mines and an old slag dump furnishing the slag-making material.

Output of zinc-lead-silver ore from the Page mine of the Federal Mining & Smelting Co. increased from 102,875 tons in 1946 to 129,276 tons in 1947. The ore, treated in the Page 500-ton flotation mill, contained an average of 3.57 ounces of silver to the ton, 6.23 percent lead, and 6.92 percent zinc. The mine ranked second in zinc production in Idaho in 1947, third in lead, and fifth in silver. According to the company annual report to stockholders, the Page mine had a full crew at the end of the year and was producing at capacity. Development consisted of sinking the main shaft 267 feet. Ore reserves at the end of the year were estimated at 486,000 tons, a decrease of 132,000 tons from the estimated tonnage at the end of 1946.

Output of zinc-lead-silver ore from the Sidney mine of the Sidney Mining Co. on Denver Creek increased from 24,562 tons in 1946 to 70,865 tons in 1947. The ore was treated in the Sidney 250-ton flotation mill, which yielded 4,758 tons of lead concentrate and 12,704 tons of zinc concentrate containing 206 ounces of gold, 181,153 ounces of silver, 56,650 pounds of copper, 7,302,094 pounds of lead, and 14,509,194 pounds of zinc. From the Little Pittsburg mine, also on Denver Creek, the Denver Development Co. produced 43,626 tons of ore in 1947 (39,844 tons in 1946), containing an average of about 1 ounce of silver to the ton, 2.73 percent lead, and 7.30 percent zinc; the ore was treated in the company 150-ton flotation mill. The 200-ton flotation mill of the Highland-Surprise Consolidated Mining Co. ran continuously in 1947 and treated 40,888 tons of zinc-lead ore from the company mine on Stewart Creek. The mill yielded 1,441 tons of zinc-lead concentrate and 4,925 tons of zinc concentrate. Output of ore from the Spokane-Idaho mine on Pine Creek increased to 38,468 tons in 1947. The ore, treated in the company 175-ton flotation mill, contained 63,310 ounces of silver, 2,044,112 pounds of lead, and 5,651,870 pounds of zinc. Mining and milling of zinc-lead ore from the Liberal King mine also on Pine Creek were continuous throughout the year by the Sunset Minerals, Inc.; 28,630 tons of ore (containing an average of 0.75 ounce of silver to the ton, 2.67 percent lead, and 5.62 percent zinc) were treated in the company 100-ton flotation mill. The rest of the district output was principally 22,610 tons of zinc-lead ore produced from the Douglas, Nabob, and Senator Stewart properties on Pine Creek and 2,842 tons of silver-lead-iron fluxing ore shipped direct to a smelter from the Sierra-Nevada waste dump.

VALLEY COUNTY

Deadwood Basin District.—Output of zinc-lead-silver ore from the Hall-Interstate mine, 54 miles southeast of Cascade, dropped from 16,350 tons in 1946 to 3,297 tons in 1947. Exploration and development at the mine by the Callahan Zinc-Lead Co. were so disappointing that the company surrendered its lease and all work was terminated in October.

Yellow Pine District.—Mining and milling of gold-silver-iron-antimony ore from the open pit at the Yellow Pine mine by the Bradley Mining Co. were continuous throughout the year. The company increased the capacity of its flotation mill from 1,800 to 2,000 tons of ore a day, and in 1947 the mill treated 584,483 tons of ore containing 0.076 ounce of gold and 0.555 ounce of silver to the ton, 1.146 percent antimony, and some iron. The mine was by far the largest producer of gold and antimony in the State. In May 1948, the company announced it had made plans for the construction of a smelter at Stibnite, Idaho, for reduction of the antimony and gold concentrates produced at the mill.

Missouri, Oklahoma, Kansas, and Arkansas

Silver, Copper, Lead, and Zinc[1]

(MINE REPORT)

By A. J. MARTIN

GENERAL SUMMARY

THE mine production of recoverable lead in Missouri, Oklahoma, Kansas, and Arkansas, as a whole decreased 3 percent in 1947 from 1946 and that of zinc decreased 21 percent. The output of silver—a byproduct of lead mining in Southeastern Missouri—increased 35 percent. The copper production, which also came from Southeastern Missouri and was largely incidental to the mining of lead, decreased 5 percent. The principal factors affecting production of lead and zinc in 1947 were the stimulus to lead mining and exploration afforded by a higher lead price than in any previous year on record and the contraction in zinc mining that followed expiration of the Premium Price Plan. Zinc production in July, the first month after Federal premiums were discontinued, decreased to only 32 percent of the monthly average from January through June. Production increased gradually in the succeeding months and in October, November, and December averaged 53 percent of the January-to-June monthly average. The quantity of lead produced by zinc-lead mines increased slightly in 1947. The principal straight-lead mines operated steadily throughout the year, but the output of concentrates was a little lower than in 1946, as the average grade of ore declined and much development work was necessary to replenish ore reserves drawn upon during the war.

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, 1943–47

Year	Gold[1] (per fine ounce)	Silver[2] (per fine ounce)	Copper[3] (per pound)	Lead[3] (per pound)	Zinc[3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

[1] This chapter replaces part of the chapter in preceding volumes of the Minerals Yearbook-Mineral Resources series headed "Silver, Copper, Lead, and Zinc in the Central States." Another chapter of this volume entitled "States East of the Mississippi River—Gold, Silver, Copper, Lead, and Zinc" contains the mine reports for Illinois, Kentucky, Michigan, and Wisconsin, formerly included with those of Arkansas Kansas, Missouri, and Oklahoma in the Central States chapter.

Mine production of silver, copper, lead, and zinc in Arkansas, Kansas, Missouri, and Oklahoma in 1943–46 and, by States, in 1947, in terms of recovered metals

	Mines producing	Material sold or treated		Silver	
		Crude ore (short tons)	Old tailings (short tons)	Fine ounces	Value
1943	305	16,178,069	11,402,382	111,285	$79,136
1944	289	15,730,407	12,293,010	92,243	65,595
1945	247	14,163,065	11,271,347	94,822	67,429
1946	269	13,831,590	10,178,620	69,401	56,076
1947					
Arkansas	5	405			
Kansas	79	2,253,309	1,395,338		
Missouri	63	6,765,213	541,594	93,600	84,708
Oklahoma	107	2,818,476	4,104,851		
Total 1947	254	11,837,403	6,041,783	93,600	84,708

	Copper		Lead		Zinc		Total value
	Pounds	Value	Short tons	Value	Short tons	Value	
1943	2,680,000	$348,400	213,857	$32,078,550	201,538	$43,532,208	$76,038,294
1944	6,604,000	891,540	198,021	31,683,360	191,797	43,729,716	76,370,211
1945	6,798,000	917,730	196,610	33,816,920	140,172	32,239,560	67,041,639
1946	3,714,000	601,668	159,256	34,717,808	139,574	34,056,056	69,431,608
1947							
Arkansas			18	5,184	18	4,356	9,540
Kansas			7,285	2,098,080	41,497	10,042,274	12,140,354
Missouri	3,520,000	739,200	132,246	38,086,848	17,074	4,131,908	43,042,664
Oklahoma			14,289	4,115,232	51,062	12,357,004	16,472,236
Total 1947	3,520,000	739,200	153,838	44,305,344	109,651	26,535,542	71,664,794

Mine production of silver, copper, lead, and zinc in Arkansas, Kansas, Missouri, and Oklahoma in 1947, by months, in terms of recovered metals

Month	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	7,732	154	14,135	11,986
February	10,130	145	13,192	11,176
March	8,270	118	13,935	12,406
April	7,800	139	13,480	12,493
May	7,030	134	13,071	12,993
June	6,764	141	12,870	13,605
July	7,300	121	11,927	3,981
August	8,450	149	11,848	5,517
September	8,090	154	11,810	5,798
October	7,630	164	13,287	6,359
November	6,560	159	11,573	6,318
December	7,844	182	12,710	7,019
Total 1947	93,600	1,760	153,838	109,651

Silver.—In 1947 silver continued to be recovered as a byproduct by smelters treating Southeastern Missouri lead concentrates. These concentrates usually contain 1 to 2 ounces of silver to the ton. A large part of the lead made from the concentrates is not desilverized and this silver is not recorded as recoverable production. A little silver was recovered from copper concentrates made in treating lead-copper ore from Southeastern Missouri. The lead concentrates from other districts in Missouri, Oklahoma, Kansas, and Arkansas contain very little silver; when assays for silver are made, they generally range from a trace to 0.15 ounce to the ton. Silver in such small quantity is not considered to be recoverable.

Copper.—The output of recoverable copper in Southeastern Missouri totaled 1,760 tons in 1947 compared with 1,857 tons in 1946. Part of the output in both years was contained in byproduct matte shipped from smelters treating lead concentrates, and part in copper concentrates shipped from the Madison mill, which treated lead-copper ore. Some of the ore from Southwestern Missouri, Oklahoma, Kansas, and Arkansas contains traces of copper but the quantity of copper recovered is negligible.

Lead.—The Southeastern Missouri disseminated-lead district, most productive lead district in the United States, produced 129,516 tons of recoverable lead in 1947 compared with 135,796 tons in 1946. The bulk of the output came from the mines of the St. Joseph Lead Co. The Tri-State zinc-lead district (Oklahoma, Kansas, and Southwestern Missouri) produced 24,239 tons of lead in 1947 compared with 23,363 tons in 1946. The principal producer in this district was the Eagle-Picher Mining & Smelting Co. Mines in Central Missouri and Arkansas produced small tonnages of lead.

Zinc.—In 1947 the Tri-State district produced 109,338 tons of recoverable zinc, the Southeastern Missouri region 295 tons, and Arkansas 18 tons compared with 139,038, 451, and 85 tons, respectively, in 1946. Output in the Tri-State district dropped precipitously after the Premium Price Plan expired June 30, 1947; the production from July through December represented only 32 percent of the total for the year. A general review of mining and milling in this district is in the Southwestern Missouri section of this chapter.

MINING AND METALLURGIC INDUSTRY

The Premium Price Plan, which was in operation since February 1, 1942, and which fixed the price basis upon which most of the lead and zinc mines operated during the war, was terminated June 30, 1947. Under the plan, mine operators whose mines could not be worked at a reasonable profit at the Office of Price Administration ceiling or market prices of their products received supplemental payments from the Government if they submitted certain data on production costs and other items to the Quota Committee at Washington, D. C. The committee determined the amount to be paid to each individual operator, using a sliding scale designed to give an adequate operating margin per ton of ore or pound of metal produced provided such margin did not raise the total price above the specified maximum price. Advances in the price of lead early in 1947 brought the market price close to the level of the maximum price paid under the Premium Price Plan, and expiration of the plan had little effect on operations of the straight-lead mines. The effect on the zinc and zinc-lead mines, however, was severe. The total output of crude ore from these mines in Oklahoma, Kansas, Missouri, and Arkansas decreased from 8,328,236 tons in 1946 to 6,242,677 tons in 1947, and the tonnage of old zinc tailings remilled from 10,178,620 to 5,740,459 tons.

A provision for special premiums to encourage exploration was made in Office of Economic Stabilization Directive 137, dated September 13, 1946. The total amount of these premiums, both limited and project types, received by mine operators in Oklahoma, Kansas, and Missouri (none in Arkansas) was $435,998, as reported to May 17, 1948. This premium plan expired June 30, 1947, but approved projects were given until the end of the year to expend their allotments.

The Bureau of Mines, in cooperation with the Geological Survey, continued to investigate sources of strategic minerals. The work on copper, lead, and zinc included exploratory drilling, geophysical surveys, field examinations, and metallurgical tests.

About 57 mills were operated all or part of 1947 on lead and zinc ores and old tailings from Missouri, Oklahoma, Kansas, and Arkansas. The daily capacity of the mills ranged from 40 tons to 15,000 tons and averaged 1,552 tons. Most of the mills used gravity concentration and flotation. Flotation concentrates comprised 43 percent of the total lead concentrates and 64 percent of the zinc concentrates produced. Active smelters in the four States comprised two lead smelters, one each at Galena, Kans., and Herculaneum, Mo.; four zinc smelters, one each at Bartlesville, Blackwell, and Henryetta, Okla., and Fort Smith, Ark.; and an oxide plant at Coffeyville, Kans. Three waelz plants operated in conjunction with the zinc smelters at Bartlesville (waelz plant at Cherryvale, Kans.), Henryetta, and Fort Smith treated a total of 98,280 tons of old residues, current residues, oxidized ore, and clean-up material yielding 16,759 tons of oxide averaging 65.09 percent zinc and about 2 percent lead. The oxide was smelted along with concentrates to produce metal.

ORE CLASSIFICATION

The following table classifies the combined ore and old tailings produced in Arkansas, Kansas, Missouri, and Oklahoma in a manner comparable to the classes shown in the tables in ore classification in the chapters devoted to mining in the Western States. The basis for classification is given in the Gold and Silver chapter of this volume. Additional details of the tenor of ore and old tailings milled and the concentrates produced in Kansas, Missouri, and Oklahoma are given in tables in the Review by States section that follows. Such tables for Arkansas are omitted because only small-scale intermittent mining of lead and zinc was done there from 1918 through 1947.

Ore and old tailings sold or treated in Arkansas, Kansas, Missouri, and Oklahoma in 1947, with content in terms of recoverable metals

Source	Mines producing	Ore, etc. (short tons)	Silver (fine ounces)	Copper (pounds)	Lead (short tons)	Zinc (short tons)
Lead ore [1]	30	5,896,050	93,600	3,520,000	129,866	148
Zinc ore [2]	76	6,968,795			1,023	35,111
Zinc-lead ore	148	5,014,341			22,949	74,392
Total: 1947	254	17,879,186	93,600	3,520,000	153,838	109,651
1946	269	24,010,210	69,401	3,714,000	159,256	139,574

[1] Includes lead-copper ore from 1 mine; also includes 301,324 tons of old tailings remilled, concentrates from which were mixed with those from crude ore.
[2] Includes 5,740,459 tons of old tailings yielding 11,759 tons of recoverable zinc and 73 tons of lead.

REVIEW BY STATES

ARKANSAS

Lead and zinc mining in Arkansas in 1947 was confined to scattered small-scale operations. Production (in terms of recoverable metals) was 18 tons each of zinc and lead compared with 85 tons of zinc and 2 tons of lead in 1946. Ore shipments—all small tonnages—comprised lead and zinc ores shipped from Harrison, Boone County, by J. C. Dirst; zinc ore shipped from Yellville, Marion County, by the Mattie Mae Mining Co. and N. W. Palmer; lead and zinc-lead ores shipped from the Brewer mine near Ponca, Newton County, by Hedges & Heur and C. W. Allen & Co.; and zinc ore that had lain in bins at the Kellog mine at Levy, Pulaski County, since 1922, shipped by C. C. Spencer. In December the Lucky Dog Mining Co. completed a 100-ton mill at the Lucky Dog mine in Searcy County.

KANSAS

Mine production of zinc in Kansas decreased 13 percent and lead increased 13 percent in 1947 from 1946. The rate of decrease in zinc output in Kansas after the Premium Price Plan expired June 30 was less than in the parts of the Tri-State district in Missouri and Oklahoma. The mining industry of the district as a whole is reviewed in the Southwestern Missouri section of this report.

Mine production of lead and zinc in Kansas, 1943–47

Year	Mines producing	Lead concentrates		Zinc concentrates		Metal content [1]			
						Lead		Zinc	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1943	82	12,243	$1,473,891	105,656	$10,792,583	9,213	$1,381,950	56,944	$12,299,904
1944	85	12,176	1,418,781	117,827	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
1946	82	8,499	1,388,210	87,963	9,902,906	6,445	1,405,010	47,703	11,639,532
1947	79	9,569	1,811,269	76,699	7,641,709	7,285	2,098,080	41,497	10,042,274
1876–1947		747,820	55,601,592	4,994,112	220,382,098	570,852	66,734,869	2,588,961	343,455,182

[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.

The Baxter Springs-Blue Mound-Treece area produced 90 percent of the total Kansas output of zinc concentrates and 92 percent of the lead concentrates in 1947 compared with 84 percent and 95 percent, respectively, in 1946. About 43 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 to the principal ore-hoisting shafts. Producing Eagle-Picher mines in this area were the Big John, Foley-Mullen, Foley No. 3, Leopard No. 2, Leopard-Youse Slaughter, Puterbaugh, Webber mines, Westside-Foley mines, and Wilbur. The company operated as agent for the Office of Metals Reserve until June 30, the Paxson, Stoskopf,

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Kansas, 1946–47

	1946		1947	
	Crude ore	Old tailings	Crude ore	Old tailings
Total ore and old tailings milled — short tons	2,980,313	1,314,012	2,253,309	1,395,338
Total concentrates produced:				
Galena — do	8,499		9,522	47
Sphalerite — do	84,010	3,953	69,720	6,979
Ratio of concentrates to ore, etc.:				
Lead — percent	.29		.42	.003
Zinc — do	2.82	.30	3.09	.50
Metal content of ore, etc.:[1]				
Lead — do	.22		.33	.002
Zinc — do	1.70	.18	1.86	.29
Average lead content of galena concentrates — do	77.31		75.76	58.50
Average zinc content of sphalerite concentrates — do	60.29	59.55	60.25	58.70
Average value per ton:				
Galena concentrates	$163.34		189.51	144.68
Sphalerite concentrates	112.40	$116.36	102.03	75.73

[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.

and Swalley "D" mines and the Paxson mill; all were idle the rest of the year.

The mines of the St. Louis Smelting & Refining Co. near Baxter Springs together produced considerably more zinc in 1947 than in 1946. The company Walter Hartley mine, operated throughout the year, was the largest individual producer of zinc concentrates in Kansas and the Tri-State district. Other producing company mines were the Ballard, Clark, Keith (North 60), Moore, Shanks, and Slaughter, operated mostly during the first part of the year. The ore was treated in the No. 8 (Ballard) central mill, which also handled custom ore from the Keith (South 20 or Robob) in Kansas and the Imbeau (C. & M., formerly St. Louis No. 4) in Oklahoma.

The Beck No. 3 mill operated until June 30 on ore from the Smith and Swalley (Beck mines) and the MacArthur mine; all three mines were idle the rest of the year. The Dines Mining Co. operated its mill and the Hartley No. 1 and Stoskopf mines throughout 1947. Besides company ore, the mill treated custom ore from the C. K. & E. (Stebbins, Karcher), Robinson (Douthit, Jarrett), and Harris (E. W. No. 24) mines. The Wade-Rea mill operated on company ore (mostly from the Hunter mine) and small lots of custom ore. The Lula Bell (Liza Jane) mine was operated from January through June and intermittently until December 24; most of the ore was treated in the Youngman mill. Other producers included the Bilharz (Muncie), Bilwil (Ebenstein, closed May 31), Brugger, Grace Jarrett (Wright), and Mark Twain (Blue Mound). The newly developed Vanatta mine of Fred Childress & Sons near Melrose was in production from April to July 14 and during November and December.

The Captain tailing mill operated from January through June and from December 1 to 30. The Sooner (Tri-State Zinc, Inc.) mill in Oklahoma treated old tailings from Kansas. The Barr Cleanup mill operated most of the year.

At Galena the Eagle-Picher Mining & Smelting Co. operated the Murphy mine until June 30. The mine was idle until September, when the Short Creek Royalty Co. reopened it and operated the rest of the year. Other producers included the Cooper Hollow (L. & S.), Mess Cave, Murray-Davis (Southside), North End, and Oliphant & Abbey. 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.

In the Waco district (Kansas part) the St. Louis Smelting & Refining Co. No. 9 mill operated until June 30 on company ore from the Gascho mine in Missouri and custom ore from the Grasselli (leased by Glen Richey) and the Oscar Bennett, worked by the Stotts City Mining Co. Ore produced by the Grasselli mine from July through December was concentrated in the Playter custom mill in Missouri. F. W. Evans Mines continued to operate its mill and St. Louis and O'Neill mines; operations were curtailed after the Premium Price Plan expired.

At old lead diggings near Pleasanton, Linn County, dump material treated in a log washer yielded a small lot of lead concentrates.

MISSOURI

For the past 40 years Missouri has been the chief lead-producing State and until 1918 had ranked first in zinc production for many years. In 1947 the State output of lead decreased 5 percent and zinc 23 percent from 1946. The principal lead mines are in the Southeastern Missouri region. Silver and copper are recovered as byproducts in smelting lead concentrates produced in this region, and copper and a little silver have been recovered in some years (including 1944–47) from lead-copper-(cobalt-nickel-iron) ore mined in Madison County. Silver recovered in 1947 totaled 93,600 ounces and copper 1,760 tons compared with 69,401 ounces and 1,857 tons, respectively, in 1946. 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 zinc output comes largely from zinc-lead mines in Southwestern Missouri. The Central district of Missouri had a small output of lead in 1946 and 1947 and of both zinc and lead in 1943–45; 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, 1943–47

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite) [1]		Metal content [2]			
					Lead		Zinc	
	Short tons	Value [3]	Short tons	Value	Short tons	Value	Short tons	Value
1943	257,305	$18,490,413	2,284	$99,710	179,134	$26,870,100	[4] 923	$199,368
1944	243,279	19,920,200	3,206	112,485	169,962	27,193,920	[5] 1,508	343,824
1945	245,805	21,870,243	1,335	45,706	173,053	29,765,116	[6] 595	136,850
1946	189,401	21,677,221	1,731	61,147	135,891	29,624,238	451	110,044
1947	183,084	31,762,029	560	15,996	129,581	37,319,328	[7] 295	71,390

[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 360 tons recovered from lead-smelter slags.
[5] Includes 776 tons recovered from lead-smelter slags and byproduct matte from lead smelting.
[6] Includes 240 tons recovered from byproduct matte from lead smelting.
[7] Includes zinc recovered from lead-smelter slag.

Mine production of lead and zinc in Southwestern Missouri, 1943–47

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
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
1946	4,220	734,676	84	12,067	40,937	4,985,668	332	20,243	3,221	702,178	21,783	5,315,052
1947	3,412	655,080	168	23,866	31,480	3,402,384	763	49,235	2,665	767,520	16,779	4,060,518

[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, 1943–47

	1943	1944	1945	1946	1947
Total lead ore [1] short tons	6,831,377	6,535,874	6,675,767	5,491,239	[2] 5,856,334
Galena concentrates in ore percent	3.76	3.72	3.68	3.44	3.12
Average lead content of galena concentrates do	70.99	71.02	71.66	73.09	72.22
Average value per ton of galena concentrates	$71.79	$81.78	$88.95	$114.39	$173.49

[1] Includes lead-copper ore.
[2] Includes 301,324 tons of old tailings remilled.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Southwestern Missouri, 1946–47

	1946		1947	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled short tons	1,591,437	354,717	1,157,917	240,270
Total concentrates produced:				
Lead do	4,302	2	3,577	3
Zinc do	38,313	2,956	30,138	2,105
Ratio of concentrates to ore, etc.:				
Lead percent	0.27	0.001	0.31	0.001
Zinc do	2.41	0.83	2.60	0.88
Metal content of ores, etc.: [1]				
Lead do	0.21	0.001	0.23	0.001
Zinc do	1.42	0.46	1.51	0.48
Average lead content of galena concentrates do	76.29	65.75	76.68	66.67
Average lead content of lead carbonate do	63.10	----------	58.93	----------
Average zinc content of sphalerite concentrates do	58.90	55.38	58.51	54.35
Average zinc content of silicates and carbonates do	31.63	----------	40.50	----------
Average value per ton:				
Galena concentrates	$174.14	$85.50	$192.04	$134.33
Lead carbonate concentrates	143.65	----------	142.06	----------
Sphalerite concentrates	123.27	102.80	109.34	90.48
Zinc silicates and carbonates	60.97	----------	64.53	----------

[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.

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Southeastern and Central Missouri.—Production of recoverable lead in Southeastern Missouri totaled 129,516 tons in 1947 compared with 135,796 tons in 1946. The output in 1946 represented 40 percent of the United States total mine production and that in 1947 about 34 percent. The Central Missouri district produced 65 tons of lead in 1947 and 95 tons in 1946.

The output of zinc in Southeastern Missouri was 295 tons in 1947 and 451 tons in 1946.

The mines of the St. Joseph Lead Co. produce the bulk of the district output of lead. The mining, milling, and smelting operations of the company in Missouri, New York, Pennsylvania, and Argentina are described in the "St. Joe" issue of Mining and Metallurgy, August 1947. Much the largest part of the total company production of lead comes from Southeastern Missouri. In St. Francois County the company continued in 1947 to operate four large groups of mines—the Bonne Terre, Desloge, Federal, and Leadwood. Each group has an underground electrified rail haulage system which moves the ore from the working faces to a central ore-hoisting shaft at the mill. The combined daily capacity of the four mills at the end of 1947 was more than 22,000 tons. Treatment is by table concentration followed by flotation. The ore-hoisting shafts are 326, 276, 497, and 541 feet deep. Other shafts are used for men, supplies, and poor rock. Development done on the four groups in 1947 totaled 64,662 feet of drifting, 2,555,783 feet of diamond drilling, and 5,597 feet of churn drilling. In addition, the company unwatered and equipped one of the old mines at Doe Run and sank a new shaft in that area. Ore from these two shafts will be trucked to the Federal mill for treatment. Information in the following paragraph is abstracted from the eighty-fourth annual company report to stockholders.

To permit effective handling of lower grade ore, and to offset lack of adequate development work during the war years, changes were made during 1947 that should result in improved operating efficiency and that with the large expenditures being made for new and additional equipment, coupled with greatly increased development work, should help to assure continued Lead Belt operation in future years. The Desloge mill is now running solely on tailings, and the underground Desloge employees have been largely placed on development work. Under the prevailing 15-cent per pound lead price, tailings from old operations can be profitably handled. The lead thereby produced, and the profit obtained, will offset to a great extent the lower production and higher costs caused by the necessary increase in development work. The Desloge ore will be milled either at Federal or Leadwood after the underground main line haulage has been rearranged and new locomotives and larger cars have been procured. Since March 5, 1947, a so-called "lead bonus" (25 cents per shift worked for each 1-cent increase in the lead price above 12 cents per pound New York) has been paid to all Southeastern Missouri employees. The shortage of electric power in the St. Louis area permitted only 2 runs on the Herculaneum zinc furnace, and although mechanical difficulties are still being encountered, it is believed that the process is a forward step in the art of recovering lead and zinc from smelter slag.

In Madison County the St. Joseph Lead Co. continued to operate the Mine La Motte mine and 1,500-ton mill. Mine development in 1947 comprised a 136-foot shaft, 6,604 feet of drifts, 90,835 feet of diamond drilling, and 64,001 feet of churn drilling.

The Park City Consolidated Mines Co. operated continuously its Ruth mine and 500-ton flotation mill. The mine shaft is 370 feet deep. The Fredericktown Lead Co. operated the Fleming mine and 400-ton mill. Two shafts, 195 and 112 feet deep, were used. Exploratory drilling consisting of 8,495 feet of lateral diamond drilling and 11,620 feet of churn drilling, financed by Government exploration premiums, disclosed a fairly substantial ore body apart from the old workings. Reserves thus developed kept the mine in operation the latter part of 1947 and improved the outlook for future operations. The St. Louis Smelting & Refining Co. produced chiefly lead and lead-copper ore from its Madison group in 1947. Operations on the ore bodies that yield considerable cobalt and nickel continued to be curtailed. The mines averaged about 425 feet in depth. The 600-ton flotation mill made both lead and copper concentrates.

In Jefferson County the Fredericktown Lead Co. took over the Valle Mine property and operated the mill on dump ore from May 24 through December. One of the old shafts where lead predominates was reopened, and underground work was done with a view to developing enough ore from the mine to keep the mill operating before the dumps are depleted. The Bureau of Mines did exploratory drilling on the Kreuger tract in Washington County.

In Central Missouri the D. F. & H. Mining Co. operated the Glover open-pit lead mine and Joplin-type mill at Russellville, Cole County, part of the year.

Southwestern Missouri.—The following table, the first five paragraphs, and the charts 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 zinc concentrates in the Tri-State district totaled 204,068 tons and lead concentrates 32,006 tons in 1947 compared with 258,705 and 30,650 tons, respectively, in 1946. The value of the output in 1947 (including Government premiums paid on production from January through June and overlapping payments on 1946 production) was $21,792,921 for zinc concentrates and $6,090,622 for lead concentrates compared with $30,079,745 and $5,038,018, respectively, in 1946. The district output of recoverable zinc (109,338 tons) and lead (24,239 tons) in 1947 represented about 17 percent and 6 percent, respectively, of the United States total mine output compared with 24 percent and 7 percent in 1946.

Production of lead and zinc concentrates in the Tri-State district (Kansas, Oklahoma, and Southwestern Missouri), 1943–47

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									
1943	9,430,812	45,941	319,379	0.49	3.39	76.68	59.46	$121.12	$101.72
1944	9,118,388	36,544	301,854	.40	3.31	77.79	59.72	120.47	105.64
1945	7,441,345	31,643	217,790	.43	2.93	75.61	59.96	125.00	110.48
1946	8,271,512	30,468	224,910	.37	2.72	77.40	59.88	164.81	116.15
1947	6,229,702	31,842	181,662	.51	2.92	77.41	59.68	190.72	107.42
FROM OLD TAILINGS REMILLED									
1943	11,270,106	404	56,857	0.004	0.50	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
1946	10,178,620	182	33,795	.002	.33	48.35	58.60	90.85	117.10
1947	5,740,459	164	22,406	.003	.39	45.12	58.31	107.09	101.69
DISTRICT TOTAL									
1943	20,700,918	46,345	376,236	0.22	1.82	76.45	59.22	$120.65	$100.52
1944	21,411,398	36,934	355,401	.17	1.66	77.52	59.50	119.96	104.51
1945	18,712,692	31,844	259,001	.17	1.38	75.45	59.75	124.65	109.60
1946	18,450,132	30,650	258,705	.17	1.40	77.23	59.71	164.37	116.27
1947	11,970,161	32,006	204,068	.27	1.70	77.25	59.53	190.30	106.79

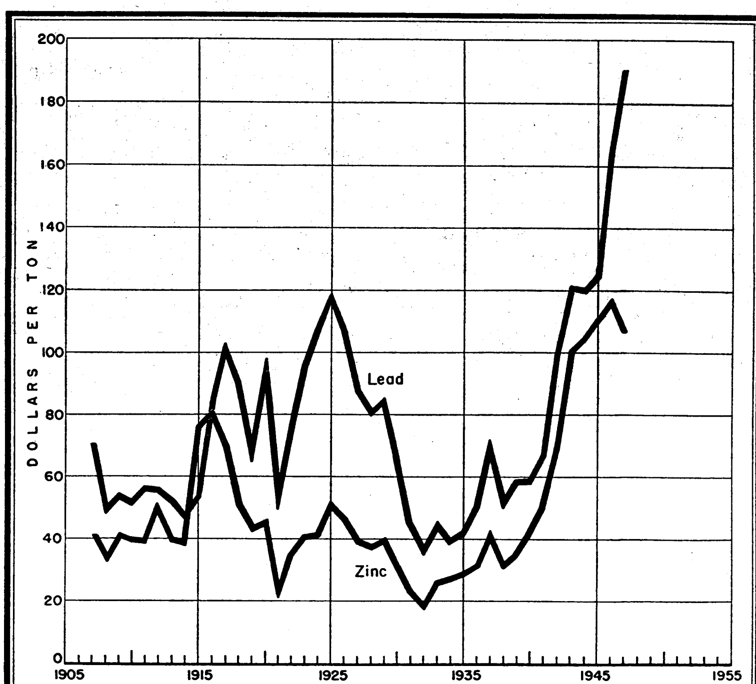

FIGURE 1.—Average prices received by sellers per ton of concentrates in the Tri-State district, 1907–47.

The weekly quoted price for 60-percent zinc concentrates at Joplin in 1947 was $64 a ton from January through August and $70.35 the rest of the year. From September 1 through December the Eagle-Picher Mining & Smelting Co. paid $72 a ton for zinc concentrates made from ore treated in the company Central mill. The quoted price of 80-percent lead concentrates was $160.50 for the week ended January 4, $166.85 from January 11 to February 22, $181.25 on March 1, and $195.65 from March 8 through December. Federal premium payments (excluding exploration premiums) from January through June, calculated on 1947 production only, averaged $55.89 a ton of zinc concentrates and $7.43 a ton of lead concentrates. The total premium payments, including overlapping payments on 1946 production received in 1947, amounted to $8,463,806 for zinc and $206,831 for lead. Exploration premiums reported by the mine operators totaled $131,685 for zinc and $3,876 for lead.

After the Premium Price Plan expired June 30, more than half the district mines and all but two of the tailing mills shut down. The production rate for zinc during July, August, and September dropped to the lowest rate for a 3-months period since the summer of 1932. Some of the mines and mills that closed resumed operations later, and the rate increased in the last quarter, when the monthly rate averaged 53 percent of the January-June rate. The total production of zinc concentrates in the latter half of 1947 was 65,632 tons compared with 138,436 tons in the first half. Lead concentrate production was 13,459 tons from July to December compared with 18,547 tons from January to June. In December, about 75 mines, 22 mine mills, and 3 tailing mills were operating compared with 170, 29, and 14, respectively, in December 1946. These mines do not include very small gouges, mill clean-ups, or clean-ups of boulder piles; the total producing mines, gouges, and clean-ups active all or part of 1947 was 234 compared with 248 in 1946. The depth of the operating shafts ranged from 55 feet to 450 feet; open pits were mined at depths ranging from 15 to 250 feet.

The mining companies did considerable exploratory drilling in 1947, some of which was financed through Government exploration premiums. The Bureau of Mines continued its investigation of ore reserves of the district and did exploratory drilling on the Miami Trough north of Picher in Kansas and in the South Carthage area in Missouri. The Bureau also completed a drilling project on the Rex property west of West Plains, Howell County. Data on certain drilling projects were published during the year.[2]

In Southwestern Missouri production of zinc concentrates decreased 22 percent in 1947 from 1946 and lead concentrates 17 percent. The Oronogo Circle open-pit mine at Oronogo, former (1941–46) largest zinc producer in Missouri, shut down soon after the Premium Price Plan expired and dropped to second rank in 1947. The largest individual producer was the Buckingham-Gibson mine of the Kansas Explorations, Inc., north of Oronogo; it operated throughout 1947. The company Jasper mine and mill near Joplin were closed in August.

[2] Ballinger, Homer J., Winchester Zinc Deposit, Newton County, Mo.: Bureau of Mines Rept. of Investigations 4085, 1947, 82 pp.
Ballinger, Homer J., Pearl Lead-Zinc Deposits, Jasper County, Mo.: Bureau of Mines Rept. of Investigations 3873, 1947, 16 pp.
Needham, A. B., and Kreamalmyer, K. L., Alice Zinc Mine, Ozark County, Mo.: Bureau of Mines Rept. of Investigations 4056, 1947, 17 pp.

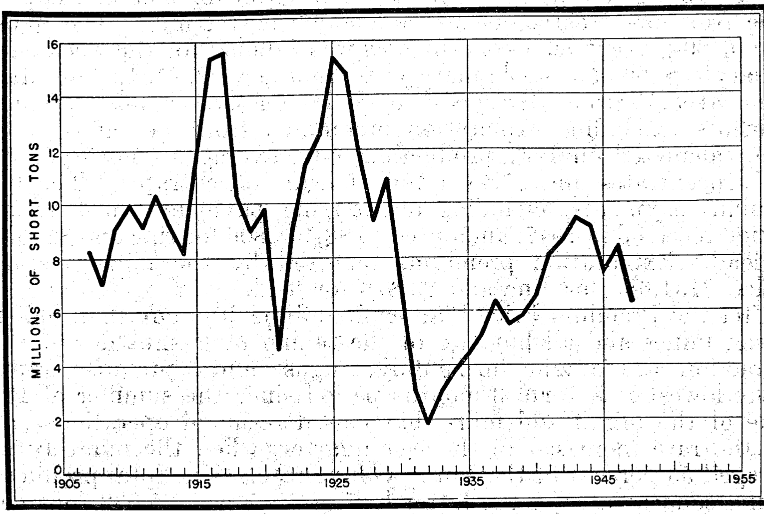

FIGURE 2.—Quantity of crude ore milled in the Tri-State district, 1907–47.

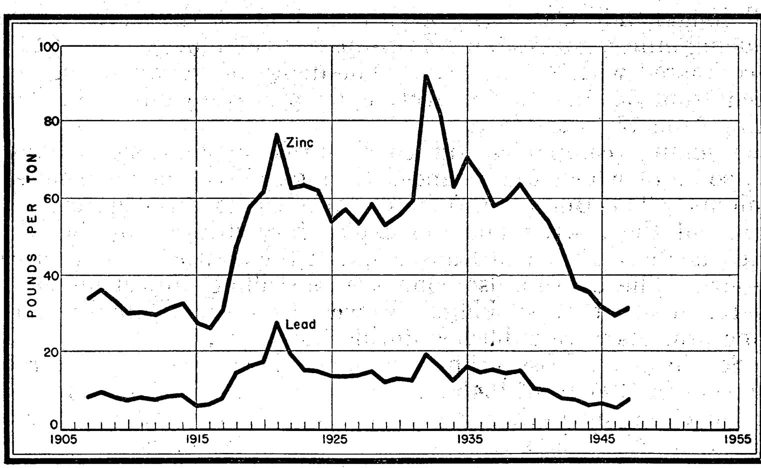

FIGURE 3.—Metal recovered per ton of crude ore (rock) milled in the Tri-State district, 1907–47.

The Federal Mining & Smelting Co. operated its Duenweg mine and mill from January through June and 9 days in August; later the mill treated ore from the Manning & Winston (Ollie D) mine at Duenweg, operated until late in December. The Federal Granby-American group operated from January through June and from August 1 to November 30. The F. W. Evans Sucker Flat mine and mill at Webb City, the F. W. Evans O'Neill-St. Louis at Waco, the C. C. Playter (Reynolds) mines and the Playter mill at Waco, and the St. Louis Mining & Milling Co. custom mill at Thoms Station ran nearly all the year. The St. Louis Smelting & Refining Co. operated the Gascho mine, and lessees operated the High Five and Olsen mines, all at Waco, until June 30. The Century Lead & Zinc Co. (Navy Bean) mine and mill ran from June through December, and the Magajupa (Sciota) mill (mine at Duenweg) operated intermittently from May through December. Other mills operated (mostly from January to June only) included the C. G. & C. Co. Northside near Chitwood, treating ore from the Wildwood (Potter) mine near Joplin and other custom ore; the Mess Cave (Southside) near Chitwood (ore from the Mess Cave mine at Galena, Kans.); the Wentworth Mining & Milling Co. (Kline) mill at Wentworth; the Dividend at Spurgeon; and the Missouri Mining Co. tailing mill at Chitwood. The Eagle-Picher Needmore mine and Fenix & Sons Oronogo No. 5 at Oronogo shipped ore to the Eagle-Picher Central mill at Cardin, Okla., and the Mattes (Burton) in North Joplin shipped to Missouri custom mills. The Dale Mining Co. built a 400-ton mill at the Dungy mine at Stark City and operated it from June through December on lead ore from the upper ground. The O'Keefe (Beverly) mine near Thoms Station and the Rex (Eureka Products) near Joplin made a small output. The Alice mine in Ozark County shipped sorted carbonate and sulfide ore. The Mary Arnold mine in Christian County operated part of the year.

OKLAHOMA

Mines and tailing mills in Oklahoma produced 47 percent of the total Tri-State output of zinc in 1947 and 50 percent in 1946; of the lead, they produced 59 percent in both years. The State output of zinc decreased 27 percent in 1947 from 1946, and lead increased 4 percent.

The Eagle-Picher Mining & Smelting Co., largest producer of zinc and lead in Oklahoma and the Tri-State district, operated its 15,000-ton Central mill at Cardin at close to capacity from January through June and at a greatly reduced rate the rest of the year. The mill is equipped with differential-density (sink-and-float) preliminary-concentration units, which furnish an enriched product for treatment by jigging and flotation. Of the 2,985,131 tons of ore treated in 1947, 59 percent came from Oklahoma. Eagle-Picher mines in Oklahoma shipping to the mill were the Blue Goose mines, Buffalo, Crawfish,

Mine production of lead and zinc in Oklahoma, 1943–47

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
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
1946	17,847	2,903,065	129,473	15,170,928	13,697	2,985,946	69,552	16,970,688
1947	18,857	3,600,407	95,126	10,699,593	14,289	4,115,232	51,062	12,357,004
1891–1947	1,468,757	124,999,663	8,962,298	412,913,148	1,133,080	148,176,139	4,722,296	658,888,702

[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, 1946–47

	1946		1947	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled — short tons	3,699,762	8,509,891	2,818,476	4,104,851
Total concentrates produced:				
Galena — do	17,667	180	18,743	114
Sphalerite — do	102,587	26,886	81,804	13,322
Ratio of concentrates to ore, etc.:				
Lead — percent	0.48	0.002	0.67	0.003
Zinc — do	2.77	.32	2.90	.32
Metal content of ore, etc.: [1]				
Lead — do	.38	.001	.52	.001
Zinc — do	1.66	.19	1.74	.19
Average lead content of galena concentrates — do	78.62	47.78	77.54	39.47
Average zinc content of zinc concentrates — do	59.91	58.81	59.78	58.73
Average value per ton:				
Galena concentrates	$163.40	$90.91	$191.54	$90.87
Zinc concentrates	116.75	118.78	111.73	117.07

[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.

Goodeagle mines, Gordon No. 2, Grace Walker Mines, Hum-bah-wat-tah mines, John Beaver, Lotson No. 2, Netta, Piokee, See Sah No. 3, Slim Jim (Bankard and Vantage), Southside, Swift, White, and Wilson. Other large Oklahoma shippers to the mill included the Federal Mining & Smelting Co. (Lucky Syndicate-Howe, Gordon, and Quapaw-Davenport mines); the Davis Big Chief (Skelton), Carpenter (New York-Grace Walker, Oko), F. W. Evans (Shorthorn, Craig), W. M. & W. (Velie, Tongaha, Anna Beaver), C. G. & C. (Lucky Bill), Mahutska (Jeff City-Eudora), Tongaha (Beaver mines), and Hunt-Craig (Netta) mining companies; Kansas Explorations, Inc. (Ritz, Crystal-Central); the Bob White (Little Greenback, Mehunka) and Frank Hudson (Bingham) mining companies; and the American Development Co. (Consolidated mine).

Other important producing mines equipped with mills were the Admiralty (Cameron & Henderson, Romo mill), American Zinc No. 7, Evans-Wallower No. 16, Marcia K, Park Walton (Melrose Mining Co.), Rialto, Scott (Scott and Mary Ann), United Zinc (Royal, Waxahachie), and Weidman (Townsite and Woodchuck mines). The Woodchuck mine was closed March 27, the Scott, Mary Ann, and Royal June 30, and the Townsite July 27; the other mines operated all or most of the year. The Harris Mining Co. reopened the Lucky Jenny mill in March and operated it the rest of the year on ore from the Douthat (Baird), Farmington, and Lucky Jenny mines in Oklahoma and the E. W. No. 24 in Kansas. The M. & W. Mining Co. operated the Brewster mines during April and May.

The Mission mill handled custom ore, mostly from the Pelican (Miller & Mills Mining Co. and Dewey Sims), Dobson, Montreal, and Santa Fe mines. The Four-Mile (T. R. Smith) mine and small mill operated a few months. The C. & M. Mining Co. operated the No. 4 (Imbeau) mine from January through June and the mine and mill during November and December.

All the tailing mills in Oklahoma except the Tri-State Zinc Sooner closed after the Premium Price Plan expired June 30, but the Big Chief Tailing Co. mill reopened later in the year. The Evans-Wallower No. 4 mill began treating mine ore in May. Other tailing mills in operation from January through June were the Atlas, Britt & Britt, Cardin (No. 3 and Western), C. G. & C., Semple (Martin), and Tri-State Zinc Ottawa (closed August 8). The Cardin No. 2 tailing mill closed in March and was dismantled. Other mills sold for dismantling were the Atlas, C. G. & C., and Ottawa.

Montana
Gold, Silver, Copper, Lead, and Zinc
(MINE REPORT)

By C. E. NEEDHAM and PAUL LUFF

GENERAL SUMMARY

AN INCREASE of 172 percent in zinc output set the pace for a marked improvement in most phases of Montana's metal-mining industry in 1947, compared with 1946. Other metals also gained appreciably in output—lead 95 percent, silver 93, and gold 28; copper output, however, was 1 percent below that in 1946. Increases in the average prices of silver, copper, and lead, plus the pronounced gains in yield of four of the metals in 1947, reversed the 4-year down trend in total value of the metals. Zinc increased 170 percent in value, lead 157, silver 116, and gold and copper 28 percent each to give an over-all gain of 63 percent in total value—from $29,957,206 in 1946 to $48,890,964 in 1947. Of the total value in 1947, copper contributed 50 percent, zinc 23, silver 12, lead 9, and gold 6. Outstanding in State metal mining in 1947 was the marked expansion in production of zinc-lead ores from the Butte Hill mines and dumps of the Anaconda Copper Mining Co. at Butte.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Montana in 1943–47 and total, 1862–1947, 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
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
1946	193	42	2,234,958	70,507	2,467,745	3,273,140	2,644,697
1947	243	54	3,100,013	90,124	3,154,340	6,326,190	5,725,202
1862–1947			(1)	17,142,245	384,431,787	755,476,013	552,801,254

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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
1946	116,962,000	18,947,844	16,560,000	1,805,040	33,540,000	4,091,880	29,957,206
1947	115,800,000	24,318,000	32,216,000	4,639,104	91,358,000	11,054,318	48,890,964
1862–1947	[2] 6,636,253	1,926,118,674	[2] 711,108	81,903,740	[2] 1,907,967	300,477,160	3,245,732,615

[1] Figure not available. [2] Short ton.

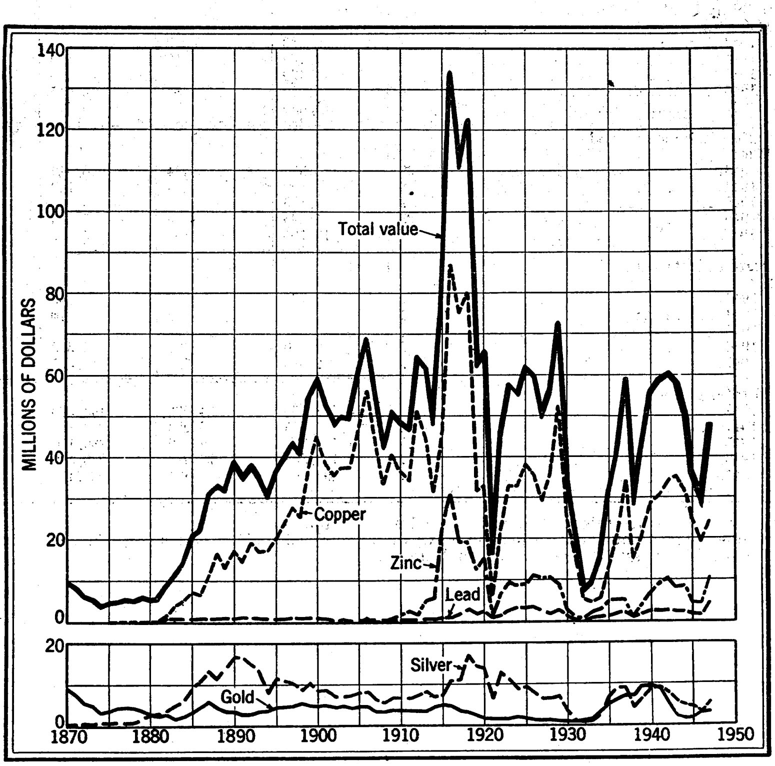

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Montana, 1870–1947.

Gold produced at placer mines in Montana, 1943–47, by classes of mines and by methods of recovery

Class and method	Mines producing	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:					
1943	3	3,215,759	13,579	$475,265	$0.148
1944	2	1,197,600	5,887	206,045	.172
1945	2	1,497,646	9,181	321,335	.215
1946	4	4,621,073	21,609	756,315	.164
1947	5	5,398,575	21,749	761,215	.141
Dragline dredges:					
1943–44					
1945	2	33,500	359	12,565	.375
1946	4	808,100	4,706	164,710	.204
1947	3	478,194	2,329	81,515	.170
Becker-Hopkins dredges:					
1946 [1]	1	5,000	32	1,120	.224
1947					
Nonfloating washing plants: [2]					
1943–44					
1945	1	3,000	30	1,050	.350
1946	2	320,000	1,354	47,390	.148
1947	6	185,050	2,883	100,905	.545
Gravel hydraulically handled:					
Hydraulic:					
1943	1	500	2	70	.140
1944	3	3,750	16	560	.149
1945	2	420	8	280	.667
1946	6	6,950	87	3,045	.438
1947	1	15,680	195	6,825	.435
Small-scale hand methods:					
Wet:					
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
1946	23	5,695	96	3,360	.590
1947	37	13,795	155	5,425	.393
Underground placers:					
Drift:					
1943	2	175	7	245	1.400
1944	1	25	2	70	2.800
1945					
1946	2	2,540	102	3,570	1.406
1947	2	2,315	123	4,305	1.860
Grand total placers:					
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
1946	42	5,769,358	27,986	979,510	.170
1947	54	6,093,609	27,434	960,190	.158

[1] First year for which this method was reported used in Montana.
[2] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."

Mine production of gold, silver, copper, lead, and zinc in Montana in 1947, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	5,716	371,817	10,844,000	1,600,000	3,420,000
February	5,540	454,546	10,118,000	2,266,000	5,552,000
March	7,176	531,605	11,326,000	2,368,000	6,958,000
April	8,284	584,855	10,438,000	3,120,000	8,324,000
May	9,488	620,064	9,504,000	3,432,000	8,284,000
June	7,783	534,611	8,952,000	2,682,000	8,386,000
July	7,462	571,806	9,092,000	2,704,000	8,376,000
August	8,352	570,700	8,088,000	2,912,000	8,670,000
September	8,278	512,516	7,826,000	2,766,000	8,348,000
October	7,612	506,470	9,426,000	2,810,000	8,134,000
November	7,517	539,655	10,068,000	2,706,000	8,548,000
December	6,916	527,545	10,118,000	2,850,000	8,358,000
Total: 1947	90,124	6,326,190	115,800,000	32,216,000	91,358,000
1946	70,507	3,273,140	116,962,000	16,560,000	33,540,000

Gold.—The rise of 19,617 ounces above the yield in 1946 brought Montana's gold output in 1947 to the highest figure since 1942. Placer production declined nearly 2 percent, but lode output increased 47 percent. Significant in increasing State gold yield were the return to production of the Perry-Schroeder dredge near Helena and the Granite-Bimetallic tailings operation at Philipsburg, the marked rise in zinc-lead materials treated by the Anaconda Copper Mining Co. at Butte, and the large increase in gold output from the Keating mine near Radersburg. Of Montana's total gold in 1947, 38 percent was derived from siliceous gold and silver ores (39 percent in 1946), 32 percent from base-metal ores (21 percent in 1946), and 30 percent from placers (40 percent in 1946). Ores concentrated yielded 33 percent of the State gold; ores shipped to smelters, 16 percent; and ores treated at amalgamation and cyanidation mills (with or without concentrating equipment), 21 percent.

Gold producers in Montana that produced 2,000 ounces or more in 1947 were the Anaconda Copper Mining Co. (copper ore and waste materials and zinc-lead ore and dumps) at Butte, Jardine Mining Co. (gold ore) at Jardine, Winston Bros. (placer) in Jefferson County, Porter Bros. (placer) at Helena, McLaren Gold Mines Co. (copper ore) in Park County, Drumlummon mine (gold ore) at Marysville, Ruby mine (gold ore) in Phillips County, Golden Sunlight mine (gold ore) near Whitehall, H. & H. Mines (placer) in Granite County, Keating mine (gold ore) in Broadwater County, and U. S. Grant mine (gold-silver ore) near Virginia City. These 11 properties produced 76 percent of the State gold in 1947.

Silver.—The increase of 3,053,050 ounces in silver output in Montana in 1947 was due mainly to the pronounced gain in yield of the metal from zinc-lead ores produced at the Butte Hill mines and dumps of the Anaconda Copper Mining Co. at Butte. This source in 1946 contributed only 2 percent of the State total silver, but in 1947 it climbed to nearly 48 percent; silver output from the copper-producing operations of the company at Butte dropped again.

The Anaconda Copper Mining Co. had no close competitors for first place among State silver producers in 1947, supplying 74 percent of the total silver. Other important producers in order of output, each producing 100,000 ounces or more, were the Emma mine at Butte, Granite-Bimetallic tailings at Philipsburg, Benton Group in Cascade County, Mike Horse mine at Flesher, and the North Butte mine at Butte. These six contributed 85 percent of the State silver in 1947.

Zinc-lead ore furnished 61 percent of the total silver in 1947; copper ore, 28 percent; siliceous ores, nearly 10 percent; and lead ore and zinc ore, almost 2 percent. Ore treated at concentrating mills yielded 88 percent of the total silver and smelting ore, 11 percent; old slag fumed, ores amalgamated or cyanided, and placers were minor sources.

Copper.—The slight decrease in copper output in Montana in 1947 marked the fifth consecutive year of State decreases. The decline was due mainly to a drop in output of the metal from copper ore and waste materials of the Anaconda Copper Mining Co. at Butte; yield of recoverable copper from the company zinc-lead operations at Butte was nearly 2,500,000 pounds above that in 1946. The company supplied 92 percent of the State copper in 1947, and the North Butte mine furnished over half of the remainder. Of the other producers, only the old tailings from the Montana Ore Purchasing Co. dumps at Butte exceeded a million pounds of recoverable copper.

Lead.—Lead production in Montana in 1947 rose to the highest figure since 1943. The increase of over 15,000,000 pounds above the output in 1946 was supplied almost entirely by the Anaconda Copper Mining Co. from zinc-lead ore produced at the Butte Hill mines and dumps. The Emma, Travona, and Toledo-Buckeye mines made gains in output of the metal; output from the Mike Horse, Jack Waite, and Poulin mines and the East Helena old slag dump declined. The Anaconda Copper Mining Co. contributed 49 percent of the State lead in 1947. Other operations that produced more than a million pounds of recoverable lead each were the Emma and Mike Horse mines. These three furnished 75 percent of the total lead in 1947. Of the State lead output, 91 percent was recovered from zinc-lead ore, 5 percent from lead ore, 3 percent from siliceous ores, and 1 percent from zinc ore and slag.

Zinc.—Production of recoverable zinc in Montana in 1947 was nearly 58,000,000 pounds above that in 1946 and was the largest since 1942. The output at most of the larger zinc-producing operations declined, but the Anaconda Copper Mining Co. made a remarkable record at its Butte Hill mines and dumps—zinc yield from this source was 62 times that in 1946. Leading State producers of zinc in 1947, each producing more than a million pounds of recoverable metal, were the operations of the Anaconda Copper Mining Co. (71 percent of the State total), Emma, Poulin, and Mike Horse mines, East Helena old slag dump, and the Travona and Toledo-Buckeye mines. These seven producers contributed 95 percent of the State zinc. Of Montana's zinc in 1947, over 96 percent was derived from zinc-lead ore, 2 percent from zinc ore and old 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 1947 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	18	2	2,547	$89,145	83,190	$75,287
Broadwater	27	11	4,326	151,410	33,021	29,884
Cascade	5		231	8,085	191,632	173,427
Deer Lodge	3		4	140	2,652	2,400
Fergus		1	4	140		
Granite	16	3	4,851	169,785	202,684	183,429
Jefferson	41	3	13,374	468,090	110,704	100,187
Judith Basin	3		13	455	6,484	5,868
Lewis and Clark	35	16	14,888	521,080	177,389	160,537
Lincoln	2	2	205	7,175	11	10
Madison	30	5	3,723	130,305	154,358	139,694
Meagher	1				53	48
Mineral	4		23	805	14,106	12,766
Missoula	3	2	2,043	71,505	96	87
Park	4	2	18,271	639,485	44,980	40,707
Phillips	2		3,964	138,740	12,316	11,146
Powell	13	5	1,650	57,750	35,346	31,988
Sanders	5		204	7,140	5,157	4,667
Silver Bow	31	1	19,801	693,035	5,252,011	4,753,070
Yellowstone		1	2	70		
Total: 1947	243	54	90,124	3,154,340	6,326,190	5,725,202
1946	193	42	70,507	2,467,745	3,273,140	2,644,697

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaverhead	45,800	$9,618	619,000	$89,136	42,600	$5,155	$268,341
Broadwater	51,700	10,857	586,000	84,384	626,200	75,770	352,305
Cascade	13,800	2,898	1,164,000	167,616	1,209,200	146,313	498,339
Deer Lodge	900	189	25,500	3,672	54,400	6,582	12,983
Fergus							140
Granite	214,000	44,940	266,000	38,304	343,600	41,576	478,034
Jefferson	58,200	12,222	754,500	108,648	717,400	86,805	775,952
Judith Basin	2,300	483	177,000	25,488	55,600	6,728	39,022
Lewis and Clark	313,800	65,898	4,701,500	677,016	4,715,600	570,588	1,995,119
Lincoln			300	43			7,228
Madison	33,300	6,993	940,500	135,432	1,111,800	134,528	546,952
Meagher			2,500	360			408
Mineral	9,800	2,058	130,200	18,749	184,600	22,336	56,714
Missoula			5,500	792	600	73	72,457
Park	451,600	94,836	234,000	33,696	236,000	28,556	837,280
Phillips	100	21			5,000	605	150,512
Powell	8,400	1,764	554,000	79,776	376,600	45,568	216,846
Sanders	222,300	46,683	786,000	113,184	253,800	30,710	202,384
Silver Bow	114,374,000	24,018,540	21,269,500	3,062,808	81,425,000	9,852,425	42,379,878
Yellowstone							70
Total: 1947	115,800,000	24,318,000	32,216,000	4,639,104	91,358,000	11,054,318	48,890,964
1946	116,962,000	18,947,844	16,560,000	1,805,040	33,540,000	4,091,880	29,957,206

MINING INDUSTRY

Labor was more plentiful in Montana in 1947 than in 1946, but in most places it was not plentiful enough to enable the mines to operate at full capacity. According to press reports, the labor force at Butte was increased by 1,300 men in the second half of 1947, but an additional 1,500 were needed by the spring of 1948. No labor strikes occurred during the year, and production of ore moved at a rather uniform rate at all times.

The expiration of the Premium Price Plan on June 30, 1947, appears to have caused few significant changes in Montana metal mining. The North Butte mine, which closed in August, was the only large operation known to have shut down because of lack of premiums; a few operators shifted to mining higher-grade ore after July, and some small and medium operators may have been affected in some ways.

The pronounced increase in production of zinc-lead ores from the Butte Hill mines and dumps was the chief factor in the 39-percent increase in State output of ore—from 2,234,958 tons in 1946 to 3,100,013 tons in 1947. Of the total ore and old tailings treated in 1947, 59 percent was copper ore; 31 percent, zinc-lead ore; 9 percent, siliceous gold and silver ores; and 1 percent, zinc ore and lead ore.

Highly significant in the future of the Summit Valley (Butte) district was the announcement in the fall by the Anaconda Copper Mining Co. that it would soon begin work on a $20,000,000 5-year program to mine low-grade copper ore above the 3,400-foot level in the company Butte Hill mines and that the concentrator at Anaconda would be enlarged to treat 15,000 tons daily.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Montana in 1947, 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	69	186,813	28,903	48,502	73,262	36,343	35,958
Dry and siliceous gold-silver ore	33	53,385	4,259	260,812	156,854	112,862	120,400
Dry and siliceous silver ore	45	47,532	933	298,165	151,227	825,678	826,867
	147	287,730	34,095	607,479	381,343	974,883	983,225
Copper ore	19	1,838,580	12,872	1,784,945	[1] 111,907,310		
Lead ore	70	12,508	729	70,864	39,237	1,645,401	235,839
Zinc ore	8	[2] 10,758	58	32,776	7,406	404,952	2,083,402
Zinc-lead ore	27	[2] 950,437	14,936	3,824,884	3,464,704	29,190,764	88,055,534
Total lode mines	[3] 243	3,100,013	62,690	6,320,948	[1] 115,800,000	32,216,000	91,358,000
Placers	54		27,434	5,242			
Total: 1947	297	3,100,013	90,124	6,326,190	[1] 115,800,000	32,216,000	91,358,000
1946	235	2,234,958	70,507	3,273,140	[4] 116,962,000	16,560,000	33,540,000

[1] Includes 6,004,223 pounds recovered from precipitates.
[2] Includes 7,403 tons of zinc 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 6,376,070 pounds recovered from precipitates.

METALLURGIC INDUSTRY

The 3,100,013 tons of ore produced from Montana lode mines in 1947 were treated as follows: 2,789,311 tons (90 percent) at concentrating mills (2,005,486 tons in 1946); 153,317 tons (5 percent) shipped to smelters (74,535 tons in 1946); 7,403 tons (0.2 percent) of old lead-smelter slag fumed (55,458 tons in 1946); 139,379 tons (4 percent) at cyanidation mills (82,040 tons in 1946); and 10,603 tons (0.3 percent) at amalgamation mills (17,439 tons in 1946). The ore that went to concentrating mills comprised 1,816,069 tons of copper ore, 949,871 tons of zinc-lead ore, 18,201 tons of gold ore, and 5,170 tons of lead ore.

The 12,320-ton copper concentrator and the 2,000-ton zinc concentrator of the Anaconda Copper Mining Co. at Anaconda operated continuously in 1947, the copper concentrator at a lower rate and the zinc concentrator at a higher rate than in 1946. The company 2,000-ton slime disintegrating plant was closed all year. 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. The zinc plants treated 429,756 tons of zinc concentrates containing 453,575,671 pounds of zinc, compared with 401,963 tons containing 431,938,462 pounds of zinc in 1946. The concentrates were received from Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and several foreign countries. The company slag-fuming plant at East Helena was operated throughout the year; more hot current slag was treated than in 1946, but the quantity of cold slag treated was greatly reduced. The output of zinc-lead fume increased from 26,180 tons in 1946 to 38,229 tons in 1947; nearly all of it was treated at the Great Falls electrolytic-zinc plant.

The lead smelter of the American Smelting & Refining Co. at East Helena operated throughout the year and treated chiefly lead-silver concentrates from the Coeur d'Alene region in Idaho, residues from the electrolytic-zinc plants at Anaconda and Great Falls, crude ores, concentrates, and old tailings from various districts in Montana, and lead-silver concentrates from the Loomis-Oroville district in Washington.

Mine production of metals in Montana in 1947, 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	10,603	3,056	1,767			
Ore cyanided	139,379	13,984	9,266			
Concentrates smelted [1]	367,367	31,372	5,607,199	107,968,614	29,065,614	88,001,314
Copper precipitates smelted	4,050			6,004,223		
Ore smelted	[2] 153,317	14,278	701,334	1,827,163	3,032,219	1,861,486
Old slag fumed	7,403		1,382		118,167	1,495,200
Placer		27,434	5,242			
Total: 1947		90,124	6,326,190	115,800,000	32,216,000	91,358,000
1946		70,507	3,273,140	116,962,000	16,560,000	33,540,000

[1] Includes zinc concentrates treated at electrolytic plants.
[2] Includes metals recovered from 48 tons of current tailings smelted.

Gross metal content of Montana ore treated at mills in 1947, by classes of ore and methods of treatment [1]

Class of ore	Method of treatment	Ore (short tons)	Gross metal content of mill feed: Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	Amalgamation	10,603	4,941	25,154	6,240	13,735	16,100
Do	Cyanidation	139,379	17,789	10,770			
Do	Concentration	18,201	3,579	846	55,000		
Copper	do	1,816,069	16,971	1,916,739	114,884,144		
Lead	do	5,170	62	19,026	14,125	167,334	31,865
Zinc-lead	do	949,871	19,359	4,589,773	4,844,444	34,818,950	100,344,833
Total: 1947		2,939,293	62,701	6,562,308	119,803,953	35,000,019	100,392,798
1946		2,104,965	38,143	3,381,462	123,102,788	16,735,660	27,503,585

[1] Exclusive of copper ore by leaching.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Montana in 1947, by types of mills and by counties, in terms of recovered metals

County	Ore treated (short tons)	Recovered in bullion: Gold (fine ounces)	Recovered in bullion: Silver (fine ounces)	Concentrates smelted and recovered metal: Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
AMALGAMATION MILLS									
Broadwater	248	230	34	5	31	234			
Jefferson	240	56	10	4	12	51		1,373	
Lewis and Clark	10,040	2,763	1,719	107	1,436	21,770	3,762	9,423	10,929
Lincoln	50	2							
Silver Bow	25	5	4						
Total: 1947	10,603	3,056	1,767	116	1,479	22,055	3,762	10,796	10,929
1946	17,439	2,740	1,438	202	2,065	15,406	2,136	7,079	6,332
CYANIDATION MILLS									
Park	68,149	10,104	1,821						
Phillips	71,230	3,844	7,445						
Total: 1947	139,379	13,984	9,266						
1946	82,040	11,943	6,174						
Grand total: 1947	149,982	17,040	11,033	116	1,479	22,055	3,762	10,796	10,929
1946	99,479	14,683	7,612	202	2,065	15,406	2,136	7,079	6,332

Mine production of metals from concentrating mills in Montana in 1947, 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	22,902	4,268	2,521	13,770	45,811	229,323	350,843
Cascade	35,919	2,659	229	191,392	13,197	1,162,461	1,208,202
Granite	282	145	----------	1,250	664	15,985	66,805
Lewis and Clark	62,202	6,687	250	119,707	280,024	4,332,794	3,056,540
Madison	21,788	1,558	535	44,612	28,797	696,600	987,436
Mineral	6,910	282	21	14,106	9,800	130,200	184,600
Missoula	65	5	----------	11	----------	5,500	----------
Park	40,975	2,230	6,152	42,320	447,827	234,000	236,000
Powell	9,037	1,835	681	24,721	6,212	440,278	355,753
Sanders	4,201	869	115	4,231	144,505	708,919	249,314
Silver Bow	2,585,030	346,713	19,389	5,129,024	112,992,238	21,098,758	81,294,892
Total: 1947	2,789,311	367,251	29,893	5,585,144	113,969,075	29,054,818	87,990,385
1946	2,005,486	322,803	14,013	2,744,481	115,193,396	13,734,643	22,728,350

Gross metal content of concentrates produced from ore mined in Montana in 1947, 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	3,703	2,508	850	44,625	----------	210
Dry gold-silver	107	1,436	21,770	4,360	9,620	12,280
Copper	192,773	12,643	1,720,251	107,222,492	----------	----------
Lead	16,466	2,665	885,876	1,192,223	19,258,839	2,202,920
Zinc	90,515	10,104	2,568,253	2,285,078	9,808,461	87,574,127
Zinc-lead	1,961	341	161,377	9,942	808,420	429,145
Dry iron (from copper and zinc-lead ore)	61,842	1,675	248,822	773,463	1,023,189	2,847,611
Total: 1947	367,367	31,372	5,607,199	111,532,183	30,908,529	93,066,293
1946	323,005	16,078	2,759,887	113,071,317	14,052,595	23,527,301

Mine production of metals from Montana concentrates shipped to smelters in 1947, in terms of recovered metals

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Broadwater	4,273	2,552	14,004	45,811	229,323	350,843
Cascade	2,659	229	191,392	13,197	1,162,461	1,208,202
Granite	145		1,250	664	15,985	66,805
Jefferson	4	12	51		1,373	
Lewis and Clark	6,794	1,686	141,477	283,786	4,342,217	3,067,469
Madison	1,558	535	44,612	28,797	696,600	987,436
Mineral	282	21	14,106	9,800	130,200	184,600
Missoula	5		11		5,500	
Park	2,230	6,152	42,320	447,827	234,000	236,000
Powell	1,835	681	24,721	6,212	440,278	355,753
Sanders	869	115	4,231	144,505	708,919	249,314
Silver Bow	346,713	19,389	5,129,024	106,988,015	21,098,758	81,294,892
Total: 1947	367,367	31,372	5,607,199	107,968,614	29,065,614	88,001,314
1946	323,005	16,078	2,759,887	108,819,462	13,741,722	22,734,682
BY CLASSES OF CONCENTRATES						
Dry gold	3,703	2,508	850	43,250		200
Dry gold-silver	107	1,436	21,770	3,762	9,423	10,929
Copper	192,773	12,643	1,720,251	103,996,368		
Lead	16,466	2,665	885,876	1,013,429	18,943,391	1,839,568
Zinc	90,515	10,104	2,568,253	2,163,829	9,314,806	85,800,821
Zinc-lead	1,961	341	161,377	8,476	796,257	349,796
Dry iron (from copper and zinc-lead ore)	61,842	1,675	248,822	739,500	1,737	
Total 1947	367,367	31,372	5,607,199	107,968,614	29,065,614	88,001,314

Gross metal content of Montana crude ore shipped to smelters in 1947, 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]	18,630	7,907	14,798	28,808	26,176	30,480
Dry and siliceous gold-silver	53,385	4,259	260,812	163,494	800,022	147,474
Dry and siliceous silver	47,532	933	298,165	178,216	849,027	1,154,236
Copper	22,511	183	27,189	1,495,941		72
Lead	7,338	708	57,439	39,266	1,558,261	288,192
Zinc	3,355	58	31,394	8,678	291,416	728,154
Zinc-lead	566	230	11,537	4,594	262,553	103,135
Total: 1947	153,317	14,278	701,334	1,918,997	3,787,455	2,451,743
1946	74,535	11,760	492,787	1,866,131	1,969,822	1,066,245

[1] Includes metals recovered from 48 tons of current tailings smelted.

Mine production of metals from Montana crude ore shipped to smelters in 1947, in terms of recovered metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Beaverhead	11,599	2,236	83,147	45,800	619,000	42,600
Broadwater [1]	2,341	328	18,868	5,889	356,677	275,357
Cascade	13	2	240	603	1,539	998
Deer Lodge	444	4	2,652	900	25,500	54,400
Granite	43,807	1,928	201,223	213,336	250,015	276,795
Jefferson	29,396	4,436	107,254	58,200	753,127	717,400
Judith Basin	377	13	6,484	2,300	177,000	55,600
Lewis and Clark	6,927	952	31,780	30,014	241,116	152,931
Lincoln	1	4			300	
Madison	15,031	2,873	109,683	4,503	243,900	124,364
Meagher	6		53		2,500	
Mineral	1	2				
Missoula	39	52	53			600
Park	125	61	544	3,773		
Phillips	96	120	4,871	100		5,000
Powell	2,681	773	10,573	2,188	113,722	20,847
Sanders	573	89	926	77,795	77,081	4,486
Silver Bow	39,860	405	122,983	1,381,762	170,742	130,108
Total: 1947	153,317	14,278	701,334	1,827,163	3,032,219	1,861,486
1946	74,535	11,760	492,787	1,766,468	1,898,278	855,318
BY CLASSES OF ORE						
Dry and siliceous gold	18,630	7,907	14,798	26,250	25,547	24,829
Dry and siliceous gold-silver	53,385	4,259	260,812	156,854	112,862	120,400
Dry and siliceous silver	47,532	933	298,165	151,227	825,678	826,867
Copper	22,511	183	27,189	1,450,995		
Lead	7,338	708	57,439	30,537	1,522,627	217,139
Zinc	3,355	58	31,394	7,406	286,785	588,202
Zinc-lead	566	230	11,537	3,894	258,720	84,049
Total 1947	153,317	14,278	701,334	1,827,163	3,032,219	1,861,486

[1] Includes metals recovered from 48 tons of current tailings smelted.

REVIEW BY COUNTIES AND DISTRICTS

BEAVERHEAD COUNTY

Argenta District.—Shafer Bros. and Harry C. Renz operated the Shafer group throughout the year and shipped 1,780 tons of gold smelting ore containing 1,719 ounces of gold and 5,181 ounces of silver. E. G. Cummings, lessee, worked the Louis Phillip mine and shipped 1,601 tons of lead smelting ore containing 231 ounces of gold, 14,131 ounces of silver, 12,567 pounds of copper, and 360,676 pounds of lead. Remaining district production was mainly lead smelting ore—114 tons from the Daylight claim, 58 tons from the Iron Mountain mine, 33 tons from the May Day claim, 40 tons from the Tuscarora claim, 19 tons from the Rena claim, and 39 tons from the Brownell mine. The Brownell mine also produced 53 tons of gold-silver ore.

Bald Mountain District.—Lessees produced 50 tons of lead smelting ore from the Alice group.

Bryant District.—Output from the Hecla mine and dumps comprised 1,666 tons of old silver slag, 292 tons of old silver tailings, 259 tons of gold-silver ore, 121 tons of zinc ore, and 110 tons of lead ore, all shipped to smelters.

Mine production of gold, silver, copper, lead, and zinc in Montana in 1947, 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	11		3,751	2,020		2,020	20,885		20,885	11,600	418,200	100	$152,270
Bald Mountain	1		50	2		2	179		179	300	11,000		1,879
Bannack		1			4	4							140
Big Hole	1		1	2		2							70
Bryant	1		2,448	168		168	13,273		13,273	22,800	164,700	42,500	51,540
Horse Prairie Creek	1	1	60	1	307	308	158	43	201		12,000		12,690
Medicine Lodge	1		40				84		84		11,600		1,746
Vipond	2		5,249	43		43	48,568		48,568	11,100	1,500		48,006
Broadwater County:													
Backer	2	8	19	200	55	255	295	10	305				9,201
Beaver	7		887	363		363	11,305		11,305	3,300	215,300	61,000	62,013
Cedar Plains	13	1	20,034	2,472	2	2,474	11,948		11,948	46,900	202,500	250,000	166,662
Hell Gate	1		2							200			42
Park or Indian Creek	4	2	4,549	75	1,159	1,234	9,358	105	9,463	1,300	168,200	315,200	114,387
Cascade County: Montana	5		35,932	231		231	191,632		191,632	13,800	1,164,000	1,209,200	498,339
Deer Lodge County:													
Oro Fino	2		15	1		1	378		378				377
Silver Lake	1		429	3		3	2,274		2,274	900	25,500	54,400	12,606
Fergus County: North Moccasin		1			4	4							140
Granite County:													
Boulder and South Boulder	3		549	4		4	5,147		5,147	9,900	25,900	68,600	18,907
Dunkleberg	1		373	14		14	3,621		3,621	1,400	45,800	11,000	11,987
First Chance	2	1	23	29	37	66	21		21			600	2,402
Flint Creek	5		37,673	1,615		1,615	173,716		173,716	133,900	110,500	218,800	284,244
Gold Creek		1			236	236		43	43				8,299
Henderson	3	1	5,329	198	2,650	2,848	19,495	168	19,663	68,800	81,000	44,600	148,984
Maxville	1		85	1		1	463		463		2,800		857
Red Lion	1		57	67		67	10		10				2,354
Jefferson County:													
Amazon	1		48				253		253	700	1,800	2,300	913
Big Foot and State Creek	1		123	23		23	348		348	900	9,000	1,400	2,774
Cataract	14	1	2,448	157	4	161	9,894		9,894	4,100	39,400	35,800	25,456
Clancey		2			8,866	8,866		3,389	3,389				313,377
Colorado	5		600	53		53	4,315		4,315	11,600	36,000	9,600	14,542
Elkhorn	2		14,134	266		266	82,663		82,663	30,400	307,200	593,500	206,555
Golconda	2		34	19		19	232		232		4,900	400	1,629
Lowland	2		184	41		41	2,042		2,042	200	8,000	1,000	4,598
Montana City	1		2	2		2	10		10		200		108
Warm Springs	2		24	4		4	53		53	100	600	900	404
Whitehall	10		11,949	3,876		3,876	7,473		7,473	10,200	347,300	72,500	203,348
Wilson and Ticer Creeks	1		90	63		63	32		32		100		2,248

Judith Basin County: Barker	3	--------	377	13	--------	13	6,484	--------	6,484	2,300	177,000	55,600	39,022
Lewis and Clark County:													
Blue Cloud	1	--------	39	38	--------	38	10	--------	10	100	--------	400	1,408
Canyon Creek	--------	2	--------	--------	13	13	--------	--------	--------	--------	--------	--------	455
Dry Gulch	1	1	24	25	2	27	10	--------	10	--------	--------	1,800	1,172
Grass Valley	2	--------	79	14	--------	14	21	--------	21	--------	100	--------	523
Heddleston	2	--------	53,826	81	--------	81	111,252	--------	111,252	277,700	4,173,400	2,963,800	1,121,425
Helena	3	10	3,402	353	7,553	7,906	4,000	779	4,779	6,700	19,900	67,600	293,488
Jefferson Gulch	1	--------	188	51	--------	51	10	--------	10	--------	--------	200	1,818
Lincoln	1	--------	4	8	--------	8	--------	--------	--------	--------	--------	--------	280
Marysville	10	--------	10,953	4,413	--------	4,413	26,063	--------	26,063	8,200	44,500	28,700	189,645
Missouri River	--------	2	--------	--------	1,916	1,916	--------	252	252	--------	--------	--------	67,288
Rimini	8	1	10,547	365	3	368	33,200	--------	33,200	20,600	337,100	156,900	114,779
Scratch Gravel	4	--------	99	27	--------	27	285	--------	285	500	5,600	1,000	2,235
Smelter	1	--------	7,407	4	--------	4	1,422	--------	1,422	--------	120,900	1,495,200	199,756
Stemple-Gould	1	--------	4	22	--------	22	85	--------	85	--------	--------	--------	847
Lincoln County:													
Libby	--------	2	--------	--------	199	199	--------	11	11	--------	--------	--------	6,975
Troy	1	--------	1	4	--------	4	--------	--------	--------	--------	300	--------	183
West Fisher Creek	1	--------	50	2	--------	2	--------	--------	--------	--------	--------	--------	70
Madison County:													
Norris and Norwegian	6	--------	101	238	--------	238	400	--------	400	400	3,800	1,900	9,553
Pony and South Boulder	1	--------	13	17	--------	17	42	--------	42	--------	--------	300	669
Renova	1	--------	2	2	--------	2	--------	--------	--------	--------	--------	--------	70
Rochester	4	--------	725	39	--------	39	5,285	--------	5,285	1,500	162,800	53,900	36,428
Sheridan	6	2	22,496	552	31	583	50,464	--------	50,464	30,300	762,000	1,054,000	309,700
Silver Star	4	--------	50	56	--------	56	73	--------	73	--------	200	100	2,067
Tidal Wave	5	--------	782	483	--------	483	1,579	--------	1,579	700	11,200	1,600	20,288
Virginia City	3	3	12,650	2,021	284	2,305	96,452	63	96,515	400	500	--------	168,177
Meagher County: Castle Mountain	1	--------	6	--------	--------	--------	53	--------	53	--------	2,500	--------	408
Mineral County:													
Cedar-Trout Creek	1	--------	1	2	--------	2	--------	--------	--------	--------	--------	--------	70
Iron Mountain	1	--------	60	--------	--------	--------	327	--------	327	--------	6,200	300	1,225
Keystone	1	--------	5,000	20	--------	20	12,821	--------	12,821	8,700	99,700	18,200	30,689
Packer Creek	1	--------	1,850	1	--------	1	958	--------	958	1,100	24,300	166,100	24,730
Missoula County:													
Coloma	2	--------	39	52	--------	52	53	--------	53	--------	--------	600	1,941
Copper Cliff	1	--------	65	--------	--------	--------	11	--------	11	--------	5,500	--------	802
Elk Creek	--------	1	--------	--------	2	2	--------	--------	--------	--------	--------	--------	70
Nine Mile	--------	1	--------	--------	1,989	1,989	--------	32	32	--------	--------	--------	69,644
Park County:													
Basin Creek	--------	1	--------	--------	1	1	--------	--------	--------	--------	--------	--------	35
Emigrant Creek	--------	1	--------	--------	1,917	1,917	--------	295	295	--------	--------	--------	67,362
New World	3	--------	41,100	6,213	--------	6,213	42,864	--------	42,864	451,600	234,000	236,000	413,335
Sheepeater	1	--------	68,149	10,140	--------	10,140	1,821	--------	1,821	--------	--------	--------	356,548
Phillips County: Little Rockies	2	--------	71,326	3,964	--------	3,964	12,316	--------	12,316	100	--------	5,000	150,512

Mine production of gold, silver, copper, lead, and zinc in Montana in 1947, 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				
Powell County:													
Big Blackfoot	1	1	5	5	121	126	10	42	52	-	-	100	$4,469
Nigger Hill	7	-	751	56	-	56	5,358	-	5,358	2,200	78,800	17,400	20,723
Ophir Gulch	-	1	-	-	3	3	-	-	-	-	-	-	105
Pioneer	1	3	1	2	72	74	10	10	20	-	200	-	2,637
Zozell	4	-	10,961	1,391	-	1,391	29,916	-	29,916	6,200	475,000	359,100	188,912
Sanders County:													
Camas Prairie	1	-	302	3	-	3	379	-	379	21,500	-	-	4,963
Eagle	1	-	3,552	9	-	9	4,032	-	4,032	16,800	786,000	253,800	151,386
Plains	2	-	12	-	-	-	31	-	31	700	-	-	175
Revais	1	-	908	192	-	192	715	-	715	183,300	-	-	45,860
Silver Bow County:													
Highland	1	-	20	19	-	19	-	-	-	100	-	-	686
Lost Child (Pilgrim Gulch)	-	1	-	-	2	2	-	-	-	-	-	-	70
Melrose	2	-	98	3	-	3	916	-	916	-	10,500	200	2,470
Summit Valley (Butte)	28	-	2,624,797	19,777	-	19,777	5,251,095	-	5,251,095	114,373,900	21,259,000	81,424,800	42,376,652
Yellowstone County: Yellowstone River	-	1	-	-	2	2	-	-	-	-	-	-	70
Total Montana	243	54	3,100,013	62,690	27,434	90,124	6,320,948	5,242	6,326,190	115,800,000	32,216,000	91,358,000	48,890,964

Horse Prairie Creek District.—W. C. McLeod operated a dragline excavator and nonfloating washing plant on the Golden Leaf placer and recovered 307 ounces of gold and 43 ounces of silver from 60,000 cubic yards of gravel. Patterson and Steele shipped 60 tons of lead smelting ore from the H. & S. claim.

Medicine Lodge District.—Ryburn & Ward shipped from the Sweeney mine 40 tons of lead smelting ore containing 84 ounces of silver, 80 pounds of copper, and 12,101 pounds of lead.

Vipond District.—Quartz Hill Mines group was operated all year and produced 2,027 tons of silver smelting ore containing 20 ounces of gold, 26,548 ounces of silver, and 6,081 pounds of copper. L. D. Foreman & Co. shipped 3,220 tons of old silver tailings from the Dewey property. Remaining district output was clean-up material.

BROADWATER COUNTY

Backer District.—White's Gulch Placer Co. operated a dragline and nonfloating washing plant from August to November and washed 1,400 cubic yards of gravel. Perkins & Buckingham treated by amalgamation and concentration about 15 tons of gold ore from the Superior group. Other district production was a few ounces of gold and silver from several small gold lodes and placers.

Beaver District.—H. W. Carver, lessee, worked the East Pacific and No. 4 Tunnel claims and produced 716 tons of zinc-lead ore. Stewart & Schneider worked the Little Bonanza group from June 10 to November 20 and shipped 117 tons of lead smelting ore containing 5 ounces of gold, 2,934 ounces of silver, 570 pounds of copper, 84,128 pounds of lead, and 4,572 pounds of zinc. John Celock shipped 37 tons of gold smelting ore from the Custer group. Remaining district output was small.

Cedar Plains District.—The Rademont Mining Co. operated the Keating mine and produced 3,689 tons of gold concentrate from about 18,000 tons of ore. R. S. Stewart shipped 925 tons of zinc smelting ore from the Ruby Silver mine and then closed the mine on July 1 because of the expiration of the Premium Price Plan. From the Santa Anita claim, 366 tons of lead smelting ore were shipped, which contained 7 ounces of gold, 1,123 ounces of silver, 872 pounds of copper, 90,578 pounds of lead, and 11,534 pounds of zinc. Remaining district production was mainly lead ore—269 tons from the North Home claim, 192 tons from the Joe Dandy group, and 38 tons from the Gopher claim. In addition, lessees shipped 106 tons of silver ore from the Spar claim, 98 tons of zinc ore from the Montana Silver Star group, and 22 tons of gold ore from the Cyclone claim.

Park or Indian Creek District.—The Broadwater Zinc & Lead Co. worked the Iron Mask mine all year and milled 4,300 tons of zinc-lead ore containing 43 ounces of gold, 23,220 ounces of silver, 2,000 pounds of copper, 335,400 pounds of lead, and 748,200 pounds of zinc. From the Diamond Hill claim Palmer Engh produced 233 tons of gold ore, which was treated by amalgamation. Douglas Placers operated its dragline dredge and nonfloating washing plant from April 1 to December 22 and recovered 1,155 ounces of gold and 105 ounces of silver from 50,000 cubic yards of gravel. Remaining district output was small.

CASCADE COUNTY

Montana District.—The Lexington Silver-Lead Mines, Inc., worked the Benton group for 9 months, treated 14,273 tons of zinc-lead ore in a 100-ton flotation mill, and shipped 900 tons of zinc-lead concentrate. From the Dacotah group the Bennett Mining Co. mined 7,581 tons of zinc-lead ore, which was treated in the company 75-ton flotation mill, and produced 226 tons of lead concentrate and 547 tons of zinc concentrate. The Neihart Mine & Milling Co. operated the Broadwater group for 9 months, shipped 9 tons of zinc-lead ore to a smelter, and milled a large tonnage of zinc-lead ore, which produced 268 tons of lead concentrate and 194 tons of zinc concentrate. Several thousand tons of ore from the Star mine were treated in the 50-ton flotation mill on the property; the yield was 395 tons of zinc-lead concentrate and 129 tons of zinc concentrate. Other district production was negligible.

DEER LODGE COUNTY

Silver Lake District.—C. T. DeLude worked the Blue Eyed Nellie claim from May to August and shipped 429 tons of zinc smelting ore.

GRANITE COUNTY

Boulder and South Boulder District.—The Saranac Mining Co., operating the Brooklyn group, produced 187 tons of silver smelting ore containing 2 ounces of gold, 1,556 ounces of silver, 746 pounds of copper, 5,946 pounds of lead, and 1,740 pounds of zinc; and 282 tons of zinc-lead milling ore containing 1 ounce of gold, 1,416 ounces of silver, 997 pounds of copper, 17,862 pounds of lead, and 84,697 pounds of zinc. A 150-ton flotation mill was built on the property in 1947. Remaining district production was 56 tons of copper ore from the Copper State claim and 24 tons of lead ore from the Moonlight claim.

Dunkleberg District.—C. R. Oliphant produced 373 tons of lead smelting ore from the Samuel claim.

First Chance District.—Lode production was 13 tons of gold ore from the Alice claim and 10 tons of similar ore from the Mitchell-Mussigbrod group. Placer production was clean-up material from a dredge formerly operated in the district.

Flint Creek District.—J. C. and Juanita Yob worked the Granite-Bimetallic tailing pile in 1947, which was inactive in 1946, and shipped 35,479 tons of old gold-silver tailings to a smelter. The Taylor-Knapp Co. worked the Moorlight group throughout 1947; output was 494 tons of silver smelting ore containing 11 ounces of gold and 10,044 ounces of silver; and 314 tons of zinc smelting ore containing 10 ounces of gold, 8,557 ounces of silver, 1,209 pounds of copper, 27,520 pounds of lead, and 85,249 pounds of zinc. Remaining district production was 958 tons of zinc ore from the Silver Prince claim, 123 tons of lead ore and 206 tons of silver ore from the Trout group, and 99 tons of silver ore from the Hobo group.

Gold Creek District.—The Master Mining Co. operated a dragline dredge and nonfloating washing plant nearly all year and recovered 236 ounces of gold and 43 ounces of silver.

Henderson District.—The Henderson Creek Placer was worked by H. & H. Mines from April to the end of the year. The bucket-line dredge washed 752,800 cubic yards of gravel and recovered 2,650 ounces of gold and 168 ounces of silver. Remaining district production, all shipped to smelters, was 4,976 tons of old silver tailings and dump ore from the Black Pine property and 353 tons of gold ore from the Queen claim.

Maxville District.—Total district production was 85 tons of silver dump ore from the Queen property.

Red Lion District.—Lessees shipped 57 tons of gold smelting ore from the Glittering Hill claim.

JEFFERSON COUNTY

Amazon District.—Nat Chamberlin shipped 48 tons of silver ore from the Robert Emmett waste dump.

Big Foot and State Creek District.—Stranahan, Craine, & Cowley shipped 123 tons of gold-silver ore from the Mountain Queen claim.

Cataract District.—John Guilio shipped 1,527 tons of old gold-silver tailings from the Comet property. Rufus Turner worked the Gray Lead mine all year and treated 150 tons of gold ore by amalgamation and gravity separation. M. G. Sturgis shipped 428 tons of gold-silver ore from the High Ore claim. From the Morning Glory mine J. K. Curtiss shipped 78 tons of silver ore, which contained 14 ounces of gold and 1,947 ounces of silver, and 37 tons of gold-silver ore, which contained 16 ounces of gold and 1,429 ounces of silver. Remaining district production comprised 89 tons of gold-silver dump ore from the Lady Hennessey property, 52 tons of gold-silver ore from the Crescent claim, and small lots of lead ore and siliceous ores from a number of small producers.

Clancey District.—N. Rogers Gold Mining Co. operated the Jefferson Placers from January 2 to October 24 with a dragline dredge, power shovel, and nonfloating washing plant. It washed 27,150 cubic yards of gold-bearing gravel, which yielded 1,132 ounces of gold and 442 ounces of silver. Winston Bros. operated its bucket dredge on Prickly Pear Creek for about 11 months and washed 1,382,548 cubic yards of gravel.

Colorado District.—Arthur Loiselle, lessee, worked the Chalcopyrite claim from March to September and shipped 139 tons of copper smelting ore containing 6 ounces of gold, 1,048 ounces of silver, and 10,927 pounds of copper. Remaining district production, all shipped to smelters, comprised mainly 165 tons of lead ore from the Mount Washington property, 164 tons of gold-silver ore from the Minah claim, and 130 tons of gold-silver dump ore from the Gregory Mines property.

Elkhorn District.—District output was all silver ore shipped to smelters—1,805 tons from the Elkhorn mine and 12,329 tons from the Elkhorn waste dump.

Golconda District.—Output was all lead smelting ore—25 tons from the Buckeye (Gold Coin) group and 9 tons from the Big Chief claim.

Lowland District.—Albert F. Carlson worked the North Boulder claim for 6 weeks and shipped 54 tons of lead smelting ore containing 5 ounces of gold, 351 ounces of silver, 220 pounds of copper, 8,102 pounds of lead, and 1,256 pounds of zinc. Remaining district production comprised 130 tons of gold-silver ore from the Badger claim and 11 tons of clean-up material from the Newburgh mill.

Whitehall District.—From the Golden Sunlight mine Marvin Riebhoff shipped 10,195 tons of gold smelting ore. George Wolfe worked the Lucky Hit claim all year and shipped 316 tons of gold ore containing 223 ounces of gold, 468 ounces of silver, 2,603 pounds of copper, 8,380 pounds of lead, and 4,316 pounds of zinc. Albert Critchfield operated the Iron Side claim most of the year and shipped 279 tons of lead smelting ore containing 2 ounces of gold, 1,230 ounces of silver, 1,223 pounds of copper, 72,436 pounds of lead, and 14,726 pounds of zinc. Remaining district production was principally lead ore—593 tons from the Carbonate claim, 370 tons from the Perhaps claim, 37 tons from the Inspiration claim, and 14 tons from the Sunny Corner claim. The Sunny Corner mine also produced 76 tons of gold-silver ore and 32 tons of gold ore.

Wilson and Ticer Creeks District.—The Callahan Mining Syndicate, using amalgamation and concentration, treated about 90 tons of gold ore from the Callahan claim.

JUDITH BASIN COUNTY

Barker District.—Thorson & Brazee worked the Wright-Edwards group all year and shipped 129 tons of zinc-lead smelting ore containing 5 ounces of gold, 4,235 ounces of silver, 1,041 pounds of copper, 114,858 pounds of lead, and 26,058 pounds of zinc. Remaining district output was 102 tons of zinc-lead ore from the Liberty (Faith) group and 146 tons of similar ore from the Tiger (Moulton) group.

LEWIS AND CLARK COUNTY

Blue Cloud District.—Output was 39 tons of gold ore from the Pearl claim.

Canyon Creek District.—Two small-scale hand operations recovered 13 ounces of placer gold.

Dry Gulch District.—District production was 24 tons of gold ore from the Easy Money claim and 2 ounces of placer gold from the Oro claim.

Grass Valley District.—Principal output was 76 tons of gold ore from the Consolidated (Cross Fire) claim.

Heddleston District.—The Mike Horse Mining & Milling Co. operated the Mike Horse mine all year and treated in the company 200-ton flotation mill 53,814 tons of zinc-lead ore containing 94 ounces of gold, 124,848 ounces of silver, 559,666 pounds of copper, 4,724,869 pounds of lead, and 3,573,250 pounds of zinc. Remaining district output was 12 tons of lead ore from the Rogers Pass claim.

Helena District.—Porter Bros. Corp. operated its 6-cubic-foot Yuba bucket dredge on Last Chance Gulch throughout 1947 and washed 1,917,890 cubic yards of gravel. The rest of the district output was largely 3,392 tons of siliceous tailings from the Whitlatch Union property and the Peck mill.

Jefferson Gulch District.—Ray Crumb worked the Humdinger mine and treated about 188 tons of gold ore by amalgamation and concentration.

Marysville District.—The Montana Rainbow Mining Co. operated the Drumlummon mine all year and treated 10,000 tons of gold ore in its 150-ton amalgamation-flotation mill. The Belmont-Cruse-Bald Mountain group produced 230 tons of gold ore containing 122 ounces of gold, 728 ounces of silver, and 254 pounds of copper. Remaining district output was largely 182 tons of lead ore and 21 tons of silver ore from the Tousley-Nile claim, 43 tons of lead ore from the Paragon claim, and 425 tons of old siliceous tailings from the Big Ox and Trinity properties.

Missouri River District.—Perry-Schroeder Mining Co. operated its 6-cubic-foot bucket dredge on Eldorado Bar until July 1 and then moved it to French Bar for the remainder of the year; a total of

525,337 cubic yards of gravel was washed. Ted Nyquist operated a dry washer on the Canyon Ferry placer claim during the latter part of 1947 and recovered 12 ounces of gold and 3 ounces of silver from 310 cubic yards of gravel.

Rimini District.—From the Valley Forge waste dump lessees produced 556 tons of zinc-lead concentrate from milling several thousand tons of zinc-lead ore and, in addition, shipped 81 tons of the material to a smelter. Lessees mined 796 tons of silver ore and 196 tons of lead ore from the Bunker Hill-Evergreen claims and 92 tons of lead ore and 91 tons of gold-silver ore from the Copper Dyke group. From the Anna May-Broadway group, 60 tons of lead smelting ore were shipped, which contained 8 ounces of gold, 396 ounces of silver, 243 pounds of copper, 8,193 pounds of lead, and 5,928 pounds of zinc. Remaining district production was principally 1,031 tons of siliceous dump ore from the Eureka, Red Mountain Consolidated, Stanton, and Peerless Jennie properties.

Scratch Gravel District.—Output was 23 tons of gold ore from the Ajax claim, 45 tons of gold-silver ore from the Franklin waste dump, 23 tons of similar ore from the Julia dump, and 8 tons of lead ore from the Magpie claim.

Smelter District.—Hot slag and cold slag treated at the East Helena slag-fuming plant of the Anaconda Copper Mining Co. totaled 226,668 tons in 1947, compared with 161,306 tons in 1946, but only the metals recovered from fuming 7,403 tons of old cold lead-smelter slag were credited to the slag dump as a producer in the district. The remaining metals, after elimination of material from foreign sources, were credited to the individual domestic mines producing the ores and concentrates treated at the lead smelter.

LINCOLN COUNTY

Libby District.—Lessees operated a hydraulic giant on the Liberty placer claim from April 15 to July 12 and recovered 195 ounces of gold and 11 ounces of silver from 15,680 cubic yards of gravel. Remaining district output was small.

MADISON COUNTY

Norris and Norwegian District.—The bulk of production in 1947 was 80 tons of gold smelting ore from the Boaz group.

Rochester District.—Jacobson & Keene, lessees, worked the Calvin Mines from January to July and shipped 584 tons of lead smelting ore containing 25 ounces of gold, 4,045 ounces of silver, 1,354 pounds of copper, 131,662 pounds of lead, and 58,108 pounds of zinc; McLaughlin & Knitter, lessees, shipped 72 tons of similar ore from the Jack Rabbit claim. The Emma mine, after being pumped out in November, was sampled at different levels, and 65 tons of zinc-lead ore were shipped to a smelter. Remaining district production was small.

Sheridan District.—Victoria Mines, Inc., treated a large tonnage of zinc-lead ore in the company mill and produced 969 tons of zinc concentrate and 586 tons of lead concentrate; in addition, 449 tons of zinc ore went direct to a smelter. Lessees produced 212 tons of silver ore from the Silversmith mine, and Charles D. Storer shipped 27 tons of silver ore from the Silver Bullion group. Small-scale placer mining recovered 31 ounces of gold from the Ihde and Pine claims. Remaining district production was small.

Silver Star District.—The bulk of the output was 23 tons of gold ore from the Silver King Extension mine and 14 tons of similar ore from the Aurora claim.

Tidal Wave District.—Lessees operated the Corncracker group and shipped to smelters 231 tons of gold ore containing 172 ounces of gold and 149 ounces of silver. Remaining district production likewise was nearly all gold ore—106 tons from the Giant Lode claim, 292 tons from the High Ridge and High Ridge Fraction claims, 112 tons from the Smith claim, and 36 tons (as well as 5 tons of lead ore) from the Granger group.

Virginia City District.—The U. S. Grant Mining Co. operated its U. S. Grant mine all year and shipped to smelters 12,518 tons of gold-silver ore containing 2,005 ounces of gold, 95,568 ounces of silver, and 436 pounds of copper. The company also operated the Alameda-Wa Koosta-Bamboo Chief group and shipped 130 tons of gold-silver smelting ore. Russell Unrue operated a dragline dredge on the Barton Gulch placer from August through October and washed 30,000 cubic yards of gravel. Other district output was small.

MINERAL COUNTY

Iron Mountain District.—The Smith Mining Co. sampled the Iron Mountain group and milled about 60 tons of lead ore.

Keystone District.—Lessees at the Nancy Lee group produced 111 tons of lead concentrate from milling a quantity of lead ore in the 100-ton flotation mill on the property.

Packer Creek District.—In September, lessees began operating the Silver Cable mine and during the remainder of the year hauled 1,850 tons of zinc-lead ore to a custom mill,which yielded 18 tons of lead concentrate and 143 tons of zinc concentrate.

MISSOULA COUNTY

Coloma District.—Output was gold smelting ore—27 tons from the Mammoth & East Mammoth group and 12 tons from the Dixie claim.

Copper Cliff District.—The Hecla Mining Co. opened the Black Tail mine and milled 65 tons of lead ore containing 14 ounces of silver and 6,784 pounds of lead.

Nine Mile District.—Canusco, Inc., worked placer ground on Nine Mile and McCormick Creeks with a dragline dredge and recovered 1,989 ounces of gold and 32 ounces of silver from 446,194 cubic yards of gravel.

PARK COUNTY

Emigrant Creek District.—The Emigrant Dredging Co. operated its bucket-line dredge until August 26, when it ceased operations and dismantled the dredge. During the period of operation, 820,000 cubic yards of gravel were handled.

New World District.—McLaren Gold Mines Co. operated the Estelle-New Year's Gift mine all year and treated in the company 200-ton concentration mill about 38,500 tons of copper ore. Zinc-lead ore produced at the Irma mine yielded 283 tons of lead concentrate and 212 tons of zinc concentrate. Ex-Cello Mines worked the Homestake claim through August and September and shipped to a smelter 124 tons of gold-silver ore containing 24 ounces of gold, 538 ounces of silver, and 3,894 pounds of copper.

Sheepeater District.—The Jardine Mining Co. operated its Jardine mine all year and treated 68,149 tons of gold ore in the company cyanidation-flotation mill. The yield was 10,140 ounces of gold and 1,821 ounces of silver.

PHILLIPS COUNTY

Little Rockies District.—The Ruby Gulch Mining Co. operated the Ruby group all year and treated in the company 350-ton cyanidation mill 71,230 tons of gold ore containing 4,500 ounces of gold and 8,500 ounces of silver. In addition, 9 tons of gold ore were shipped to a smelter. Lessees worked the Little Ben claim for about 5 months and shipped 87 tons of gold-silver ore.

POWELL COUNTY

Big Blackfoot District.—John B. Hopkins & Associates worked the Wilson Creek placer claims all year by drift mining and washed about 2,240 yards of gravel. Remaining district output was mill cleanings.

Nigger Hill District.—Hopkins & Sons Mining Co., lessees, operated the Charter Oak mine all year and shipped 610 tons of lead smelting ore containing 42 ounces of gold, 4,220 ounces of silver, 1,480 pounds of copper, 68,275 pounds of lead, and 16,288 pounds of zinc. Remaining district production was principally 56 tons of zinc-lead ore from the Sunnyside and Sunset claims, 51 tons of silver ore from the Surething group, and 16 tons of lead ore from the Third Term claim.

Pioneer District.—Principal production came from intermittent dragline operations of the Montana Mines, Inc., during July, August, and September.

Zozell District.—The Deer Lodge Mining Co. worked the Emery group all year and in September began operating a new 80-ton flotation mill on the property; 8,981 tons of zinc-lead ore were treated. The Bonanza group was operated 9 months by the Bonanza Leasing Co.; production was 1,853 tons of gold ore containing 686 ounces of gold and 3,569 ounces of silver; and 71 tons of lead ore containing 8 ounces of gold, 1,800 ounces of silver, 141 pounds of copper, 36,630 pounds of lead, and 7,684 pounds of zinc. Remaining district output was mainly 47 tons of gold ore and 2 tons of lead ore from the Hidden Hand claim.

SANDERS COUNTY

Camas Prairie District.—Laurence G. Howard operated the Glaucus & Cardiff mine until the expiration of the Premium Price Plan in June, shipping 302 tons of copper smelting ore, which contained 3 ounces of gold, 379 ounces of silver, and 22,196 pounds of copper.

Eagle District.—The Jack Waite mine, operated the entire year by the American Smelting & Refining Co., produced 61 tons of zinc smelting ore and 3,491 tons of zinc-lead milling ore. The milling ore yielded 512 tons of lead concentrate and 215 tons of zinc concentrate.

Revais District.—The Drake group was operated all year by the Green Mountain Mining Co. Production was 198 tons of copper smelting ore and several hundred tons of copper milling ore.

SILVER BOW COUNTY

Ore production in Silver Bow County in 1947 was 44 percent above that in 1946, and the output of zinc increased 473 percent, lead 351, gold 186, and silver 117 percent; copper production, however, declined 1 percent. The total value of the five metals in 1947 was nearly 83 percent greater than in 1946. The following table gives the output of mines in Silver Bow County, which includes the Summit Valley (Butte) district, in 1946 and 1947 and the total from 1882 to the end of 1947.

Production of gold, silver, copper, lead, and zinc in Silver Bow County, Mont., 1946–47, and total, 1882–1947, 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
1946	27	1,827,606	6,926	2,417,969	115,809,000	4,713,000	14,216,500	$23,205,317
1947	32	2,624,915	19,801	5,252,011	114,374,000	21,269,500	81,425,000	42,379,878
1882–1947		(1)	2,045,998	551,036,990	(2) 6,601,006	(2) 245,497	(2) 1,611,482	2,641,791,890

[1] Figure not available.
[2] Short tons.

Highland District.—Total output was 20 tons of gold ore from the Only Chance claim.

Melrose District.—Production was 40 tons of lead ore from the George Peabody claim and 58 tons of silver ore from the Old Glory mine.

Summit Valley (Butte) District.—The copper concentrator of the Anaconda Copper Mining Co. at Anaconda treated 1,178,845 tons of copper ore from company-owned Butte mines in 1947 (1,187,143 tons in 1946); 4,050 tons of copper mine-water precipitates were produced (4,203 tons in 1946). Additional company material treated in the concentrator was as follows (1946 figures in parentheses): Special waste, 59,926 tons (29,286 tons); mixed Butte slimes and tailings, 91,866 tons (171,646 tons); and East Project and Adams ore, 286,550 tons (53,671 tons). Direct smelting ore totaled 21,391 tons (19,846 tons in 1946). The slime-disintegrating plant, which treated 252,462 tons in 1946, was permanently closed in 1947.

Zinc-lead ore from the Butte Hill mines of the Anaconda Copper Mining Co. totaled 465,385 tons in 1947, compared with 766 tons in 1946, and that from the Butte Hill dumps totaled 298,654 tons, compared with 31,973 tons in 1946. These two sources were the chief factor in raising Montana's zinc production in 1947 far above that in 1946, and accounted for 15,000,000 pounds of recoverable lead, 3,000,000 ounces of silver, more than 11,000 ounces of gold, and 2,500,000 pounds of copper. The company continued to operate the Emma mine and produced 27,254 tons of zinc-lead dump ore and mine ore and middling from the treatment of manganese ore. Zinc-lead middling (5,172 tons) was also produced in milling manganese ore from the Travona mine; the middling was treated further at the Anaconda zinc concentrator. The remaining large producer of zinc in the district was the Poulin mine, operated under lease from the Anaconda Copper Mining Co.; 11,213 tons of zinc-lead ore were produced.

The North Butte Mining Co. closed the North Butte mine in August because of the expiration of the Premium Price Plan. During the year the mine produced 67,806 tons of copper milling ore and 109 tons of copper smelting ore. Old copper tailings (91,866 tons) from the Montana Ore Purchasing Co. dump near Butte were shipped in 1947 to the Anaconda copper concentrator for treatment.

From the remaining 20 or more active properties in the district, only siliceous silver ore was produced in significant tonnages. The more important of these were the Fredonia, 477 tons; Elba, 507 tons (dump ore); Lena K, 4,074 tons (dump ore); Burlington, 1,265 tons; Bluebird, 1,789 tons (dump ore); Little Darling, 8,055 tons (dump ore); and Nettie, 1,001 tons.

Nevada
Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By ALFRED L. RANSOME

GENERAL SUMMARY

THE quantity of zinc produced in Nevada in 1947 showed a marked decline from the record level attained in 1946, largely owing to the expiration of the Premium Price Plan for copper, lead, and zinc on June 30. The effect of the termination of this plan on copper and lead production was negligible, as the rise in the market price of copper and lead (to an unprecedented level), a greater labor supply, and a strong demand were factors contributing to a maintained level of output. The higher Government price paid for silver after June 30, 1946, was a principal factor in the 10-percent rise in production of this metal, whereas gold output was slightly below that of 1946 and was the lowest in quantity since 1895. The total value of gold, silver, copper, lead, and zinc recovered from ore, old tailings, and gravels in Nevada in 1947 was $31,366,282, compared with $27,026,416 in 1946—an increase of 16 percent—owing to the greater average price of these metals except gold and zinc.

Comparing 1947 with 1946, gold output decreased 2 percent in quantity and value, lead decreased a fraction of 1 percent in quantity but advanced 32 percent in value; zinc decreased 25 percent in quantity and 26 percent in value; silver increased 10 percent in quantity and 23 percent in value; and copper increased 2 percent in quantity and 32 percent in value. Of the total value of the five metals, copper comprised 66 percent; zinc, 13 percent; gold, 10 percent; lead, 7 percent; and silver, 4 percent.

White Pine County continued its lead over the other counties by producing 70 percent of the State total value of the five metals; it stood first in output of copper and gold, second in silver, third in lead, and fourth in zinc. Lincoln County ranked second to White Pine County, with 17 percent of the State total value; it led the State in production of silver, lead, and zinc.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1943–47, and total, 1859–1947, 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
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
1946	193	33	5,725,805	90,680	3,173,800	1,250,651	1,010,526
1947	276	31	6,541,635	89,063	3,117,205	1,377,579	1,246,709
1859–1947 [2]			(3)	25,606,064	574,773,916	590,981,291	541,973,311

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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
1946	97,232,000	15,751,584	14,350,000	1,564,150	45,298,000	5,526,356	27,026,416
1947	99,206,000	20,833,260	14,322,000	2,062,368	33,940,000	4,106,740	31,366,282
1859–1947 [2]	[4] 1,832,271	526,536,782	[4] 554,341	62,309,885	[4] 364,458	59,595,256	1,765,189,150

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] From 1904 (when first satisfactory annual canvass of mine production was made) to 1947, inclusive, the output was as follows: Gold, 13,799,187.51 ounces valued at $330,290,683; silver, 302,568,442 ounces, $204,815,088; copper, 1,830,345 tons, $525,890,154; lead, 316,550 tons, $39,673,323; zinc, 364,458 tons, $59,595,256; total value, $1,160,264,504.
[3] Figure not available.
[4] Short tons.

Gold.—Gold production in Nevada in 1947, decreasing 2 percent below the 1946 output, was the lowest in quantity since 1895 and in value since 1933. Continued rising costs of labor, supplies, and equipment left little incentive to mine gold at the established and unchanged price. Although the output from placer mines decreased 53 percent below the total for 1946 (largely owing to the termination of operation of Nevada's only connected-bucket dredge), gold from a greater number of lode mines—which accounted for 92 percent of the State's total gold production—increased 8 percent. Monthly production of gold, as shown in the accompanying table, was erratic, with no definite trend indicated. Byproduct gold from base-metal ores comprised 53 percent of the output of gold, again exceeding the gold recovered from precious-metal ores, which was 39 percent of the total.

The 10 leading gold-producing mines in 1947 produced 87 percent of Nevada's output, the 3 leaders contributing 63 percent.

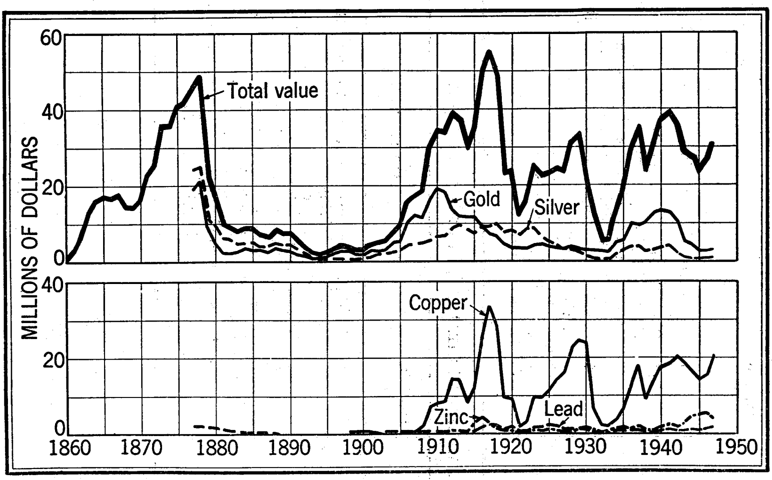

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value of Nevada, 1860–1947.

Silver.—As in preceding years, most of the silver output of Nevada was a byproduct of ore mined chiefly for other metals. Base-metal ores were the source of 71 percent of the State's silver production in 1947; only 13 percent of the silver (compared with 5 percent in 1946) was derived from straight silver ore. The monthly production figures in the accompanying table show no definite trend in the first 6 months of 1947. Peak production attained in June was followed by a gradually diminishing output of silver for the remainder of the year. The 10 leading silver-producing mines in Nevada in 1947 produced 63 percent of the State total recoverable silver, the first three yielding 38 percent of the total.

Ten leading gold-producing mines in Nevada in 1947, in order of output

Rank	Mine	District	County	Rank in 1946	Operator	Source of gold
1	Ruth and Copper Flat pit	Robinson	White Pine	1	Kennecott Copper Corp. (Nevada Mines Division).	Copper ore.
2	Goldacres	Bullion	Lander	4	Consolidated Goldacres Co	Gold ore.
3	Coppermines group	Robinson	White Pine	2	Consolidated Coppermines Corp	Copper ore.
4	Overman	Comstock	Storey	5	Consolidated Chollar Gould & Savage	Gold ore.
5	Standard	Echo (Rye Patch)	Pershing	8	Standard Cyaniding Co	Do.
6	Pioche group	Pioche	Lincoln	7	Combined Metals Reduction Co. and Raymond Ely West Mining Co.	Zinc-lead ore.
7	Copper Canyon	Battle Mountain	Lander	6	Copper Canyon Mining Co	Copper ore.
8	Dayton dredge	Silver City	Lyon	11	Grafe-Dayton Dredging Co	Dragline.
9	Greenan placers	Battle Mountain	Lander	26	Natomas Co	Do.
10	Silver Hill group	Silver City	Lyon	12	William M. Donovan	Gold and lead ore.

Ten leading silver-producing mines in Nevada in 1947, in order of output

Rank	Mine	District	County	Rank in 1946	Operator	Source of silver
1	Pioche group	Pioche	Lincoln	1	Combined Metals Reduction Co. and Raymond Ely West Mining Co.	Zinc-lead ore.
2	Ruth and Copper Flat pit	Robinson	White Pine	2	Kennecott Copper Corp	Copper ore.
3	Bristol Silver	Jack Rabbit	Lincoln	3	Bristol Silver Mines Co	Do.
4	Overman	Comstock	Storey	8	Consolidated Chollar Gould & Savage	Gold ore.
5	Tonopah Mining Co	Tonopah	Nye	5	Tonopah Mining Co. of Nevada	Gold-silver ore.
6	Alpha Rye Patch	Echo (Rye Patch)	Pershing	[1]	Standard Cyaniding Co	Silver ore.
7	Cleveland	Delano	Elko	4	McFarland & Hullinger	Lead ore.
8	Coppermines group	Robinson	White Pine	9	Consolidated Coppermines Corp	Copper ore.
9	Apex	Pioche	Lincoln	22	Salt Lake Pioche Mining Co	Lead ore.
10	Prince	do	do	6	Prince Consolidated Mining Co	Lead and zinc-lead ore.

[1] Did not operate in 1946.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1947, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	8,345	121,412	3,467	537	1,976
February	7,364	107,251	4,164	508	1,766
March	6,506	95,395	4,269	567	1,413
April	6,751	107,251	4,217	537	1,355
May	8,345	137,110	4,815	664	1,260
June	7,844	151,271	3,157	616	1,689
July	7,711	140,491	4,216	611	1,289
August	8,150	111,401	4,580	660	1,336
September	7,977	100,599	4,341	547	1,355
October	7,507	104,507	4,153	586	1,432
November	6,435	102,092	4,060	664	1,145
December	6,128	98,799	4,164	664	954
Total 1947	89,063	1,377,579	49,603	7,161	16,970

Copper.—The three leading copper producers in Nevada in 1947 accounted for 98 percent of the copper output; these were: The Kennecott Copper Corp. (Nevada Mines Division), working the Ruth and the Copper Flat open-pit mines; the Consolidated Coppermines Corp., working the Coppermines group at Kimberly (all in the Robinson district, White Pine County); and the Mountain City Copper Co., working the Mountain City mine at Mountain City (in the Cope district, Elko County). The Mountain City mine was permanently shut down in September 1947 after an extensive development program failed to disclose additional ore bodies.

Lead.—Of the recoverable lead produced in Nevada in 1947, 49 percent was mined in the Pioche district, Lincoln County, where the leading properties were: The Combined Metals Reduction Co., working the Pioche No. 1 and 2 groups and the Raymond Ely West Mining Co. property; and the Ely Valley mine, operated by Ely Valley Mine. Other important lead producers in the State were: Hamilton & Jacobson, operating the Yellow Pine mine, Yellow Pine district, Clark County (second largest producer of lead in Nevada); McFarland & Hullinger, Cleveland mine (Delano district, Elko County); Bratton and Blair, shipping calcined mercury ore, Nevada Quicksilver and Red Bird mines (Antelope Springs district, Pershing County); and the Nevada Lead & Zinc Co., Nevada Lead mine (Spruce Mountain district, Elko County).

Zinc.—In 1947, as in recent years, zinc production in Nevada was centered in the Pioche district, Lincoln County, where 85 percent of the State total for the year was mined. The Combined Metals Reduction Co. (including the Raymond Ely West property) and Ely Valley Mine were the State's leading producers, in the order named; both are in the Pioche district. Other important zinc producers in the State were: Callahan Zinc-Lead Co., Mount Hope mine, Eureka district, Eureka County (closed down after a fire on March 10, which destroyed the power plant); Prince Consolidated Mining Co., Prince mine (Pioche district, Lincoln County); and Hamilton & Jacobson Yellow Pine mine (Yellow Pine district, Clark County). The monthly State total production in the accompanying table showed a peak output in January, followed by a gradual decrease until June when a recovery was recorded. Production during the last 6 months of 1947 was erratic, but followed a downward trend which was the result of the termination on June 30 of the Premium Price Plan for copper, lead, and zinc.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1947, 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	9	1	63	$2,205	63	$2,205	126	$4,410	5,295	$4,792
Clark	29		1,777	62,195			1,777	62,195	35,487	32,116
Douglas	1		14	490			14	490	5	5
Elko	27	1	500	17,500	83	2,905	583	20,405	111,693	101,082
Esmeralda	8	2	388	13,580	7	245	395	13,825	2,157	1,952
Eureka	8	1	61	2,135	87	3,045	148	5,180	64,606	58,468
Humboldt	13	1	531	18,585	11	385	542	18,970	8,629	7,809
Lander	15	2	20,676	723,660	2,126	74,410	22,802	798,070	59,048	53,438
Lincoln	16		3,902	136,570			3,902	136,570	553,899	501,279
Lyon	12	2	1,599	55,965	2,928	102,480	4,527	158,445	14,696	13,300
Mineral	21	3	458	16,030	27	945	485	16,975	44,075	39,888
Nye	36	7	1,732	60,620	1,193	41,755	2,925	102,375	132,292	119,724
Ormsby	3		9	315			9	315	769	696
Pershing	15	10	5,093	178,255	464	16,240	5,557	194,495	76,522	69,252
Storey	8	1	5,016	175,560	12	420	5,028	175,980	68,621	62,102
Washoe	4		194	6,790			194	6,790	66	60
White Pine	51		40,049	1,401,715			40,049	1,401,715	199,719	180,746
Total: 1947	276	31	82,062	2,872,170	7,001	245,035	89,063	3,117,205	1,377,579	1,246,709
1946	193	33	75,894	2,656,290	14,786	517,510	90,680	3,173,800	1,250,651	1,010,526

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill	22,000	$4,620	16,000	$2,304			$16,126
Clark	66,000	13,860	1,180,000	169,920	1,450,000	$175,450	453,541
Douglas							495
Elko	2,294,000	481,740	1,596,000	229,824	496,000	60,016	893,067
Esmeralda			28,000	4,032			19,809
Eureka	20,000	4,200	690,000	99,360	1,804,000	218,284	385,492
Humboldt	4,000	840	10,000	1,440			29,059
Lander	1,034,000	217,140	86,000	12,384			1,081,032
Lincoln	422,000	88,620	7,818,000	1,125,792	29,224,000	3,536,104	5,388,365
Lyon	102,000	21,420	4,000	576			193,741
Mineral	12,000	2,520	712,000	102,528	106,000	12,826	174,737
Nye	18,000	3,780	240,000	34,560	16,000	1,936	262,375
Ormsby	6,000	1,260	12,000	1,728			3,999
Pershing	6,000	1,260	624,000	89,856	6,000	726	355,589
Storey							238,082
Washoe							6,850
White Pine	95,200,000	19,992,000	1,306,000	188,064	838,000	101,398	21,863,923
Total: 1947	99,206,000	20,833,260	14,322,000	2,062,368	33,940,000	4,106,740	31,366,282
1946	97,232,000	15,751,584	14,350,000	1,564,150	45,298,000	5,526,356	27,026,416

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

MINING INDUSTRY

The 14-percent increase in total tonnage of ores and old tailings sold or treated in Nevada in 1947 compared with 1946 reflects an increase in total dry and siliceous ores (to a large extent used as fluxing ore at base-metal smelters) and an increase in all the base-metal ores except zinc ore and zinc-lead ore. These increases in production resulted from higher prices for the metals (except gold and zinc). It is notable that production of zinc ore and zinc-lead ore (especially among the smaller operations) declined after premium prices for zinc were discontinued on June 30, 1947.

The dragline dredge of the Grafe-Dayton Dredging Co. in the Silver

City district, Lyon County, was the largest producer of placer gold and the eighth largest producer of gold in the State in 1947. Except for this dredge and the Natomas Co. dragline dredge in Lander County, Nevada placer mines were limited almost entirely to small-scale hand operations. The connected-bucket dredge of the Manhattan Gold Dredging Co. in the Manhattan district, Nye County (largest producer of placer gold in Nevada in 1946), was not operated during 1947.

ORE CLASSIFICATION

The accompanying table classifying ores sold or treated in Nevada in 1947 shows that 89 percent of the tonnage (including old tailings) was copper ore, 7 percent gold ore and old tailings, 3 percent zinc-lead ore, and the remainder silver ore and old tailings, lead ore, gold-silver ore and old tailings, zinc ore, and zinc-lead-copper ore.

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore and old tailings sold or treated in Nevada in 1947, with content in terms of recovered metals

Source	Material sold or treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
Dry and siliceous gold ore	425,142	205	32,796	102,813	60,800	6,400	
Dry and siliceous gold-silver ore	9,872	1,775	1,699	108,993	17,800	68,500	
Dry and siliceous silver ore	10,242	14,852	581	182,699	28,700	455,300	113,100
	445,256	16,832	35,076	394,505	107,300	530,200	113,100
Copper ore	5,828,016		42,673	285,249	[1] 98,937,800	332,100	251,300
Lead ore	24,139		555	243,440	62,900	4,867,700	70,600
Zinc ore	3,913		28	7,082	31,800	264,600	1,024,900
Zinc-lead ore	223,291		3,728	441,359	56,200	8,289,900	32,441,100
Zinc-lead-copper ore	188		2	3,207	10,000	37,500	39,000
Total lode mines	6,524,803	16,832	82,062	1,374,842	[1] 99,206,000	14,322,000	33,940,000
Placers			7,001	2,737			
Total: 1947	6,524,803	16,832	89,063	1,377,579	[1] 99,206,000	14,322,000	33,940,000
1946	5,719,438	6,367	90,680	1,250,651	[2] 97,232,000	14,350,000	45,298,000

[1] Includes 2,607,400 pounds of copper from precipitates.
[2] Includes 3,229,000 pounds of copper from precipitates.

METALLURGIC INDUSTRY

Of the 6,541,635 tons of lode material from Nevada mines sold or treated during 1947, 91 percent went to concentrating mills, 7 percent to amalgamation and cyanidation mills, and 2 percent to smelters. Of the total, 16,832 tons (0.3 percent) were old tailings treated largely by cyanidation and smelting; a smaller tonnage was treated by amalgamation. Flotation was employed at concentration mills to the virtual exclusion of gravity concentration.

The 1,500-ton selective-flotation mill (increased from a 600-ton capacity in 1946) 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 milled company zinc-lead ore. The Kennecott Copper Corp. treated all the copper ore produced by the Consolidated Coppermines Corp., on a contract basis, in addition to milling its own ore. It also operated the McGill copper smelter, Nevada's only smelter.

Mine production of metals in Nevada in 1947, 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 old tailings amalgamated	5,639	2,345	1,371	---	---	---
Ore and old tailings cyanided	432,444	28,117	151,043	---	---	---
Concentrates smelted:						
Flotation	220,500	45,818	587,495	92,097,500	7,163,300	30,830,300
Gravity	424	102	8,134	1,700	156,500	96,600
Ore and old tailings smelted	141,815	5,680	626,799	4,499,400	7,002,200	3,013,100
Precipitates smelted	---	---	---	2,607,400	---	---
Total lode mines	---	82,062	1,374,842	99,206,000	14,322,000	33,940,000
Placers	---	7,001	2,737	---	---	---
Total: 1947	---	89,063	1,377,579	99,206,000	14,322,000	33,940,000
1946	---	90,680	1,250,651	97,232,000	14,350,000	45,298,000

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Nevada in 1947, 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] (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
				AMALGAMATION MILLS						
Clark	2,323	---	740	145	---	---	---	---	---	---
Douglas	60	---	14	5	---	---	---	---	---	---
Elko	300	145	51	80	---	---	---	---	---	---
Humboldt	290	---	442	252	---	---	---	---	---	---
Lander	20	---	7	1	---	---	---	---	---	---
Lincoln	30	---	7	6	---	---	---	---	---	---
Lyon	95	---	42	44	---	---	---	---	---	---
Mineral	129	---	55	267	---	---	---	---	---	---
Nye	665	60	474	262	---	---	---	---	---	---
Pershing	909	---	319	243	9	82	110	---	500	---
Washoe	613	---	194	66	---	---	---	---	---	---
Total: 1947	5,434	205	2,345	1,371	9	82	110	---	500	---
1946	3,502	---	1,915	1,397	20	177	492	---	---	---
				CYANIDATION MILLS						
Churchill	186	---	23	829	---	---	---	---	---	---
Clark	3,617	1,700	125	4,091	33	759	2,366	---	4,100	---
Humboldt	---	75	4	95	---	---	---	---	---	---
Lander	134,614	---	16,995	2,139	---	---	---	---	---	---
Lyon	10,454	---	1,516	12,691	---	---	---	---	---	---
Mineral	33	---	13	168	---	---	---	---	---	---
Pershing	143,635	11,104	4,511	63,047	1	11	1,678	300	---	---
Storey	127,026	---	4,930	67,983	---	---	---	---	---	---
Total: 1947	419,565	12,879	28,117	151,043	34	770	4,044	300	4,100	---
1946	301,428	1,865	20,298	71,882	54	15	2,960	---	6,000	---
Grand total:										
1947	424,999	13,084	30,462	152,414	43	852	4,154	300	4,600	---
1946	304,930	1,865	22,213	73,279	74	192	3,452	---	6,000	---

[1] Figures under "Ore" include both raw ore and concentrates amalgamated or cyanided, but not raw ore concentrated before amalgamation or cyanidation of concentrates.

Mine production of metals from concentrating mills in Nevada in 1947, in terms of recovered metals

	Ore treated (short tons)	Concentrates smelted and recovered metal [1]					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES							
Churchill	10	1	6	49	----------	----------	----------
Clark	5, 305	563	12	6, 211	2, 000	286, 700	117, 900
Elko	23, 412	5, 844	113	4, 363	1, 961, 200	53, 300	53, 400
Eureka	13, 767	1, 903	31	25, 495	13, 700	111, 100	1, 804, 000
Lander	30, 661	3, 794	2, 854	20, 839	262, 400	21, 500	----------
Lincoln	202, 323	34, 085	3, 619	386, 053	----------	6, 758, 500	28, 935, 900
Mineral	225	48	1	1, 423	300	45, 500	----------
Nye	359	27	----------	2, 130	400	5, 500	15, 600
White Pine	5, 685, 675	174, 616	38, 432	144, 912	89, 858, 900	33, 100	100
Total: 1947	5, 961, 737	220, 881	45, 068	591, 475	92, 098, 900	7, 315, 200	30, 926, 900
1946	5, 303, 641	234, 747	45, 936	662, 963	87, 347, 100	7, 936, 200	40, 255, 700
BY CLASSES OF CONCENTRATES							
Dry gold		2	13	55	----------	----------	----------
Copper		184, 131	41, 397	168, 629	92, 080, 500	21, 500	----------
Lead		6, 965	2, 444	277, 780	3, 500	6, 545, 700	1, 040, 700
Zinc		29, 417	1, 212	138, 279	13, 500	665, 100	29, 774, 100
Zinc-lead		366	2	6, 732	1, 400	82, 900	112, 100
Total 1947		220, 881	45, 068	591, 475	92, 098, 900	7, 315, 200	30, 926, 900

[1] Includes in 1946 concentrates and metals from tungsten ore not included in "Ore treated."

Gross metal content of concentrates produced from ores mined in Nevada in 1947, by classes of concentrates

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	44	864	4, 114	699	5, 023	----------
Dry silver	1	1	95	----------	----------	----------
Copper	184, 131	41, 397	168, 629	94, 356, 074	35, 866	----------
Lead	6, 965	2, 444	277, 780	4, 544	6, 660, 708	1, 247, 557
Zinc	29, 417	1, 212	138, 279	14, 428	891, 840	30, 391, 866
Zinc-lead	366	2	6, 732	1, 574	84, 431	153, 763
Total: 1947	220, 924	45, 920	595, 629	94, 377, 319	7, 677, 868	31, 793, 186
1946	234, 821	46, 128	666, 415	89, 518, 420	8, 156, 211	41, 674, 753

Mine production of metals from Nevada concentrates shipped to smelters in 1947, in terms of recovered metals

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Churchill	1	6	49			
Clark	596	771	8,577	2,000	290,800	117,900
Elko	5,844	113	4,363	1,961,200	53,300	53,400
Eureka	1,903	31	25,495	13,700	111,100	1,804,000
Lander	3,794	2,854	20,839	262,400	21,500	
Lincoln	34,085	3,619	386,053		6,758,500	28,935,900
Mineral	48	1	1,423	300	45,500	
Nye	27		2,130	400	5,500	15,600
Pershing	10	93	1,788	300	500	
White Pine	174,616	38,432	144,912	89,858,900	33,100	100
Total: 1947	220,924	45,920	595,629	92,099,200	7,319,800	30,926,900
1946	234,821	46,128	666,415	87,347,100	7,942,200	40,255,700
BY CLASSES OF CONCENTRATES						
Dry gold	44	864	4,114	300	4,600	
Dry silver	1	1	95			
Copper	184,131	41,397	168,629	92,080,500	21,500	
Lead	6,965	2,444	277,780	3,500	6,545,700	1,040,700
Zinc	29,417	1,212	138,279	13,500	665,100	29,774,100
Zinc-lead	366	2	6,732	1,400	82,900	112,100
Total 1947	220,924	45,920	595,629	92,099,200	7,319,800	30,926,900

Gross metal content of Nevada crude ore and old tailings shipped to smelters in 1947, by classes of material

Class of material	Material treated		Gross metal content				
	Ore (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	4,462		1,781	5,391	62,265	503	
Dry and siliceous gold-silver	5,520		1,481	99,919	18,958	94,493	
Dry and siliceous silver	6,699	3,748	485	125,840	30,520	408,813	2,755
Copper	88,907		1,276	116,620	[1] 7,086,993	318,599	346,940
Lead	20,873		551	239,171	78,047	4,729,917	66,576
Zinc	3,913		28	7,082	37,388	269,560	1,416,768
Zinc-lead	7,505		76	29,569	138,938	1,464,724	2,279,721
Zinc-lead-copper	188		2	3,207	11,773	38,135	53,808
Total: 1947	138,067	3,748	5,680	626,799	[1] 7,464,882	7,324,744	4,166,568
1946	110,867	4,502	7,553	504,975	[2] 10,223,869	6,696,464	7,053,205

[1] Includes 2,671,498 pounds of copper from precipitates.
[2] Includes 3,308,405 pounds of copper from precipitates.

Mine production of metals from Nevada crude ore and old tailings shipped to smelters in 1947, in terms of recovered metals

	Material treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
BY COUNTIES							
Churchill	261		34	4,394	22,000	16,000	
Clark	6,100		141	22,674	64,000	889,200	1,332,100
Elko	7,644		336	107,227	332,800	1,542,700	442,600
Esmeralda	643		388	2,154		28,000	
Eureka	4,015		30	39,104	6,300	578,900	
Humboldt	380		85	8,281	4,000	10,000	
Lander	15,456		820	35,753	771,600	64,500	
Lincoln	8,863		276	167,840	422,000	1,059,500	288,100
Lyon	739		41	453	102,000	4,000	
Mineral	2,235	3,748	389	42,207	11,700	666,509	106,000
Nye	3,029		1,258	129,351	17,600	234,500	400
Ormsby	171		9	769	6,000	12,000	
Pershing	4,536		170	11,322	5,700	623,500	6,000
Storey	10		86	463			
White Pine	83,985		1,617	54,807	[1] 5,341,100	1,272,900	837,900
Total: 1947	138,067	3,748	5,680	626,799	[1] 7,106,800	7,002,200	3,013,100
1946	110,867	4,502	7,553	504,975	[2] 9,884,900	6,407,800	5,042,300
BY CLASSES OF MATERIAL							
Dry and siliceous gold	4,462		1,781	5,391	60,500		
Dry and siliceous gold-silver	5,520		1,481	99,919	17,800	70,300	
Dry and siliceous silver	6,699	3,748	485	125,840	27,300	372,400	1,000
Copper	88,907		1,276	116,620	[1] 6,857,300	310,600	251,100
Lead	20,873		551	239,171	61,500	4,507,800	49,100
Zinc	3,913		28	7,082	31,800	264,600	1,024,900
Zinc-lead	7,505		76	29,569	40,600	1,439,000	1,648,000
Zinc-lead-copper	188		2	3,207	10,000	37,500	39,000
Total 1947	138,067	3,748	5,680	626,799	[1] 7,106,800	7,002,200	3,013,100

[1] Includes 2,607,400 pounds of copper from precipitates.
[2] Includes 3,229,000 pounds of copper from precipitates.

REVIEW BY COUNTIES AND DISTRICTS

CHURCHILL COUNTY

Broken Hills District.—Broken Hills Mine, operating the Broken Hills mine during 1947, shipped 40 tons of silver ore (containing 1,403 ounces of silver and 2,053 pounds of lead) to a smelter.

Leete District.—Lloyd Shaw worked the Anglo Saxon mine from May 1 through December 1947; 143 tons of copper ore containing 2 ounces of gold, 161 ounces of silver, and 22,644 pounds of copper was shipped to a smelter.

CLARK COUNTY

Eldorado Canyon District.—H. G. Smalley operated claims in the Eldorado-Rover group during 1947, treating the gold-silver dump ore and old tailings by cyanidation.

Searchlight District.—George Oxborrow and Glenn Brubaker, working the Grand Gulch mine, shipped copper ore containing some gold and silver to a smelter during 1947. Harry Reid and Old Barney's Gold Mines, Inc., operated the Blossom (Coyote) mine in 1947, treating gold ore by cyanidation. J. A. Gordon and A. A. Chapman

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1947, by counties and districts, in terms of recovered metals [1]

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (lode and placer) [3] (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Churchill County:											
Broken Hills	1		40				1,403		2,000		$1,558
Desert	1		34	21		21	145				866
Eastgate	1		186	23		23	829				1,555
Fairview	1		35	1		1	302		12,200		2,065
Holy Cross	4	1	19	16	63	79	2,455		1,800		5,246
Leete	1		143	2		2	161	22,000			4,836
Clark County:											
Eldorado Canyon	3		5,133	55		55	4,285				5,803
Searchlight	9		405	737		737	2,768	20,300	7,500		33,643
Yellow Pine (Goodsprings)	17		13,507	985		985	28,434	45,700	1,172,500	1,450,000	414,095
Douglas County: Buckskin	1		60	14		14	5				495
Elko County:											
Contact (Salmon River)	3		350	2		2	346	5,000	86,000	18,400	16,043
Cope	5	1	25,071	410	83	493	43,973	2,209,600	26,500		524,883
Delano	3		2,264	18		18	51,601	8,100	748,000		156,742
Dolly Varden	1		342	2		2	369	38,800			8,552
Gold Circle	2		225	3		3	579	300	18,000		3,284
Jarbidge	1		300	48		48	39				1,715
Merrimac	2		104				896		15,000	11,000	4,302
Mud Springs	1		31				213		4,000		769
Railroad	2		201				2,812	4,900	27,500	4,000	8,018
Rock Creek	1		5	1		1	251				262
Ruby Valley	3		297	4		4	260	300	62,000	44,600	14,763
Spruce Mountain	3		2,311	12		12	10,354	27,000	609,000	418,000	153,734
Esmeralda County:											
Divide	1		518	328		328	1,435				12,779
Goldfield	4		69	57		57	458				2,409
Hornsilver	1		2	1		1	16		1,000		193
Klondyke	1		32	1		1	198		13,000		2,086
Lida		1			5	5	2				177
Silver Peak	1		22	1		1	47		14,000		2,094
Sylvania		1			2	2	1				71
Eureka County:											
Cortez	2		623	43		43	21,493	1,900	33,000	11,000	27,438
Diamond	2		3,537	2		2	20,086	4,500	521,000		94,217
Eureka	3		13,617	16		16	22,783	13,400	136,000	1,793,000	260,530
Safford	1		5				237	200			256
Humboldt:											
Awakening	3		313	424		424	6,416	1,800	9,000		22,320
Barrett Springs	3		96	12		12	151				557

Gold Run	5		300	83		83	2,058	2,200	1,000		5,373
Paradise Valley	2	1	36	12	11	23	4				809
Lander County:											
Battle Mountain	9	(4)	45,280	3,606	(4)	[5] 3,606	[5] 32,022	1,030,000	77,000		[5] 382,578
Bullion	3		134,630	17,058		17,058	2,189				599,011
Lewis	1		794	12		12	24,168	3,900	6,000		23,975
New Pass	1		8				188		2,500		530
Reese River	1		39				165	100	500		242
Lincoln County:											
Chief (Caliente)	1		8	1		1	3				38
Comet	1		2,124	105		105	16,157	200	99,000	207,200	57,666
Ferguson	2		78	56		56	38	1,500			2,309
Groom	2		1,760				6,109	4,600	397,000	28,000	67,051
Jack Rabbit	2		4,824	36		36	100,884	400,400	332,000	264,600	256,469
Pahranagat	1		284	1		1	4,479	7,000	17,000	1,000	8,128
Pioche	7		202,138	3,703		3,703	426,229	8,300	6,973,000	28,723,200	4,996,704
Lyon County:											
Silver City	10	2	10,566	1,596	2,928	4,524	14,451		4,000		171,994
Yerington	2		722	3		3	245	102,000			21,747
Mineral County:											
Bell	2		789	27		27	9,353	2,700	319,000	106,000	68,738
Columbus (Candelaria)	3		1,446	120		120	10,613	1,800	103,500		29,087
East Walker (Mount Grant)	3		35	15		15	432				916
Fitting	1		1	10		10	1				351
Garfield	1		68	38		38	2,906	100	1,500		4,197
Hawthorne	1		3	5		5	1				176
Pilot Mountain	1		3,349	53		53	16,876	3,500	228,500		50,767
Regent (Rawhide)		3			27	27	10				954
Santa Fe	3		94	7		7	867	3,300	3,000		2,155
Silver Star	4		454	138		138	2,652	600	56,500		15,492
Nye County:											
Bellehelen	3		24	7		7	6				250
Bullfrog	1		96	71		71	59				2,538
Jackson	1		81	199		199	7,862	2,000			14,500
Johnnie	1	1	20	2	16	18	1				631
Mammoth	1		5	3		3	2				107
Manhattan	8	6	617	441	1,177	1,618	1,751	6,400			59,559
Morey	1		4	1		1	99				125
Quartz Mountain	1		595	43		43	7,452	3,100	116,500		25,676
Round Mountain	2		72	6		6	1,129		5,000		1,952
San Antone	2		96	5		5	1,319	1,600			1,705
Silver Bow	1		16	1		1	459				450
Tonopah	11		1,993	941		941	76,091	1,400	20,000		104,971
Union	2		462	9		9	33,355	3,500	85,500	15,600	45,436
Washington	1		32	3		3	2,707		13,000	400	4,475
Ormsby County: Voltaire	3		171	9		9	769	6,000	12,000		3,999

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1947, by counties and districts, in terms of recovered metals [1]—Continued

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (lode and placer)[3] (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Pershing County:											
Antelope Springs	1	----	4,415	125	----	125	9,970	4,200	610,000	----	$102,120
Goldbanks	1	----	35	----	----	----	37	500	5,500	5,400	1,583
Imlay	1	5	40	----	55	55	145	1,000	----	----	2,266
Placeritas	----	2	----	----	109	109	29	----	----	----	3,841
Rochester	3	1	83	57	174	231	577	----	----	----	8,607
Rosebud	----	1	----	----	124	124	14	----	----	----	4,353
Seven Troughs	4	----	813	341	----	341	399	----	8,000	600	13,521
Unionville	1	1	1	1	2	3	2	----	----	----	107
Storey County: Comstock	8	1	127,036	5,016	12	5,028	68,621	----	----	----	238,082
Washoe County: White Horse (Olinghouse)	4	----	613	194	----	194	66	----	----	----	6,850
White Pine County:											
Aurum	5	----	3,960	72	----	72	5,850	128,700	198,000	519,800	126,249
Bald Mountain	1	----	68	2	----	2	256	4,600	----	----	1,268
Cherry Creek	3	----	789	56	----	56	2,708	100	14,500	----	6,520
Duck Creek	4	----	135	1	----	1	1,258	6,500	18,000	14,600	6,897
Eagle	1	----	92	9	----	9	268	500	23,000	----	3,975
Granite (Steptoe)	3	----	184	49	----	49	150	----	44,000	----	8,187
Osceola	3	----	543	283	----	283	371	100	6,000	----	11,126
Robinson (Ely)	22	----	5,759,256	39,490	----	39,490	161,806	95,048,600	498,000	264,600	21,592,519
Taylor	3	----	2,957	74	----	74	15,532	----	----	----	16,646
White Pine (Hamilton)	6	----	1,676	13	----	13	11,520	10,900	504,500	39,000	90,536
Other districts [6]	6	3	154,928	4,614	2,213	6,827	66,036	300	500	----	298,842
Total Nevada	276	31	6,541,635	82,062	7,001	89,063	1,377,579	99,206,000	14,322,000	33,940,000	31,366,282

[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts listed in footnote 6 and their output included with "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: 1,374,842 ounces from lode mines and 2,737 from placers.

[4] Included with "Other districts."

[5] Exclusive of placer output, which is included in "Other districts."

[6] Includes following districts: Lynn in Eureka County; Battle Mountain (placer) in Lander County; Rand in Mineral County; Echo (Rye Patch); and Sierra in Pershing County.

worked the Quartette mine from July 1 to November 1, 1947; gold ore containing some silver, copper, and lead was shipped to a mill for treatment.

Yellow Pine (Goodsprings) District.—J. W. Stewart worked the Anchor mine from April 14 through December 1947, shipping lead-zinc ore to a smelter. The Argentena Consolidated Mining Co. operated the Argentena mine during the first 8 months of 1947. Zinc ore containing some gold, silver, copper, and lead was shipped to a smelter. The Southwestern Copper Co. shipped copper ore from the Azurite mine during 1947. The Kinney-Keystone Mine worked the Keystone Barefoot mine from January to October 10, 1947, treating gold ore (2,268 tons containing 858 ounces of gold and 64 ounces of silver) by amalgamation and flotation; concentrate was shipped to a smelter. Hamilton and Jacobson operated the Sultan and Yellow Pine mines. Zinc-lead concentrates and zinc-lead ore containing some gold, silver, and copper were shipped to a smelter during 1947.

ELKO COUNTY

Contact (Salmon River) District.—Dave Richards worked the Copper Queen and Independence mines from June 15 to September 15, 1947, and shipped 20 tons of copper ore containing 3,118 pounds of copper, 47 ounces of silver, and 1 ounce of gold to a smelter.

Cope (Mountain City) District.—The Mountain City Copper Co. (the third largest copper producer in Nevada) operated during the first 9 months of 1947, suspending operations September 30. Some high-grade copper ore was shipped for direct smelting, but most of the ore was concentrated in the company 400-ton flotation mill.

Delano District.—McFarland & Hullinger, operating the Cleveland mine, and L. H. Bayless, working the Delno mine during 1947, shipped lead ore containing some copper, silver, and gold to smelters.

Dolly Varden District.—The Anaconda Copper Mining Co. worked the Victoria mine from January 1 through September 1947. The company shipped 342 tons of ore containing 39,580 pounds of copper, 369 ounces of silver and 2 ounces of gold to a smelter.

Merrimac District.—The Rip Van Winkle Consolidated Mining Co. operated the Rip Van Winkle mine the latter 8 months of 1947, shipping 98 tons of zinc-lead ore containing 11,188 pounds of zinc, 9,027 pounds of lead, and 875 ounces of silver to a concentrator-smelter for treatment.

Railroad District.—Sam Zunino, lessee, operated the Aladdin mine from October 1 through December 1947 and shipped 40 tons of lead ore containing 420 ounces of silver, 1,332 pounds of copper, and 7,073 pounds of lead to a smelter.

Ruby Valley District.—W. H. McKibben and Thomas Fitzgerald operated the Betty open-pit mine from January 20, 1947, to October 15, 1947, and shipped lead ore containing some zinc, copper, silver, and gold to a smelter.

Spruce Mountain District.—The Missouri Monarch Consolidated Mines Co. and R. J. Birch worked the Monarch mine during 1947; lead ore containing some zinc, copper, and silver was shipped to a smelter. Nevada Lead Zinc Co. operated the Nevada Lead mine during 1947, shipping zinc-lead ore to a smelter.

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ESMERALDA COUNTY

Goldfield District.—The Newmont Mining Corp., which held at the end of 1947 a 20.7-percent interest in the Goldfield Deep Mines Co. of Nevada, directed a development program on small, high-grade, gold-bearing veins that had been discovered on the latter company's property beneath the post-mineral Siebert lake beds. The erection of a small mill was planned for 1948. Several operators, including the Combination Fraction Mining Co. (Combination Fraction mine), August Anderson and Pius Kaelin (Merger mine), and the Goldfield Consolidated Mines Co., shipped small quantities of gold ore to smelters during 1947.

Divide (Gold Mountain) District.—Lessees working the Divide mine during 1947 shipped gold ore to a smelter.

EUREKA COUNTY

Cortez District.—Cortez Metals Co. operated the Cortez mine, shipping lead ore containing some copper and silver to a smelter during 1947. The McCarthy Mining Co. worked the Mill Canyon (Majestic) mine during 1947. Zinc-lead ore was shipped to a concentrator-smelter and silver ore to a smelter for treatment.

Diamond District.—Thompson and Wilmont shipped a substantial quantity of lead ore containing some copper and silver to a smelter from the Philipsburg mine during 1947.

Eureka District.—The Callahan Zinc-Lead Co., Inc., operated the Mount Hope mine from January 1 to March 10, 1947, treating 13,510 tons of zinc-lead ore in the company 250-ton flotation mill. Lead and zinc concentrates were shipped to smelters. The mine was shut down after a fire that destroyed the powerhouse.

Lynn District.—Mark M. Butler operated a placer mine 20 miles north of Carlin (for 2 months in 1947); gold was recovered from alluvial wash, using hydraulic equipment.

HUMBOLDT COUNTY

Awakening District.—Jay S. Jones worked the May Day mine from January 1 to August 15, 1947, treating gold ore by amalgamation. The Austin Bros. Gold Mining Co. treated gold ore from the Jumbo mine by the same method.

LANDER COUNTY

Battle Mountain District.—The Copper Canyon Mining Co. operated the Copper Canyon mine throughout 1947, treating 30,661 tons of copper ore in the company 350-ton flotation mill; 3,794 tons of copper concentrate (containing 2,854 ounces of gold, 20,839 ounces of silver, 267,724 pounds of copper, and 35,866 pounds of lead) was shipped to a smelter. In addition, 5,829 tons of copper ore (containing 60 ounces of gold, 2,396 ounces of silver, 279,070 pounds of copper and 6,656 pounds of lead) were shipped for direct smelting. Lessees worked the Copper Canyon Mining Co. Copper Basin property (Contention, Sweet Marie, and Henryetta mines) during 1947; 4,904 tons of copper ore (containing 293 ounces of gold, 3,538 ounces of silver, and 324,738 pounds of copper) were shipped for direct smelting.

Bullion District.—The Consolidated Goldacres Co. operated the Goldacres mine throughout 1947. Gold ore was treated in the company 300-ton cyanide plant.

LINCOLN COUNTY

Comet District.—The Comet Mining Co. worked the Comet mine during 1947 and shipped zinc-lead ore to a custom flotation mill for treatment. Some zinc-lead ore was shipped for direct smelting.

Groom District.—Dan Sheahan operated the Groom mine throughout 1947. Lead ore (1,037 tons containing 4,794 ounces of silver, 3,777 pounds of copper, 327,694 pounds of lead, and 38,756 pounds of zinc) was shipped to a smelter. In addition, 693 tons of lead ore was treated in a 50-ton flotation mill, yielding 63 tons of lead concentrate (containing 971 ounces of silver and 73,302 pounds of lead), which was shipped to a smelter.

Jack Rabbit District.—The Bristol Silver Mines Co. worked the Bristol Silver mine during 1947, shipping 4,750 tons of copper ore (containing 36 ounces of gold, 100,505 ounces of silver, 470,517 pounds of copper, 311,720 pounds of lead, and 346,940 pounds of zinc) to a smelter.

Pioche District.—The Combined Metals Reduction Co. operated its 1,500-ton flotation mill on company and custom ore throughout 1947. Company zinc-lead ore (83,323 tons containing 2,324 ounces of gold, 237,213 ounces of silver, 4,354,595 pounds of lead, and 10,827,584 pounds of zinc) was derived from the Pioche No. 1, Pioche No. 2, and Pan American mines. Custom ore treated came principally from the Ely Valley mine (second largest producer of zinc in Nevada), the Prince mine, and the Raymond Ely West Mining Co. property. The mill products were lead and zinc concentrates, which were shipped to smelters. The Salt Lake-Pioche Mining Co. worked the Apex mine and Financier mine (Owen Jarvis, lessee) throughout 1947; 2,417 tons of lead ore containing 168 ounces of gold, 55,270 ounces of silver, 8,345 pounds of copper, and 417,896 pounds of lead was shipped to a smelter from the two mines.

LYON COUNTY

Silver City District.—W. M. Donovan operated his custom cyanide mill in Silver City during 1947 on ores from his own mines—the Silver Hill (open pit) and the Hartford and Imperial (Storey County)—and from a number of smaller neighboring properties. The Grafe Dayton Dredging Co. operated its large dragline excavator and floating washing plant north of Dayton during the first quarter of 1947. A number of small mines in the district were active during 1947; gold ore from the following properties was treated by cyaniding: M & C No. 1, Valley View, and Gamble (J. A. Cushman); Haywood and Oest (Dickson and Bennett); Silver City (R. De La Mare); Wonder Extension (C. M. Peterson, et al.); and Wedge (Dickson and McCrea).

Yerington District.—Anton Lilja worked the Mason Valley mine during 1947, as did Johnson and Spezzi and J. B. Bookman; copper ore containing some silver and gold was shipped to a smelter. Ed Parr shipped copper ore from the Malachite mine to a smelter.

MINERAL COUNTY

Bell District.—The B. B. S. Mining Corp. and the Swanson Milling Co. operated the Simon Lead mine in 1947. Zinc-lead ore was shipped to a smelter.

Columbus (Candelaria) District.—Charles Hammock and Martin Mackley shipped silver ore containing some lead, copper, and gold from the Columbus mine to a smelter.

Garfield District.—The West-End Consolidated Mines Corp. operated the Mabel mine under a leasing system 6 months in 1947, shipping gold-silver ore to a smelter.

Pilot Mountain District.—Material from the old Sodaville mill (worked in 1882) was shipped to a smelter during 5 months of 1947 by Mineral Ventures; 3,349 tons contained 53 ounces of gold, 16,876 ounces of silver, 3,846 pounds of copper, and 234,337 pounds of lead.

Regent (Rawhide) District.—The Minco Placer Engineering Co. operated a dry-land dredge in Hooligan Wash during a period of testing in 1947; 7 ounces of gold and 5 ounces of silver were recovered from 700 cubic yards of gravel washed. Placer operations were conducted also by Harry W. Keep and Charles Milan.

NYE COUNTY

Manhattan District.—The Manhattan Gold Mines Co. treated gold ore from the Manhattan mine in 1947 by amalgamation. The Manhattan Gold Dredging Co., largest producer of placer gold in Nevada in 1946, did not operate its connected-bucket dredge during 1947. A number of smaller placer mines were active in the district during 1947.

Quartz Mountain District.—Obie LeFavor, lessee, operated the San Rafael mine throughout 1947, shipping lead ore (595 tons containing 43 ounces of gold, 7,452 ounces of silver, 4,099 pounds of copper, and 119,539 pounds of lead) to a smelter.

Tonopah District.—Lessees working the Tonopah Mining Co. of Nevada property throughout 1947 shipped 1,517 tons of gold-silver ore containing 723 ounces of gold and 63,501 ounces of silver to a smelter. Gold-silver ore from the Jim Butler mine, operated by lessees in 1947, was shipped to a smelter. Among other operators in the district in 1947 were: W. E. Brodie (gold ore); Walter J. Ball, Purple Blossom mine (gold-silver ore); Wilson & Moorehead, E. G. B. mine (lead ore); Joe and Roy Clifford, Jeep mine (silver ore); H. D. Budelman, Montana-Tonopah mine (gold-silver ore); J. O. Greenan, Reed mine (lead ore); and Clarence Santie and L. R. Ramstad, Sally Louise mine (copper and lead ores).

Union District.—Alexander & Brooklyn Mines, Inc., operated the Alexander mine during 1947; silver ore was treated in the company flotation mill, and the zinc-lead concentrate produced, as well as a smaller tonnage of lead ore, was shipped to smelters.

PERSHING COUNTY

Antelope Springs District.—Bratton and Blair shipped lead ore (calcined mercury ore) containing a considerable quantity of gold, silver, lead, and some copper from the Nevada Quicksilver and Red Bird mines to a smelter in 1947.

Echo (Rye Patch) District.—The Standard Cyaniding Co. treated ore from its Standard mine and tailings from the Rye Patch property by cyaniding during 1947, recovering substantial quantities of gold and silver.

Rochester District.—The Spring Valley Gold Dredging Co. operated a dry-land dredge in Spring Valley Canyon during September and October 1947.

Seven Troughs District.—G. P. Williams operated the Portland mine during 1947; gold ore was treated in an amalgamation-concentration mill.

STOREY COUNTY

Comstock District.—The Consolidated Chollar Gould & Savage Mining Co. operated the Overman open-pit mine from April 1 through December 1947. Gold ore (125,779 tons containing 4,672 ounces of gold and 63,116 ounces of silver) was treated in the company 500-ton cyanide plant. In addition, a small quantity of ore was shipped to a smelter. W. M. Donovan worked the Hartford mine and Imperial mine during 1947 and treated the ore by cyanidation in his mill at Silver City. Lessees at the Justice mine shipped gold-silver ore to a custom cyanide plant for treatment in 1947.

WHITE PINE COUNTY

Aurum (Silver Mountain) District.—The Grand Deposit Mining Co. worked the Kansas and Grand Deposit mines from January 1 to August 20, 1947. Zinc ore from the Grand Deposit mine (2,245 tons containing 7 ounces of gold, 2,284 ounces of silver, 29,589 pounds of copper, 186,065 pounds of lead, and 717,970 pounds of zinc) and copper ore from the Kansas mine (1,405 tons containing 14 ounces of gold, 1,976 ounces of silver, and 102,524 pounds of copper) were shipped for direct smelting.

Osceola District.—The Gilded Age Mining Co. worked the Gilded Age mine throughout 1947; gold ore (485 tons containing 281 ounces of gold and 135 ounces of silver) was shipped to a smelter.

Robinson (Ely) District.—The Nevada Mines Division of the Kennecott Copper Corp. worked the Copper Flat pit and the Ruth mine throughout 1947. The ore from these mines and that produced by the Consolidated Coppermines Corp. was treated at Kennecott's McGill flotation concentrator and copper smelter. Kennecott—the largest privately financed industrial organization in Nevada—produced over half the total copper for the State and was the leading producer of gold in Nevada. The Consolidated Coppermines Corp., second largest copper and third largest gold producer in the State in 1947, was active throughout the year. Among other larger operators in the district in 1947 were: Korgan & Piscovitch (zinc ore); Sam Robinson and Lewis Mattice, Columbia mine (lead and zinc ores); Drollinger & Steele, Ely Gold mine (gold-silver ore); Benson Bros. & M. Mayes, Golden Rod and Green Stake mines (lead ore); Andrew Siri & Steadman, Jupiter mine (gold ore); Smith, Siri, and Yrazabel, McDonald Ely mine (gold-silver ore); C. A. Gardner, Revenue claim (gold-silver ore); Roy Linsea, Veteran mine (copper ore); and Fred Farnsworth (lead ore). A large proportion of the dry and siliceous ores from these and other smaller mines was shipped to the McGill smelter for use primarily as flux.

Taylor District.—The Nevada Sunshine Mining Co. shipped silver ore to a smelter during 1947 from the Goodman mine.

White Pine District.—E. R. Wooley shipped lead ore from the Dog Star mine, the Mary Ellen mine, and the Young Treasure dump to a smelter in 1947. J. C. Bettles worked the Oro mine during 1947, shipping zinc-lead-copper ore to a smelter.

New Mexico

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By A. J. MARTIN

GENERAL SUMMARY

UNDER the stimulus of strong demand for copper, lead, and zinc and advances in the prices of these metals, the New Mexico output of copper in 1947 increased 20 percent, lead 30 percent, and zinc 22 percent over 1946. Production rates were higher after the Premium Price Plan expired June 30, 1947, although some mines producing chiefly zinc closed. Gold production decreased 22 percent from 1946 and silver increased 53 percent. Activity in straight gold and silver mining was at a low ebb during the year, and most of the precious-metal output was recovered from base-metal mines. The value of the copper and zinc—the principal metals produced in the State—was $25,286,100 and $10,672,926, respectively, in 1947; the combined value of the lead, silver, and gold was $2,415,243.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946 to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

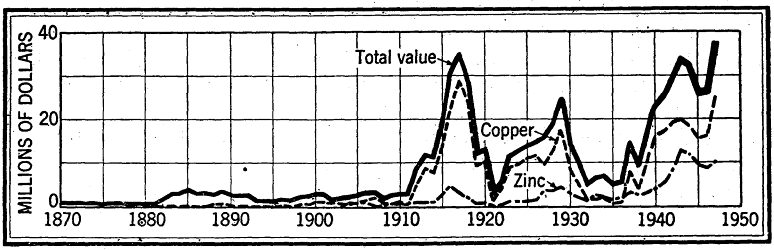

FIGURE 1.—Value of mine production of copper and zinc and total value of gold silver, copper, lead, and zinc in New Mexico, 1870–1947. The value of gold, silver, and lead produced annually has been relatively small.

Mine production of gold, silver, copper, lead, and zinc in Mexico in 1947, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	220	32,960	8,628,000	764,000	7,202,000
February	230	33,425	8,864,000	748,000	6,834,000
March	220	24,625	9,022,000	716,000	7,038,000
April	240	30,750	10,342,000	798,000	7,104,000
May	250	35,575	10,204,000	988,000	7,424,000
June	261	48,540	10,310,000	990,000	7,310,000
July	310	47,800	10,200,000	1,080,000	6,318,000
August	315	52,475	11,244,000	1,172,000	7,336,000
September	300	55,550	11,046,000	1,302,000	7,848,000
October	290	54,360	10,510,000	1,428,000	8,468,000
November	260	49,930	10,270,000	1,380,000	7,774,000
December	250	49,843	9,770,000	1,400,000	7,550,000
Total: 1947	3,146	515,833	120,410,000	12,766,000	88,206,000
1946	4,009	338,000	100,382,000	9,798,000	72,206,000

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 1943 to 1947, as well as the total production from 1848 to 1947. 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, 1943–47, and total, 1848–1947, 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
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
1946	50	4	6,594,890	4,009	140,315	338,000	273,104
1947	82	3	7,352,945	3,146	110,110	515,833	466,829
1848–1947			(1)	2,185,981	49,843,528	68,270,564	53,412,027

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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
1946	100,382,000	16,261,884	9,798,000	1,067,982	72,206,000	8,809,132	26,552,417
1947	120,410,000	25,286,100	12,766,000	1,838,304	88,206,000	10,672,926	38,374,269
1848–1947	[2] 1,410,404	423,714,817	[2] 281,224	30,394,203	[2] 889,043	136,701,118	694,065,693

[1] Figure not available.
[2] Short tons.

Gold and silver produced at placer mines in New Mexico, 1943–47, 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	
1943	92	$3,220	25	$18	$3,238	1946	10	$350	2	$2	$352
1944	8	280			280	1947	23	805	10	9	814
1945	15	525	7	5	530						

Gold.—The 3,146 fine ounces of gold produced in New Mexico in 1947 were recovered largely from base-metal ores. The output in 1946, also mostly from base-metal ores, was 4,009 ounces. High labor and material costs have hampered the reopening of gold mines closed during the war. Copper ore yielded 56 percent of the State total gold in 1947, zinc ore 24 percent, lead and zinc-lead ores 12 percent, and dry and siliceous ores and placers 8 percent. Output by districts is shown in the table that follows under Review by Counties and Districts. The principal producing mines in 1947, in order of output, were: Atwood mine, Lordsburg district (Hidalgo County); Bayard, Central district (Grant County); and Bonney and Miser's Chest group, Lordsburg district.

Silver.—Most of the silver output in New Mexico in 1947 came from mines producing chiefly base metals. The quantity recovered totaled 515,833 fine ounces compared with 338,000 ounces in 1946. Zinc ore yielded 41 percent of the total in 1947, copper ore 35 percent, zinc-lead ore 17 percent, lead ore 6 percent, and dry and siliceous ores and placers 1 percent. The principal silver producers, in order of output, were C. H. & S. A. McIntosh (Atwood) in Hidalgo County, American Smelting & Refining Co. (Ground Hog unit) in Grant County, United States Smelting, Refining & Mining Co. (Bayard mine) in Grant County, American Smelting & Refining Co. (Magdalena Unit) in Socorro County, Banner Mining Co. (Bonney and Miser's Chest group) in Hidalgo County, and J. D. Torres (Kelly mine) in Socorro County.

Copper.—The New Mexico mine output of recovered copper in 1947—120,410,000 pounds—was larger than in either 1946 or 1945; the value of the output, enhanced by the highest average price since 1918, was $25,286,100, the largest since 1917. The Chino open-pit mine of the Kennecott Copper Corp. at Santa Rita, Grant County, was much the largest producer in the State. Other important producers, in order of output, were the Bonney and Miser's Chest group of the Banner Mining Co. south of Lordsburg, Hidalgo County; the leaching operation at the Burro Mountain properties of the Phelps Dodge Corp. at Tyrone, Grant County; and the Atwood mine south of Lordsburg, operated by C. H. & S. A. McIntosh, Hidalgo County. The foregoing four mines produced 99 percent of the State total production of copper in 1947; of the total copper produced, copper ore, mine-water precipitates, and precipitates from leaching-dump material accounted for 99 percent.

Lead.—Most of the lead produced in New Mexico in 1947, as in the past, was recovered from zinc and zinc-lead ores. Of the 12,766,000 pounds of recoverable lead produced in the State during the year, 1,629,530 pounds were derived from lead ore; in 1946 lead ore yielded only 122,344 pounds. The advance in the price of lead to the highest level on record (before the further advance in 1948) stimulated the mining of lead and zinc-lead ores and of zinc ore with appreciable lead content. The output of lead increased 30 percent in quantity and 72 percent in total value over 1946. The principal lead-producing districts were the Central, Grant County (54 percent of the State total), and the Magdalena, Socorro County (31 percent). The leading producers of lead were the Bayard and Ground Hog groups in the Central district and the Waldo and Kelly groups in the Magdalena district.

Zinc.—The mine production of zinc in New Mexico in the latter half of 1947 was slightly larger than in the first half, despite the closing of some mines after the Premium Price Plan expired June 30. The increase for the year over 1946 was 22 percent; the quantity of recoverable zinc produced was 88,206,000 pounds compared with 72,206,000 pounds in 1946. In 1947 the Central district, Grant County, produced 87 percent of the State total and the Magdalena district, Socorro County, 11 percent compared with 89 and 10 percent, respectively, in 1946. Other producing districts in 1947 were: Pinos Altos, Swartz, and Steeple Rock, Grant County; San Simon, Hidalgo County; Victorio, Luna County; and Tierra Blanca, Sierra County. Zinc ore yielded 90 percent and zinc-lead ore 10 percent of the total zinc. The nine leading producers of zinc supplied 99 percent of the State total output and, in order of output, were: American Smelting & Refining Co. (Ground Hog unit), Kennecott Copper Corp. (Oswaldo mine), United States Smelting, Refining & Mining Co. (Bayard mine group), Empire Zinc Co. (Hanover mine unit), and Peru Mining Co. and subsidiary (Pewabic, Kearney, and Copper Flat mines), all in Grant County; American Smelting & Refining Co. (Magdalena Unit), J. D. Torres (Kelly mine), and McDonald & Dobson (Nitt mine), all in Socorro County; and Mathis & Mathis (Houston-Thomas mines) in Grant County.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1947, 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	1		65	$2,275	3,938	$3,564
Colfax		1	11	385	6	5
Dona Ana	1		2	70	1,792	1,622
Eddy	1					
Grant	27	1	997	34,895	196,623	177,944
Hidalgo	12		1,847	64,645	192,643	174,342
Luna	11		25	875	3,093	2,799
Otero	6		20	700	313	283
Sandoval	1		9	315	4	4
Santa Fe	1	1	29	1,015	13	12
Sierra	10		11	385	7,314	6,619
Socorro	11		130	4,550	110,094	99,635
Total: 1947	82	3	3,146	110,110	515,833	466,829
1946	50	4	4,009	140,315	338,000	273,104

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1947, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Catron							$5,839
Colfax							390
Dona Ana	1,100	$231	51,000	$7,344			9,267
Eddy	700	147					147
Grant	116,469,500	24,458,595	7,470,000	1,075,680	78,040,000	$9,442,840	35,189,954
Hidalgo	3,540,900	743,589	713,500	102,744	96,600	11,688	1,097,008
Luna	2,900	609	134,500	19,368	42,600	5,155	28,806
Otero	46,000	9,660	206,000	29,664			40,307
Sandoval	200	42					361
Santa Fe	500	105					1,132
Sierra	8,300	1,743	171,000	24,624	1,600	194	33,565
Socorro	339,900	71,379	4,020,000	578,880	10,025,200	1,213,049	1,967,493
Total: 1947	120,410,000	25,286,100	12,766,000	1,838,304	88,206,000	10,672,926	38,374,269
1946	100,382,000	16,261,884	9,798,000	1,067,982	72,206,000	8,809,132	26,552,417

MINING INDUSTRY

The war peak for copper mined in New Mexico was 160,200,000 pounds in 1942—a 74-percent increase over 1939—and the peak for zinc was 119,048,000 pounds in 1943, a 103-percent increase over 1939. The outputs in 1947 show increases over 1939 of 30 percent for copper and 50 percent for zinc. Copper ore produced in 1947 totaled 6,772,030 tons, and zinc and zinc-lead ores combined were 567,427 tons compared with 6,044,004 and 538,921 tons, respectively, in 1946. Lead ore mined increased from 737 tons in 1946 to 12,323 tons in 1947, and gold and silver ores combined decreased from 11,228 to 1,165 tons. There was considerable activity in exploratory drilling and development by the mining companies. Government exploration premiums in varying amounts were available to some of the companies producing copper, lead, or zinc. The Bureau of Mines continued its investigation of strategic minerals; the work done on copper, lead, and zinc included exploratory drilling in the Boston Hill, Central, and Pinos Altos districts, Grant County, field examinations in these and other areas, and metallurgical tests on ores. Data on drilling were published.[1]

[1] Holmquist, Ray J., Stauber Copper Mine, Guadalupe County, N. Mex.: Bureau of Mines Rept. of Investigations 4026, 1947, 7 pp.
Huntington, Morgan G., Atwood Copper Group, Lordsburg District, Hidalgo County, N. Mex.: Bureau of Mines Rept. of Investigations 4029, 1947, 9 pp.
Russell, P. L., Steeple Rock Zinc-Lead District, Grant County, N. Mex.: Bureau of Mines Rept. of Investigations 4073, 1947, 13 pp.
Soulé, John H., Silver Spot Manganese-Iron-Zinc Deposits, Grant County, N. Mex.: Bureau of Mines Rept. of Investigations 4217, 1948, 5 pp.
Mullen, Donald H., and Storms, Walter R., Copper Flat Zinc Deposit, Central Mining District, Grant County, N. Mex.: Bureau of Mines Rept. of Investigations 4228, 1948, 9 pp.
Soulé, John H., West Pinos Altos Zinc-Lead Deposits, Grant County, N. Mex.: Bureau of Mines Rept. of Investigations 4237, 1948, 10 pp.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in New Mexico in 1947, 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	238	169	60	1,140	67	
Dry and siliceous gold-silver ore	315	66	3,998		45	
Dry and siliceous silver ore	612	4	2,665	1,260	42,955	
	1,165	239	6,723	2,400	43,067	
Copper ore	6,772,030	1,756	[1] 178,794	[1] 118,918,663	197,412	
Lead ore	12,323	191	31,458	72,036	1,629,530	
Zinc ore	489,149	757	212,539	1,116,796	7,334,308	79,175,647
Zinc-lead ore	78,278	180	86,309	300,105	3,561,683	9,030,353
	7,351,780	2,884	[1] 509,100	[1] 120,407,600	12,722,933	88,206,000
Total lode mines	7,352,945	3,123	[1] 515,823	[1] 120,410,000	12,766,000	88,206,000
Placers		23	10			
Total: 1947	7,352,945	3,146	[1] 515,833	[1] 120,410,000	12,766,000	88,206,000
1946	6,594,890	4,009	[1] 338,000	[1] 100,382,000	9,798,000	72,206,000

[1] Silver and copper contained in precipitates recovered from mine water and leached dumps are included with that in copper ore as follows: 1947, 55 ounces of silver and 30,306,293 pounds of copper; 1946, 73 ounces of silver and 20,203,536 pounds of copper.

METALLURGIC INDUSTRY

The largest ore-reduction mill and the only smelter in New Mexico in 1947 were copper plants operated by the Chino Mines Division of the Kennecott Copper Corp. at Hurley, Grant County. The mill has a rated daily capacity of 20,000 tons and treated copper ore from the company open-pit mine at Santa Rita. The smelter treated concentrates from the mill, siliceous copper ore, and copper precipitates; the precipitates were derived from the company operations at Chino and at Ray, Ariz. The copper produced was marketed as fire-refined copper bars. The other mill treating copper ore was the Banner Mining Co. 500-ton flotation plant near Lordsburg, Hidalgo County.

The eight flotation mills that treated zinc and lead ores had capacities ranging from 75 to 1,000 tons daily. The 1,000-ton mill was that of the Peru Mining Co. near Deming, Luna County. The name and location of all the mills, and the source of ore treated, are given in the following review by counties and districts.

A 25-ton amalgamation and gravity-concentration mill was run intermittently at the Shamrock mine in Santa Fe County.

Direct-smelting ore and lead and copper concentrates were shipped to smelters in Texas; ore was also shipped to copper smelters in Arizona. Zinc concentrates were shipped to smelters in Illinois, Montana, Pennsylvania, and Texas.

Mine production of metals in New Mexico in 1947, 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	150	14	1			
Concentrates smelted	302,472	1,090	[1] 341,887	[1] 118,401,593	10,895,991	88,206,000
Ore smelted	109,655	2,019	173,935	2,008,407	1,870,009	
Placer		23	10			
Total: 1947		3,146	[1] 515,833	[1] 120,410,000	12,766,000	88,206,000
1946		4,009	[1] 338,000	[1] 100,382,000	9,798,000	72,206,000

[1] Silver and copper contained in precipitates recovered from mine water and leached dumps are included with that in copper concentrates as follows: 1947, 55 ounces of silver and 30,306,293 pounds of copper; 1946, 73 ounces of silver and 20,203,536 pounds of copper.

Mine production of metals from amalgamation mills (with or without concentration equipment) in New Mexico in 1947, 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)	Copper (pounds)
Santa Fe	150	14	1	3	9	10	500
Total: 1947	150	14	1	3	9	10	500
1946	135	17	6	11	10	55	4,200

Gross metal content of concentrates produced from ores mined in New Mexico in 1947, 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	204,220	5,879	[1] 127,748	[1] 125,325,508	10,000	22,000
Lead	9,150	549	204,932	599,366	9,851,684	1,153,633
Zinc	89,102	403	109,503	1,021,558	1,726,148	98,101,820
Total: 1947	302,472	6,831	[1] 442,183	[1] 126,946,432	11,587,832	99,277,453
1946	250,081	6,598	[1] 324,458	[1] 102,050,824	10,140,924	80,482,950

[1] Silver and copper contained in precipitates recovered from mine water and leached dumps are included with that in copper concentrates as follows: 1947, 66 ounces of silver and 31,289,919 pounds of copper; 1946, 89 ounces of silver and 20,630,891 pounds of copper.

Mine production of metals from concentrating mills in New Mexico in 1947, in terms of recovered metals

	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)
BY COUNTIES							
Grant	7,119,501	283,414	816	[1] 195,695	[1] 115,725,448	7,445,952	78,040,000
Hidalgo	43,266	4,911	144	46,306	2,369,436	29,684	96,600
Luna	1,400	127	14	1,777	2,304	73,991	42,600
Sierra	5	3		20		1,368	1,600
Socorro	78,968	14,014	107	98,079	303,905	3,344,996	10,025,200
Total: 1947	7,243,140	302,469	1,081	[1] 341,877	[1] 118,401,093	10,895,991	88,206,000
1946	6,522,646	250,081	1,800	[1] 244,481	[1] 99,196,563	9,481,330	72,051,707
BY CLASSES OF ORE CONCENTRATED							
Copper	6,675,713	204,059	144	[1] 43,029	[1] 116,984,192		
Zinc	489,149	85,022	757	212,539	1,116,796	7,334,308	79,175,647
Zinc-Lead	78,278	13,388	180	86,309	300,105	3,561,683	9,030,353
Total 1947	7,243,140	302,469	1,081	[1] 341,877	[1] 118,401,093	10,895,991	88,206,000

[1] Silver and copper contained in precipitates recovered from mine water and leached dumps are included with that in copper concentrates as follows: 1947, 55 ounces of silver and 30,306,293 pounds of copper; 1946, 73 ounces of silver and 20,203,536 pounds of copper.

Gross metal content of New Mexico crude ore shipped to smelters in 1947, 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	88	146	49	775	70	
Dry and siliceous gold-silver	315	66	3,998		47	
Dry and siliceous silver	612	4	2,665	1,447	44,760	
Copper	96,317	1,647	136,588	2,320,867	328,375	1,465,450
Lead	12,323	191	31,567	84,171	1,722,291	456,283
Total: 1947	109,655	2,054	174,867	2,407,260	2,095,543	1,921,733
1946	72,109	2,214	94,654	1,621,223	445,298	905,924

Mine production of metals from New Mexico crude ore shipped to smelters in 1947, by counties, in terms of recovered metals

County	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Catron	315	65	3,938			
Dona Ana	355	2	1,792	1,100	51,000	
Eddy	19			700		
Grant	68,243	175	926	744,052	24,048	
Hidalgo	30,676	1,703	146,337	1,171,464	683,816	
Luna	339	11	1,316	596	60,509	
Otero	3,053	20	313	46,000	206,000	
Sandoval	3	9	4	200		
Sierra	1,010	11	7,294	8,300	169,632	
Socorro	5,642	23	12,015	35,995	675,004	
Total: 1947	109,655	2,019	173,935	2,008,407	1,870,009	
1946	72,109	2,172	93,456	1,181,237	316,670	154,293

REVIEW BY COUNTIES AND DISTRICTS

CATRON COUNTY

Mogollon District.—The Silver Creek Mining Co. operated its Bearup group on Silver Creek from January through April and shipped gold-silver ore to the El Paso smelter.

DONA ANA COUNTY

Organ District.—J. H. Brown operated the Stephenson-Bennett mine (Torpedo group) on a small scale in 1947 and shipped lead-silver ore containing some copper and traces of gold. His lease on the mine was purchased by E. J. Longyear and the Empire Zinc Co., who also renewed their option on the Torpedo-Memphis mines for 2 years. The new lessees did several thousand feet of diamond drilling during the year.

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1947, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)		
	Lode	Placer		Lode	Placer	Total
Catron County: Mogollon	1		315	65		65
Colfax County: Mount Baldy		1			11	11
Dona Ana County: Organ	1		355	2		2
Eddy County	1		19			
Grant County:						
Burro Mountain	5		8	1		1
Central	9		7,175,605	772		772
Pinos Altos	6	1	9,057	157	6	163
Steeple Rock	1		1,348	61		61
Swartz	1		1,694			
Other districts [1]	5		32			
Hidalgo County:						
Fremont	1		54			
Gillespie	1		849	1		1
Lordsburg	4		70,893	1,845		1,845
San Simon	5		2,141	1		1
Sylvanite	1		5			
Luna County:						
Cooks Peak	6		77			
Fremont	1		129	1		1
Tres Hermanas	2		24			
Victorio	2		1,509	24		24
Otero County:						
Orogrande	4		998	20		20
Sacramento	2		2,055			
Sandoval County: Cochiti	1		3	9		9
Sante Fe County: San Pedro (New Placers)	1	1	150	23	6	29
Sierra County:						
Kingston	3		503	4		4
Other districts [2]	7		512	7		7
Socorro County:						
Magdalena	8		84,437	130		130
Oscura Mountain	1		1			
Salinas Peak	1		130			
Silver Mountain	1		42			
Total New Mexico	82	3	7,352,945	3,123	23	3,146

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1947, by counties and districts, in terms of recovered metals—Continued

County and district	Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer	Total				
Catron County: Mogollon	3,938		3,938				$5,839
Colfax County: Mount Baldy		6	6				390
Dona Ana County: Organ	1,792		1,792	1,100	51,000		9,267
Eddy County				700			147
Grant County:							
Burro Mountain	128		128	2,279,900	1,400		479,132
Central	[3] 167,538		[3] 167,538	[4] 114,142,900	6,899,900	76,309,800	34,375,723
Pinos Altos	26,504	2	26,506	32,600	399,100	1,447,400	269,144
Steeple Rock	1,010		1,010	10,500	46,800	40,800	16,930
Swartz	1,010		1,010	3,200	109,600	242,000	46,650
Other districts [1]	431		431	400	13,200		2,375
Hidalgo County:							
Fremont	199		199	200	4,500		870
Gillespie	2,548		2,548	700	110,100		18,342
Lordsburg	185,561		185,561	3,539,300	530,400		1,052,139
San Simon	4,179		4,179	700	68,500	96,600	25,516
Sylvanite	156		156				141
Luna County:							
Cooks Peak	95		95		15,900		2,376
Fremont	119		119	200	10,300		1,668
Tres Hermanas	344		344	300	500		446
Victorio	2,535		2,535	2,400	107,800	42,600	24,316
Otero County:							
Orogrande	291		291	20,600	2,400		5,635
Sacramento	22		22	25,400	203,600		34,672
Sandoval County: Cochiti	4		4	200			361
Sante Fe County: San Pedro (New Placers)	11	2	13	500			1,132
Sierra County:							
Kingston	5,032		5,032	7,500	126,100		24,427
Other districts [2]	2,282		2,282	800	44,900	1,600	9,138
Socorro County:							
Magdalena	109,945		109,945	339,800	3,973,600	10,025,200	1,960,655
Oscura Mountain	1		1		200		30
Salinas Peak	104		104	100	42,400		6,221
Silver Mountain	44		44		3,800		587
Total New Mexico	[3] 515,823	10	[3] 515,833	[4] 120,410,000	12,766,000	88,206,000	38,374,269

[1] Includes Eureka, Juniper Hill, Telegraph, and White Signal districts.
[2] Includes Caballos Mountains, Chloride, Hermosa, Lake Valley, Las Animas, Pittsburg, and Tierra Blanca districts.
[3] Includes silver recovered from precipitates.
[4] Includes copper recovered from precipitates.

GRANT COUNTY

Burro Mountain (Tyrone) District.—The Phelps Dodge Corp. continued leaching operations at the Burro Mountain mine. Water is percolated through subsided areas of the former mine workings, and copper is precipitated from the return solutions in wooden precipitating tanks that can handle about 600 gallons per minute. Small lots of ore or clean-up material—all less than 5 tons—were shipped from the Full Moon, Mystery, Silver Dollar, and Sheridan claims.

Central (Bayard, Fierro, Georgetown, Hanover, Santa Rita) District.—The Chino Mines Division of the Kennecott Copper Corp. operated its open-pit mine at Santa Rita and its flotation mill and reverberatory copper smelter at Hurley at or near capacity throughout 1947 and was the major producer of copper in New Mexico. The mill (rated capacity, 20,000 tons daily) was operated on a 6-day week. The ore is loaded at the mine with electric shovels and transported 10 miles over the Atchison, Topeka & Santa Fe Railway to the mill. The output of concentrates was larger than in 1946. The copper recovered by the smelter was marketed in the form of fire-refined copper bars; as a result, molybdenite was the only by-product made from the ore, which contains some gold and silver as well. 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 also operated its Oswaldo zinc mine, shipping the ore produced to the Empire Zinc Co. mill at Hanover. The mine was one of the major zinc producers in the State. Mine development in 1947 included 955 feet of drifts and 252 feet of raises; total development at the end of the year comprised a 475-foot vertical shaft, 7,200 feet of drifts, and 550 feet of raises.

The American Smelting & Refining Co. operated continuously its Ground Hog group and the leased 400-ton Hanover mill (formerly Cominbation-Black Hawk). Development at the Ground Hog group in 1947 included 7,687 feet of crosscuts and raises and 23,572 feet of diamond drilling. The mill handled ore from the Ground Hog group and custom ore from the Houston-Thomas, Langston, and Royal John mines in Grant County and other mines in Sierra and Socorro Counties.

The United States Smelting, Refining & Mining Co. operated the Bayard mine group and 450-ton selective-flotation mill throughout 1947 and was a large producer of zinc and a substantial producer of lead. The lead concentrates were shipped to the El Paso, Tex., smelter and the zinc concentrates to electrolytic plants in Montana.

The Hanover mine group of the Empire Zinc Co. has been a large, steady producer of zinc for many years. Operations at the mine and mill were continuous in 1947. Besides ore from the Hanover group, the mill treated custom ore from the Kelly mine group in Socorro County and the Oswaldo mine in Grant County.

The Peru Mining Co. operated the Pewabic mine in 1947 from January 1 to August 12, and the New Mexico Consolidated Mining Co. (subsidiary of the Peru Mining Co.) operated the Copper Flat mine from January 1 to May 25 and the Kearney group throughout the year. Development during the year included 881 feet of drifts and 1,615 feet of diamond drilling in the Pewabic and 1,107 feet of drifts and 6,194 feet of diamond drilling in the Kearney. Ore from the mines was treated in the Peru 1,000-ton selective-flotation mill at Wemple, near Deming, Luna County. The mill also treated custom ore from the Houston-Thomas mine (Pinos Altos district) and the Nitt (Magdalena district, Socorro County). Zinc concentrates were shipped to the Dumas, Tex., smelter and lead concentrates to the El Paso smelter.

A car of gold ore was shipped from the Boston Bicket mine to the El Paso smelter.

Pinos Altos District.—Mathis & Mathis operated the Houston-Thomas mine from May through December and shipped 8,094 tons of zinc-lead-silver-copper-gold ore to custom mills in Grant and Luna Counties for treatment. Other lode producers were the Cleveland and Langston mines and several prospects. Some placer gold was recovered by panning on the Gold Cane placer on Bear Creek.

Steeple Rock District.—The Exploration Syndicate, Inc., shipped some zinc and lead concentrates from its mill on the Carlisle group early in 1947; the property was idle most of the year.

Swartz (Carpenter, Camp Monarch) District.—A. L. Owen operated the Royal John mine 11 months in 1947 and shipped zinc-lead ore to a custom mill in the Central district.

HIDALGO COUNTY

Fremont District.—The Yucca claim 20 miles southeast of Hachita, worked during November and December 1947 by Juan Pacheco, yielded 54 tons of silver-lead ore.

Gillespie (Red Hill) District.—From January through June 1947, A. J. Fitch shipped 87 tons of newly mined silver-lead ore and 762 tons of old tailings from the Red Hill property 28 miles southwest of Hachita.

Lordsburg District.—Production of copper in the Lordsburg district increased 48 percent in 1947 over 1946. The Banner Mining Co., operating its Bonney-Manila and Miser's Chest group of mines, continued to be the district's leading producer. The ore was treated in the company 500-ton flotation mill. Mine development in 1947 comprised 364 feet of shaft, 158 feet of raises, 2,185 feet of drifts, and 5,183 feet of diamond drilling. The mine is opened by a 1,500-foot vertical shaft and a 1,000-foot incline shaft.

The Atwood group, operated under lease by C. H. & S. A. McIntosh, was the second largest district producer of copper and the principal producer of gold and silver. The ore was shipped crude to smelters. The production rate decreased after the Premium Price Plan expired June 30. The mine is opened by a three-compartment vertical shaft 800 feet deep, with crosscuts to the vein on four levels aggregating 600 feet and 3,500 feet of drifts on the vein. Development during 1947 totaled 1,800 feet of drifts, 320 feet of crosscuts, and 1,200 feet of diamond drilling. The Millsite (formerly Waldo) group was operated from March 17 through December 1947 by the Lordsburg Mining Co. (owner) and Frank Weldon, Jr. Shipments totaled 669 tons of silver-lead ore. The Walrich Mining Co. shipped lead-silver-gold-copper ore from the Tom group (Anita).

San Simon District.—Donald A. McGhee & Co. operated the McGhee lead-zinc mine throughout 1947. Ore was shipped to custom mills until October, when remodeling of the 75-ton mill on the property was completed. Ore treated in the mill included custom ore from the Crystal (Sweet) and Silver Hill mines. Small tonnages of ore were shipped to smelters from the Volcano, World's Fair, Richard, and Rody properties.

Sylvanite District.—A truckload of silver ore was shipped from the Rincon Lode in 1947.

LUNA COUNTY

Cooks Peak District.—Lead or lead-silver ore was shipped from six properties in the Cooks Peak district in 1947. Shipments totaled 77 tons, comprising a car from the Gladys property and smaller lots from the Montezuma, Ethel-"85," Goodwill, Ray Parker, and Wallace.

Fremont District.—M. V. Eaves shipped several cars of lead ore from the International property in 1947.

Tres Hermanas District.—Lessees at the Calumet mine shipped 24 tons of silver ore containing a little copper. Less than ½ ton of lead-silver ore was shipped from the Granite King No. 1 property.

Victorio District.—The Carlson & Sandberg Mining Corp., operating the Victorio group, mined a substantial tonnage of zinc-lead-silver ore (containing also a little copper and gold), which was transported to Deming and milled in the company flotation mill. About 2 cars of lead-silver-gold ore were shipped from the El Progreso-Estrella group.

OTERO COUNTY

Orogrande (Silver Hill) District.—M. F. Drunzer shipped ore from the By Chance, Delusion, Crown Point, and Providence claims.

Sacramento District.—Lead-copper ore totaling 1,879 tons was shipped in 1947 from the Warnock mine, operated from April 1 to September 15 by M. F. Drunzer. Drunzer & Casner shipped several cars of copper ore from the Courtney mine and stock-piled at the mine about 300 tons removed in developing open-cuts.

SANTA FE COUNTY

San Pedro or New Placers District.—The Shamrock Gold Mining Co. worked intermittently at its Padilla mine in 1947.

SIERRA COUNTY

Kingston District.—Direct-smelting ore was shipped in 1947 from the Kingston, Miner's Dream, and Forest King mines.

SOCORRO COUNTY

Magdalena District.—Production of zinc in the Magdalena district increased 44 percent, lead 56 percent, and silver 58 percent in 1947 over 1946. The American Smelting & Refining Co. Magdalena unit (Waldo mine), the largest producer, operated throughout 1947. Primary crushing is done at the mine plant, from which the ore is delivered to the company 200-ton flotation mill over a 1-mile aerial tram. The mill operated three shifts, 5 days a week. Both lead and zinc concentrates were produced and shipped to smelters in Texas. The other large producer was the Empire Zinc Co. Kelly mine, operated under lease by J. D. Torres. The ore was shipped to the Empire Zinc Co. mill at Hanover (Grant County) for treatment. A substantial tonnage of old tailings containing lead, silver, zinc, and copper was shipped direct to the El Paso smelter. The Nitt group, operated by McDonald & Dobson, was also a substantial producer of zinc, lead, and silver; most of the ore was shipped to the Peru mill at Deming, Luna County. Direct-smelting ore was shipped from the Queen, Juanita, South Juanita, Blue Stone, and Esperanza mines.

Salinas Peak District.—Latham & Chenowth shipped 130 tons of ore from the Night Hawk claim (Salinas mine group).

Silver Mountain District.—A car of silver-lead ore was shipped from the Love Bug No. 7 claim.

Oregon

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By ALFRED L. RANSOME

GENERAL SUMMARY

PRODUCTION of silver in Oregon in 1947 was four times the 1946 output, owing largely to operations at one mine, and the highest since 1942. Gold production increased 8 percent above that for 1946. Although the output of copper, lead, and zinc also exceeded the totals for 1946, production remained relatively small.

The total value of the gold, silver, copper, lead, and zinc (in terms of recovered metals) produced in Oregon was $701,336 in 1947 compared with $624,231 in 1946 and $4,148,271 in the peak year 1940. It was divided among the metals as follows: Gold, 95 percent; silver, 4 percent; and copper, lead, and zinc combined, 1 percent. Baker County continued to be the leading metal producer, largely due to dredging operations, and contributed 55 percent of the State total value. Grant County was again in second place and, together with Malheur County, supplied 26 percent, Jackson 9 percent, Jefferson 4 percent, Lane 3 percent, and the other five producing counties 3 percent.

The greater part of the increased value of production came from placer-gold operations, largely worked by connected-bucket dredges and an increasing number of dragline dredges. Both lode and placer mines continued to face increased costs, although supplies were obtained more easily than in 1946.

Placer mines contributed 93 percent and lode mines 7 percent of the gold produced in Oregon in 1947. In 1946 the ratio was placer mines 94 percent and lode mines 6 percent.

All tonnage figures are short tons and "dry weight"; that is, they do not contain 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.

807865—48——1

Prices of gold, silver, copper, lead, and zinc, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Oregon, 1943–47, and total 1852–1947, 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
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
1946	23	37	3,246	17,598	615,930	6,927	5,597
1947	20	49	3,277	18,979	664,265	30,379	27,493
1852–1947	----------	----------	(2)	5,710,531	127,831,628	5,255,691	4,821,928

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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
1946	14,000	2,268	4,000	436	----------	----------	624,231
1947	28,000	5,880	24,000	3,456	2,000	242	701,336
1852–1947	[3] 12,357	4,646,443	[3] 760	80,237	[3] 142	14,318	137,394,554

[1] Excludes itinerant prospectors, snipers, high-graders, and others who have no evidence of legal right to property.
[2] Figure not available.
[3] Short tons.

Gold.—Production of gold in Oregon in 1947 increased 8 percent compared with 1946, 93 percent coming from placer mines. Of the total placer gold, connected-bucket dredges and nonfloating washing plants (with mechanical excavators) recovered 69 percent, dragline dredges 28 percent, hydraulicking 2 percent, and small-scale hand methods 1 percent. Virtually all the lode gold was derived from dry and siliceous ores; a minor quantity was recovered from copper ore. Although 69 properties produced in 1947 (60 in 1946), most of the gold came from relatively few mines; the following 5 producers, listed in order of output, supplied 74 percent of the State total: Sumpter Valley Dredging Co. and Porter & Co. (connected-bucket dredges); Calhoun & Howell, Oregon Ltd., and Stearns & Owens (dragline dredges); and W. E. Pantle Gold Dredging Co. (dryland dredge).

Gold produced at placer mines in Oregon, 1943–47, 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:					
1943–44	--------	--------	--------	--------	--------
1945	3	1,895,000	3,763	$131,705	$0.070
1946	4	5,116,000	13,793	482,755	.094
1947	[2] 7	[2] 3,976,500	[2] 12,164	[2] 425,740	[2] .107
Dragline: [3]					
1943	(4)	--------	5	175	--------
1944–45	--------	--------	--------	--------	--------
1946	9	252,000	1,910	66,850	.265
1947	12	1,093,000	4,984	174,440	.160
Suction dredges: [5]					
1943–45	--------	--------	--------	--------	--------
1946	2	15,000	155	5,425	.362
1947	--------	--------	--------	--------	--------
Nonfloating washing plants: [6]					
1943	(4)	--------	17	595	--------
1944	(4)	--------	71	2,485	--------
1945	--------	--------	--------	--------	--------
1946	1	4,200	45	1,575	.375
1947	(2)	(2)	(2)	(2)	(2)
Gravel hydraulically handled:					
Hydraulic:					
1943	10	38,000	124	4,340	.114
1944	4	22,700	99	3,465	.153
1945	5	43,000	170	5,950	.138
1946	8	114,000	406	14,210	.125
1947	19	72,200	325	11,375	.158
Small-scale hand methods: [7]					
Wet:					
1943	4	2,750	52	1,820	.662
1944	6	7,500	123	4,305	.574
1945	2	3,000	53	1,855	.618
1946	10	16,800	174	6,090	.363
1947	11	8,300	175	6,125	.738
Underground placers:					
Drift:					
1943	2	250	10	350	1.400
1944–45	--------	--------	--------	--------	--------
1946	3	1,000	19	665	.665
1947	--------	--------	--------	--------	--------
Grand total placers:					
1943	16	41,000	208	7,280	.178
1944	10	30,200	293	10,255	.340
1945	10	1,941,000	3,986	139,510	.072
1946	37	5,519,000	16,502	577,570	.105
1947	49	5,150,000	17,648	617,680	.120

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Data for nonfloating washing plants included with those for connected-bucket dredges to avoid disclosure of individual output.
[3] Includes all placer operations using dragline excavator for delivering gravel to floating washing plant.
[4] Gold from terminal clean-up; property and equipment not counted as producing.
[5] 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 with "small-scale hand methods."
[6] 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."
[7] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, etc.

Mine production of gold and silver in Oregon in 1947, by months, in fine ounces, in terms of recovered metal

Month	Gold	Silver	Month	Gold	Silver
January	617	322	August	2,597	2,486
February	505	166	September	1,728	2,624
March	1,132	230	October	1,718	2,854
April	1,243	2,208	November	1,738	2,992
May	1,698	2,025	December	1,819	2,762
June	1,981	6,186			
July	2,203	5,524	Total	18,979	30,379

The monthly production figures given in the accompanying table show the usual low outputin January and February, due to winter conditions, followed by an uninterrupted rise to the high point of the year in August. Production during the last 4 months remained at a fairly constant level that was below the August total. One of the two connected-bucket dredges operated throughout 1947, and the other operated 10 months, being idle in January and September. Of the 10 dragline dredges that operated during 1947, only 3 were worked in December.

Silver.—Silver production in Oregon in 1947 increased 339 percent compared with 1946. Of the State total, Jefferson County yielded more than two-thirds, and most of the remainder came from Baker, Grant, and Lane Counties; 88 percent came from lode mines, principally from dry silver ore, and direct smelting was the principal method of recovery. The accompanying table gives the monthly production during 1947. Output—which was variable from a low point of 166 ounces in February to 6,186 ounces in June—for the most part reflects the operation of one lode mine; the marked increase from March to April is indicative of the beginning of lode-mining activity.

Copper, Lead, and Zinc.—Most of the copper output of Oregon was from copper ore mined at one property, the balance being a byproduct of ores worked primarily for their gold and silver content. Lead output was a byproduct from gold, silver, and copper ores, and the small quantity of zinc produced was recovered entirely as a byproduct from gold ore.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1947, 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
Baker	6	10	207	$7,245	10,800	$378,000	11,007	$385,245
Curry	1		6	210			6	210
Grant and Malheur [2]	4	13	356	12,460	4,679	163,765	5,035	176,225
Jackson	3	11	12	420	1,781	62,335	1,793	62,755
Jefferson	1		172	6,020			172	6,020
Josephine	1	13	16	560	369	12,915	385	13,475
Lane	2		361	12,635			361	12,635
Union		1			4	140	4	140
Wallowa		1			15	525	15	525
Wheeler	2		201	7,035			201	7,035
Total: 1947	20	49	1,331	46,585	17,648	617,680	18,979	664,265
1946	23	37	1,096	38,360	16,502	577,570	17,598	615,930

See footnotes at end of table

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1947, by counties, in terms of recovered metals—Continued

County	Silver (lode and placer) [3]		Copper		Lead		Zinc		Total value
	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
Baker	3,878	$3,510							$388,755
Curry	1	1							211
Grant and Malheur [2]	3,144	2,845			4,000	$576			179,646
Jackson	228	206							62,961
Jefferson	21,234	19,217	8,000	$1,680	14,000	2,016			28,933
Josephine	52	47							13,522
Lane	1,802	1,631	20,000	4,200	6,000	864	2,000	$242	19,572
Union	1	1							141
Wallowa	2	2							527
Wheeler	37	33							7,068
Total: 1947	30,379	27,493	28,000	5,880	24,000	3,456	2,000	242	701,336
1946	6,927	5,597	14,000	2,268	4,000	436			624,231

[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 output.
[3] Sources of total silver as follows—1947: 26,852 ounces from lode mines and 3,527 from placers; 1946: 3,698 ounces from lode mines and 3,229 from placers.

MINING INDUSTRY

Of the 3,277 tons of ore (including 870 tons of old tailings) sold or treated in Oregon in 1947, Baker County produced 989 tons (including 820 tons of old tailings) or 30 percent, Jefferson County 988 tons or 30 percent, Grant County 623 tons or 19 percent, Lane County 412 tons or 13 percent, and Josephine County 100 tons (including 50 tons of old tailings) or 3 percent. Forty percent of the total was dry gold ore, 27 percent (old tailings) was dry gold-silver, 30 percent was silver ore, and the remainder was copper ore.

The two properties worked by connected-bucket dredge had one dredge each; both were working the end of the year. Ten dragline dredges washed gravel at 12 locations in Oregon during various periods in 1947, but only 3 operated in December, and one at the close of the year.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore and old tailings sold or treated in Oregon in 1947, with content in terms of recovered metals

Source	Material sold or treated		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
	Ore (short tons)	Old tailings (short tons)					
Dry and siliceous gold ore	1,310	50	1,013	3,348	6,000	6,700	2,000
Dry and siliceous gold-silver ore		820	107	1,549			
Dry and siliceous silver ore	988		172	21,234	8,000	14,000	
	2,298	870	1,292	26,131	14,000	20,700	2,000
Copper ore	109		39	721	14,000	3,300	
Total lode mines	2,407	870	1,331	26,852	28,000	24,000	2,000
Placers			17,648	3,527			
Total: 1947	2,407	870	18,979	30,379	28,000	24,000	2,000
1946	616	2,630	17,598	6,927	14,000	4,000	

METALLURGIC INDUSTRY

Of the State total ore and old tailings (3,277 tons), nearly 48 percent was shipped crude to smelters, 25 percent (including nearly all the old tailings) was cyanided, approximately 18 percent was treated in a concentration mill, and 10 percent was amalgamated. Ultimate recovery of 55 percent of the total lode gold was from the smelting of ore, 25 percent was as bullion from the amalgamation and cyanidation of ore, and 20 percent was from the smelting of concentrates. Of the lode silver recovered, almost 89 percent was from the direct smelting of ore, 11 percent from concentrates smelted, and less than 0.5 percent from ore amalgamated and cyanided. All material requiring smelting was shipped out of the State, as Oregon has no smelters.

Mine production of metals in Oregon in 1947, 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 old tailings amalgamated	324	288	50			
Old tailings cyanided	820	40	50			
Concentrates smelted: Flotation	108	270	2,975		2,900	
Ore smelted	1,557	733	23,777	28,000	21,100	2,000
Total lode mines		1,331	26,852	28,000	24,000	2,000
Placers		17,648	3,527			
Total: 1947		18,979	30,379	28,000	24,000	2,000
1946		17,598	6,927	14,000	4,000	

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Oregon in 1947, by types of mills and by counties, in terms of recovered metals

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal		
	Ore (short tons)	Old tailings (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)
AMALGAMATION MILLS							
Baker	92		43	5			
Curry	15		6	1			
Grant and Malheur [1]	17		10	2			
Jackson	59		12	1			
Josephine	50	50	16	4			
Wheeler	41		201	37			
Total: 1947	274	50	288	50			
1946	167		207	37			
CYANIDATION MILLS							
Baker		820	40	50	44	67	1,499
Total: 1947		820	40	50	44	67	1,499
1946	2	2,630	156	607			
Grand total: 1947	274	870	328	100	44	67	1,499
1946	169	2,630	363	644			

[1] Combined to avoid disclosure of individual output.

Gross metal content of concentrates produced from ores mined in Oregon in 1947, by classes of concentrates

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold and gold-silver [1]	108	270	2,975	509	3,000	
Total: 1947	108	270	2,975	509	3,000	
1946						

[1] Combined to avoid disclosure of individual output.

Mine production of metals from Oregon concentrates shipped to smelters in 1947, in terms of recovered metals

Class of concentrates	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Dry gold and gold-silver [1]	108	270	2,975		2,900
Total 1947	108	270	2,975		2,900

[1] All from Baker and Grant Counties.

Mine production of metals from Oregon crude ore shipped to smelters in 1947, in terms of recovered metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Baker	77	57	36			
Grant and Malheur [1]	80	143	705		1,100	
Jefferson	988	172	21,234	8,000	14,000	
Lane	412	361	1,802	20,000	6,000	2,000
Total: 1947	1,557	733	23,777	28,000	21,100	2,000
1946	447	733	3,054	14,000	4,000	
BY CLASSES OF ORE						
Dry and siliceous gold	460	522	1,822	6,000	3,800	2,000
Dry and siliceous silver	988	172	21,234	8,000	14,000	
Copper	109	39	721	14,000	3,300	
Total 1947	1,557	733	23,777	28,000	21,100	2,000

[1] Combined to avoid disclosure of individual output.

Gross metal content of Oregon crude ore shipped to smelters in 1947, 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	460	522	1,822	7,360	5,608	3,055
Dry and siliceous silver	988	172	21,234	8,643	21,814	
Copper	109	39	721	14,585	5,831	
Total: 1947	1,557	733	23,777	30,588	33,253	3,055
1946	447	733	3,054	15,456	7,507	

REVIEW BY COUNTIES AND DISTRICTS

BAKER COUNTY

Greenhorn District.—The Dixie Dredging Co., following movement of its 1½-cubic yard dragline equipment from the Middle Fork of the John Day River in Grant County, operated on the North Fork of Burnt River from July 20 to September 23, 1947; a moderate quantity of gold and some silver were recovered.

Sumpter District.—The Sumpter Valley Dredging Co., the largest producer of gold in Oregon in 1947, operated its Yuba-type electric connected-bucket dredge with 72 9-cubic foot buckets throughout the year.

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1947, by counties and districts,[1] in terms of recovered metals

County and district [1]	Mines producing [2]		Ore and old tailings (short tons)	Gold			Silver (lode and placer)[3] (fine ounces)	Lead (pounds)	Total value
	Lode	Placer		Lode (fine ounces)	Placer (fine ounces)	Total (fine ounces)			
Baker County:									
Auburn		1			1	1			$35
Baker		(4)			35	35	7		1,231
Cornucopia	1		Clean-up	4		4	6		145
Cracker Creek	1		820	107		107	1,549		5,147
Greenhorn [5]	1	1	44	43	103	146	53		5,158
Mormon Basin [6]		2			58	58	15		2,044
Sumpter		3			9,640	9,640	2,099		339,300
Upper Burnt River	1	2	84	42	915	957	139		33,621
Virtue	2	1	41	11	48	59	10		2,074
Curry County: Chetco	1		15	6		6	1		211
Grant County:									
Canyon		4			414	414	67		14,551
North Fork		1			1,220	1,220	279		42,952
Quartsburg		1			3	3			105
Susanville		2			16	16	2		562
Jackson County:									
Ashland	1		40	3		3	1		106
Gold Hill	2	4	19	9	329	338	48		11,873
Jacksonville		3			601	601	74		21,102
Upper Applegate		4			851	851	105		29,880
Jefferson County: Ashwood	1		988	172		172	21,234	14,000	[7] 28,933
Josephine County:									
Galice		2			11	11			385
Grants Pass		5			40	40	6		1,405
Greenback		4			143	143	20		5,023
Illinois River	1	1	100	16	8	24	4		844
Upper Applegate					8	8			280
Waldo		1			159	159	22		5,585
Lane County: Bohemia	2		412	361		361	1,802	6,000	[8] 19,572
Union County: Camp Carson		1			4	4	1		141
Wallowa County: Snake River		1			15	15	2		527
Wheeler County: Antone	2		41	201		201	37		7,068
Other districts [9]	4	5	673	356	3,026	3,382	2,796	4,000	121,476
Total Oregon	20	49	3,277	1,331	17,648	18,979	30,379	24,000	[7 8] 701,336

[1] Only those counties and districts shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts listed in footnote 9 and their output included with "Other districts."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Source of silver: 26,852 ounces from lode mines, 3,527 ounces from placers.

[4] Output from a property not classed as a "mine."

[5] Greenhorn district is in Baker and Grant Counties.

[6] Mormon Basin district is in Baker and Malheur Counties.

[7] Includes value of 8,000 pounds of copper from Ashwood district, Jefferson County.

[8] Includes value of 20,000 pounds of copper and 2,000 pounds of zinc from Bohemia district, Lane County.

[9] Includes Granite and Greenhorn districts in Grant County and Mormon Basin district in Malheur County.

Upper Burnt River District.—Substantial quantities of gold and some silver were recovered by the Progress Mining Co. (from June 17 to December 24) and R. E. Rush (from August 5 to December 7), using dragline dredges. The Progress Mining Co. operated earlier in the year in Union County.

GRANT COUNTY

Canyon District.—The Dixie Dredging Co. operated its 1½-cubic yard dragline equipment on the Middle Fork of the John Day River from March 7 to July 12, 1947; the equipment was subsequently moved to the North Fork of Burnt River in Baker County.

Granite District.—The Buffalo mine was operated from January 1 to November 14, 1947, by Buffalo Mines (a partnership of Alan Kissock and E. R. Ramsey) under lease and bond from Bruce Dennis. Gold ore was treated in a 35-ton flotation mill and concentrates containing gold, silver, and some lead were shipped to a smelter. In addition, a smaller quantity of gold ore was shipped directly to a smelter for treatment. Porter & Co. operated a Yuba-type electric connected-bucket dredge with 60 4½-cubic foot buckets on Clear, Olive, and Crane Creeks for 10 months in 1947; the dredge was idle in January and September.

Greenhorn District.—The Associated Dredging Co. operated its ¾-cubic yard Lima dragline excavator and Bodinson floating washing plant on Vincent Creek near Bates for 4 months (April–July) in 1947.

North Fork District.—Calhoun & Howell, Oregon, Ltd., operated a dragline dredge on the U and I, and Otter Creek claims on the North Fork of the John Day River in 1947; operations began in July; 347,750 cubic yards of gravel washed yielded 1,220 ounces of gold and 279 ounces of silver.

JACKSON COUNTY

Gold Hill District.—The Walter E. Pantle Gold Dredging Co. operated a dry-land dredge (1½-cubic yard dragline excavator and a Judson-Pacific washing plant on caterpillar treads) on the Rouge River from September 1 to October 23, 1947; a substantial quantity of gold and some silver were recovered. The equipment operated in the Jacksonville district earlier in the year. Oregon Placers operated on Pleasant Creek from January 18 to March 8, 1947 and recovered a moderate quantity of gold and some silver.

Jacksonville District.—The C. & D. Mining Co., operated its 1¼-cubic yard dragline excavator and floating washing plant on Jackson and Foots Creeks from December 16, 1946, to October 24, 1947; a moderate quantity of gold and some silver were recovered. The Walter E. Pantle Gold Dredging Co. operated its dry-land dredge (see description in preceding paragraph) 1 mile from Jacksonville from January 1 to May 23, 1947; a substantial quantity of gold and some silver were recovered.

Upper Applegate District.—Stearns & Owens operated a 1½-cubic yard Lima dragline dredge on the Rowden, Kubli, and Etta Brown properties on the Applegate River from March to September, 1947; treatment of 270,000 cubic yards of gravel yielded 774 ounces of gold and 94 ounces of silver.

JEFFERSON COUNTY

Ashwood District.—Henry Anderegg and Frank McMenamin operated the Oregon King mine under lease from Oregon King Mines from April 1 to October 31, 1947; silver ore was shipped for direct smelting. The mine was the State's largest producer of silver and lead in 1947.

JOSEPHINE COUNTY

Illinois River District.—Earle N. Young operated the Eureka mine under lease and bond from Shade Bros. throughout 1947; 100 tons of gold ore (including 50 tons of old tailings) treated by amalgamation and cyanidation yielded 16 ounces of gold and 4 ounces of silver.

Waldo District.—B. H. Oregon, Ltd., operated a 3-cubic yard dragline dredge on Sucker Creek from January 1 to May 1; the enterprise proved to be unprofitable and the company was subsequently dissolved.

LANE COUNTY

Bohemia District.—Fred J. Bartels operated the Champion mine during 1947 and shipped gold ore for direct smelting. The mine was also operated by S. A. Cuddeback during the year, who shipped copper ore to smelters. More than one-half of the relatively minor copper output of the State in 1947 came from this mine. Kenneth O. Watkins operated the Helena mine during 1947 and shipped gold ore to a smelter. A small quantity of lead and zinc was recovered from the ore.

MALHEUR COUNTY

Mormon Basin District.—The Placeritas Mining Co. operated its 1½-cubic yard dragline excavator and Bodinson floating washing plant at the Colt Bros. placers in Mormon Basin from April 1 to November 15, 1947. Whitney & Boydstun operated similar equipment at the Basin Creek placers from April 12 to May 26, 1947.

UNION COUNTY

Camp Carson District.—The Progress Mining Co. operated its dragline dredge on East Fork Creek, tributary of the Grande Ronde River, for a short period in April 1947 before moving the equipment to a new location in the Upper Burnt River district, Baker County.

South Dakota
Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By A. J. MARTIN

GENERAL SUMMARY

PRODUCTION of gold in South Dakota increased 30 percent in 1947 over 1946 and amounted to 68 percent of the average for the 5 prewar years 1937 to 1941. Shortage of underground labor continued to be the principal deterrent to capacity operation of the gold mines; the labor supply at the end of the year was reported to be about 60 percent of that required for normal operations. As usual, the Homestake mine at Lead, Lawrence County, contributed the bulk of the gold output. The Bald Mountain mine at Trojan was also an important producer. The silver output, which also increased in 1947, was incidental to the mining of gold, lead, and zinc. Zinc-lead ore was produced by the Belle Eldridge mine, near Deadwood, which was under development and made test mill runs.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in South Dakota, 1943–47, and total, 1876–1947, 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
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
1946	5		872,242	312,247	10,928,645	86,901	70,216
1947	4		939,384	407,194	14,251,790	111,684	101,074
1876–1947			(2)	21,453,495	532,469,534	9,799,693	7,001,132

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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
1946							10,998,861
1947			16,000	2,304	38,000	4,598	14,359,766
1876–1947	[3] 106	36,466	[3] 463	60,804	[3] 236	48,692	539,616,628

[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] Figure not available.
[3] Short tons.

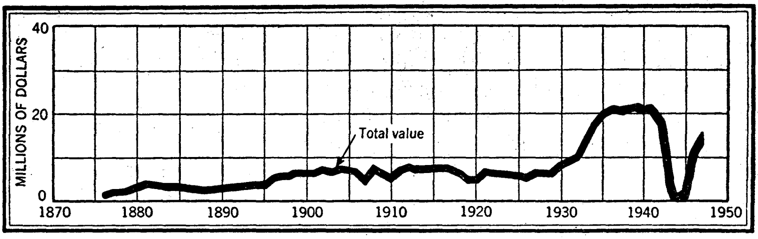

Figure 1.—Total value of mine production of gold and silver in South Dakota, 1876–1947

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, lead, and zinc in South Dakota in 1947, 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	3		939,284	407,192	$14,251,720	111,684	$101,074
Pennington	1		100	2	70		
Total: 1947	4		939,384	407,194	14,251,790	111,684	101,074
1946	5		872,242	312,247	10,928,645	86,901	70,216

County	Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	
Lawrence	16,000	$2,304	38,000	$4,598	$14,359,696
Pennington					70
Total: 1947	16,000	2,304	38,000	4,598	14,359,766
1946					10,998,861

MINING AND METALLURGIC INDUSTRY

Gold ore mined and treated in South Dakota in 1947 totaled 935,634 tons, yielding, in recovered metals, 407,145 fine ounces of gold and 111,149 fine ounces of silver. A break-down by methods of treatment shows that 849,023 tons of ore, yielding 393,174 ounces of gold and 78,044 ounces of silver, were treated by amalgamation followed by cyanidation of sands and slimes; 86,511 tons, yielding 13,969 ounces of gold and 33,105 ounces of silver, were treated by cyanidation only; and 100 tons, yielding 2 ounces of gold, were treated by amalgamation only. The zinc-lead ore (3,750 tons) that resulted from development work was treated by selective flotation in mill tests during the year. The ore yielded, in recovered metals, 49 ounces of gold, 535 ounces of silver, 16,000 pounds of lead, and 38,000 pounds of zinc, all contained in concentrates shipped to smelters.

No recovery of gold or silver has been reported from placer operations in the State since 1942.

Gold and silver bullion produced at mills in South Dakota by amalgamation, 1943–47

Year	Ore treated (short tons)	Gold in bullion (fine ounces)	Silver in bullion (fine ounces)	Quicksilver used (pounds)
1943	183,246	69,710.02	13,640	508
1944				
1945	298,830	35,398.00	7,254	1,500
1946	793,034	197,425.00	35,498	[1]
1947	849,123	262,257.00	52,057	[1]

[1] Figure not available.

Gold and silver bullion produced at mills in South Dakota by cyanidation, 1943–47

Year	Material treated (short tons)			Gold in bullion product (fine ounces)	Silver in bullion product (fine ounces)	Sodium cyanide used [1] (pounds)
	Crude ore	Sands and slimes	Total			
1943	18,772	178,318	197,090	36,679	19,048	149,326
1944	-------	-------	-------	-------	-------	-------
1945	13,782	237,503	251,285	20,550	19,310	109,900
1946	79,208	783,103	862,311	114,822	51,403	(2)
1947	86,511	848,875	935,386	144,888	59,092	(2)

[1] In terms of 96- to 98-percent strength.
[2] Figure not available.

REVIEW BY COUNTIES

LAWRENCE COUNTY

Homestake Mine.—The Homestake Mining Co. operated its mine and mills continuously in 1947. Ore treated averaged 2,326 tons daily, 7 days a week, compared with 2,173 tons in 1946. The capacity of the mills is 4,000 tons. Underground labor available at the end of the year was about 60 percent of that required for full production. The mine is opened by three vertical shafts, the deepest being 4,245 feet, and an inside winze to the 5,000-foot level. Development during the year included 25,018 feet of drifts, 9,454 feet of raises, and 28,625 feet of diamond drilling. The primary crushing plants are at the hoists. Other surface plants include the 180-stamp South mill (the main secondary crushing, grinding, and amalgamating plant), cyanide sand plant No. 1, cyanide sand plant No. 3, and the refinery—all at Lead—and the slime plant at Deadwood. At the refinery silver is parted from the gold, and virtually pure metals are shipped to the Denver Mint. Regarding the gold-mining operations of the Homestake Mining Co., the annual report of the general manager of the Homestake Mining Co. for the year ended December 31, 1947, says—

Ore mined in 1947 was 849,023 tons which compares with 792,994 tons in 1946 and approximately 1,400,000 tons annually before suspension of operations in 1942. Bullion with value of $13,796,720.25 was produced. Average realization was $16.25 per ton and metallurgical recovery was 96.63 percent.

The mine and plant are in excellent condition and there were no interruptions of operations during the year. Some increase in maintenance work was necessary, however, because of deterioration of pipe lines, mine timbers and other elements of the plant, while the mine was shut down during the war period.

Output of ore was limited by the number of men available for underground work. The average number of men employed in the mine department during 1947 was 9 percent greater than in 1946.

Operating expense per ton, exclusive of taxes, was 13 percent higher than in 1946 because of increases in wages, cost of supplies and termination of production from caving operations on upper levels. For the same reasons and also because of below capacity production, such expense was 51 percent higher than in 1941.

The reserve of developed ore including 294,000 tons of broken ore in shrinkage stopes is 21,524,000 tons; an increase of 1,679,000 tons over the reserve at the end of 1946.

Supplies of many sorts were difficult to obtain and deliveries were often slow. On this account many things normally purchased were made in our own shops. This tended to increase the total shop labor but in no case was output of ore hampered by lack of essential materials.

On July 16, 1947, a landslide in Spearfish Canyon took out a section of the pipe line to Hydro-electric Plant No. 2, necessitating the driving of a tunnel 506 feet long. The pipe line was restored on December 21 and this plant immediately placed in operation.

Ore milled, receipts, and dividends, Homestake mine, 1943–47 [1]

Year	Ore milled (short tons)	Receipts for bullion product		Dividends
		Total	Per ton	
1943	183,246	$3,629,507.33	$19.8067	
1944	(2)	402,591.29	(2)	
1945	298,828	1,873,872.64	6.2707	
1946	792,994	10,458,896.22	13.1891	$2,812,992
1947	849,023	13,796,720.25	16.2501	4,018,560

[1] From 1876 to 1947, inclusive, this mine yielded bullion and concentrates that brought a net return of $465,771,853 and paid $156,637,354 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. operated its 370-ton mill at Trojan 365 days in 1947 at an average daily rate of 237 tons. Shortage of labor and excessive labor turn-over, particularly on underground jobs, kept the production rate down to 60 to 65 percent of normal capacity. The producing claims, the same ones as in 1946, were the Portland, Dakota, and Clinton. Mine development during the year comprised 3,790 feet of drifts, 2,425 feet of crosscuts, and 2,371 feet of diamond drilling. The ore-treatment process includes crushing, roasting sulfide ores, grinding in cyanide solution, thickening and agitation, countercurrent washing, and Merrill-Crowe zinc-dust precipitation. Gold recovered in 1947 totaled 13,969 fine ounces and silver 33,105 ounces.

The Belle Eldridge mine [1] was operated on a development basis by the Belle Eldridge Gold Mines, Inc., throughout 1947. The mill was run for testing only. Much construction work was completed, and additional construction needed to increase crushing and milling capacity was started during the year. The ore contains sulfides of zinc, lead, and iron (marmatite and pyrite) and substantial quantities of gold and silver. Ore treated by selective flotation during test runs of the mill in 1947 totaled 3,750 tons, from which were recovered 29 tons of lead concentrates assaying, as shipped, 26.90 percent lead and 1.58 ounces of gold and 17.8 ounces of silver to the ton; and 61 tons of zinc concentrates assaying 36.75 percent zinc, 2.41 percent lead, and 16.5 percent iron and 0.10 ounce of gold and 0.60 ounce of silver to the ton.

PENNINGTON COUNTY

R. E. Nelson amalgamated 100 tons of ore in his mill at the Western Bell Lode near Hill City; the amalgam recovered contained 2.16 fine ounces of gold.

[1] Davis, Vernon C., Belle-Eldridge Lead-Zinc Deposits, Lawrence County, S. Dak.: Bureau of Mines Rept. of Investigations 4215, 1948, 8 pp.

Texas

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By A. J. MARTIN

GENERAL SUMMARY

THE mine production of gold, silver, copper, lead, and zinc in Texas in 1947 came from eight small-scale operations in Culberson, Hudspeth, and Presidio Counties. The total value of the output of the five metals was $50,478, compared with $56,950 in 1946. Of the total value in 1947, $22,464 was in lead, the output of which increased from 94,000 pounds in 1946 to 156,000 pounds in 1947. There were decreases in production of silver and zinc and increases in gold and copper. Construction of the slag-fuming plant at the El Paso smelting works of the American Smelting & Refining Co. progressed during the year, and operation was scheduled to begin the latter part of 1948. The plant has a large accumulation of zinc-bearing slag to treat, as well as hot slag from the lead smelter. The capacity of the new plant will be about 25,000 tons of zinc a year.

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, 1943–47

Year	Gold[1] (per fine ounce)	Silver[2] (per fine ounce)	Copper[3] (per pound)	Lead[3] (per pound)	Zinc[3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

MINE PRODUCTION

In total mine production from 1885 through 1947, silver was the principal metal produced in Texas, although the output has been small since large-scale operation of the Presidio mine at Shafter ceased in 1942. The following table shows the annual output of ore and the quantity and value of the metals recovered from Texas mines from 1943 to 1947, as well as the total metal production from 1885 to 1947.

Mine production of gold, silver, copper, lead, and zinc in Texas, 1943–47, and total, 1885–1947, in terms of recovered metals

Year	Ore (short tons)	Gold		Silver	
		Fine ounces	Value	Fine ounces	Value
1943	4,134	4	$140	10,284	$7,313
1944	4,160			5,355	3,808
1945	2,693			23,265	16,544
1946	6,705	9	315	42,922	34,681
1947	4,552	45	1,575	20,547	18,595
1885–1947	(1)	8,335	225,670	33,288,910	23,433,656

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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
1946	6,000	972	94,000	10,246	88,000	$10,736	56,950
1947	12,000	2,520	156,000	22,464	44,000	5,324	50,478
1885–1947	[2] 1,315	372,563	[2] 4,913	522,159	[2] 810	122,551	24,676,599

[1] Figure not available.
[2] Short tons.

Mine production of gold, silver, copper, lead, and zinc in Texas in 1947, by counties, in terms of recovered metals

County	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Culberson	3	587		2,895	9,200	8,300	
Hudspeth	1	2,750	1	568		20,700	44,000
Presidio	4	1,215	44	17,084	2,800	127,000	
Total: 1947	8	4,552	45	20,547	12,000	156,000	44,000
1946	5	6,705	9	42,922	6,000	94,000	88,000

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Texas in 1947, 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 silver ore	3	962	1	17,456	6,799	10,356	
Copper ore	2	68		140	4,291		
Lead ore	4	772	43	2,383	910	124,944	
Zinc-lead ore	1	2,750	1	568		20,700	44,000
Total: 1947	[1] 8	4,552	45	20,547	12,000	156,000	44,000
1946	5	6,705	9	42,922	6,000	94,000	88,000

[1] 2 mines shipped to both copper and lead plants.

SMELTING AND REFINING PLANTS IN TEXAS

Smelters in Texas treat large tonnages of ores and concentrates from several Western States and foreign countries, and a substantial tonnage of smelter residues and secondary material from plants in Texas and other States east of the Rocky Mountain region.

The copper and lead smelters of the American Smelting & Refining Co. at El Paso have an annual capacity of 600,000 tons and 250,000 tons, respectively, of furnace charge. Ores and concentrates received in 1947 came from mines in Arizona, Colorado, Michigan, New Mexico, Texas, Canada, Cuba, Mexico, Newfoundland, South-West Africa, Yugoslavia, and Argentina. Other material treated included residues and clean-up material from zinc smelters in Texas and Oklahoma, and other plants in Arizona, Kansas, and New Jersey. Retreatment of old slag accumulated at the El Paso smelters is scheduled to begin in the latter part of 1948, upon completion of the slag-fuming plant under construction during 1947. The zinc oxide recovered will be shipped to a zinc smelter and treated along with concentrates to produce metal.

The Phelps Dodge Corp. Nichols electrolytic copper refinery at El Paso treats blister-copper anodes cast at corporation smelters in Arizona; capacity operation was maintained throughout 1947. A copper sulfate (blue vitriol) section and a slime plant (for recovery of rare metals and gold, silver, and lead) are operated in connection with the electrolytic plant. Improvement and remodeling of the slime plant, begun in 1946, was completed in October 1947.

The three zinc-reduction plants in the State were operated throughout 1947. The horizontal-retort smelter of the American Smelting & Refining Co. at Amarillo received concentrates from mines in Arizona, Colorado, Montana, New Mexico, Utah, and Mexico. The same company operates the electrolytic zinc plant at Corpus Christi (annual capacity 30,000 tons of cathode zinc), which also treats both foreign and domestic concentrates. The horizontal-retort smelter of the American Zinc Co. of Illinois at Dumas purchased concentrates from mine operators in Arizona, Colorado, New Mexico, Utah, and foreign countries.

REVIEW BY COUNTIES

Culberson County.—Most of the output of silver and copper from Culberson County in 1947 came from the old Hazel mine, operated from January 1 to March 1 by M. F. Drunzer. The mine is near the Culberson-Hudspeth County line, 14 miles northwest of Van Horn. Shipments totaled 454 tons of direct-smelting ore containing 2,731 ounces of silver and 6,983 pounds of copper. Other shipments from Van Horn during the year comprised 2 cars of lead ore and a car of copper-silver ore, shipped from a prospect by Geaslin & Mayfield, and a truckload of material containing a little silver, lead, and copper, shipped by J. C. Moore and L. Ellison.

Hudspeth County.—The Bonanza zinc-lead mine in the Quitman Mountains 10 miles southwest of Sierra Blanca was operated in 1947 from January 1 to April 16 by the Clark Mining Co. The mine is opened by a 300-foot vertical shaft and 1,000 feet of drifts. The ore was treated in a gravity-concentration mill. The yield from an estimated 2,750 tons of ore treated was 12 tons of lead concentrates containing 1 ounce of gold, 568 ounces of silver, and 16,664 pounds of lead; and 70 tons of zinc concentrates containing 5,104 pounds of lead and 51,456 pounds of zinc.

Presidio County.—In 1947 the Marfa Mining Co. shipped several cars of lead ore containing a little silver from the Silver Dome group of claims 25 miles northwest of Presidio. R. I. Carr continued to ship lead-silver-gold ore from his mine near Presidio and also shipped one lot of copper ore. George Leland shipped a car of lead-silver ore from the Last Chance property. Lessees at the Presidio mine shipped about 13 cars of silver ore containing some lead.

Utah

Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By C. E. NEEDHAM AND PAUL LUFF

GENERAL SUMMARY

REBOUNDING with great vigor from a poor showing in 1946, metal mining in Utah in 1947 experienced one of the best peacetime years in the history of the State. Gold set the pace in recovery, with an increase of 136 percent in output, and copper followed closely, with a gain of 133 percent. Silver, lead, and zinc also made good records, silver production rising 89 percent, lead 62, and zinc 54. The value of each metal increased markedly over that in 1946, gold rising 136 percent, silver 112, copper 202, lead 114, and zinc 53 percent. The 1947 total value of $158,624,849—an all-time high—was 163 percent above the total value in 1946 and 27 percent more than the previous peak of $124,562,540 reached in 1943. Of the State total value in 1947, copper contributed 71, gold 9, lead 9, zinc 7, and silver 4 percent. Compared with 1946, the value of the five metals produced in the West Mountain (Bingham) district in 1947 rose 198 percent; in the Park City region, 42 percent; and in the Tintic district, 48 percent.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946 to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Utah, 1943–47, and total, 1864–1947, 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
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
1946	88	1	13,245,691	178,533	6,248,655	4,118,453	3,327,710
1947	118	2	30,383,114	421,662	14,758,170	7,780,032	7,040,929
1864–1947			[1] 599,985,802	11,064,640	287,487,440	726,952,551	531,126,691

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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	61,121,529	81,634,000	7,020,524	67,260,000	7,734,900	90,018,641
1946	228,568,000	37,028,016	61,422,000	6,694,998	56,584,000	6,903,248	60,202,627
1947	533,066,000	111,943,860	99,396,000	14,313,024	87,346,000	10,568,866	158,624,849
1864–1947	[2] 5,166,974	1,484,334,349	[2] 4,468,738	503,570,598	[2] 1,026,684	148,540,807	2,955,059,885

[1] Figures estimated for certain years before 1901.
[2] Short tons.

Mine production of gold, silver, copper, lead, and zinc in Utah in 1947, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	31,981	599,795	44,972,000	7,452,000	7,084,000
February	31,426	617,740	43,602,000	7,574,000	6,974,000
March	34,302	639,490	48,604,000	8,162,000	7,732,000
April	36,885	668,170	46,944,000	8,936,000	8,638,000
May	39,747	736,385	50,284,000	10,052,000	8,808,000
June	36,972	668,085	47,354,000	9,056,000	8,698,000
July	37,848	600,655	46,974,000	6,578,000	6,238,000
August	40,212	664,040	47,264,000	8,084,000	6,984,000
September	38,325	664,585	46,292,000	8,212,000	6,352,000
October	26,749	595,015	32,942,000	8,396,000	6,564,000
November	28,653	607,490	32,312,000	8,202,000	6,224,000
December	38,562	718,582	45,522,000	8,692,000	7,050,000
Total: 1947	421,662	7,780,032	533,066,000	99,396,000	87,346,000
1946	178,533	4,118,453	228,568,000	61,422,000	56,584,000

Gold.—The spectacular record made by gold in Utah in 1947 brought output of the metal to the highest figure in the State's history. Copper ore remained the chief source of gold, supplying 87 percent of the State output; zinc-lead ore followed with 8 percent; other base-metal ores contributed less than 1 percent; and siliceous gold and silver ores, nearly 5 percent. Two placers reported production in 1947.

Of the State gold in 1947, 91 percent came from the West Mountain (Bingham) district, where gold output was 173 percent greater than in 1946; the Park City region, second in position, gained less than 1 percent; and the Tintic district in third place recorded a loss of 14 percent.

The leading gold producers in Utah in 1947, each with an output of more than 1,000 ounces of recoverable metal, were as follows: Utah Copper mine and the United States & Lark group, both in the West Mountain (Bingham) district; New Park Mining Co. property in the Park City region; Tintic Bullion, Centennial-Beck-Victoria mines, the properties of the Chief Consolidated Mining Co., and the Eureka Lilly mine, all four in the Tintic district; and the National Tunnel & Mines Co. property in the West Mountain (Bingham) district. These eight properties produced 97 percent of the State gold in 1947.

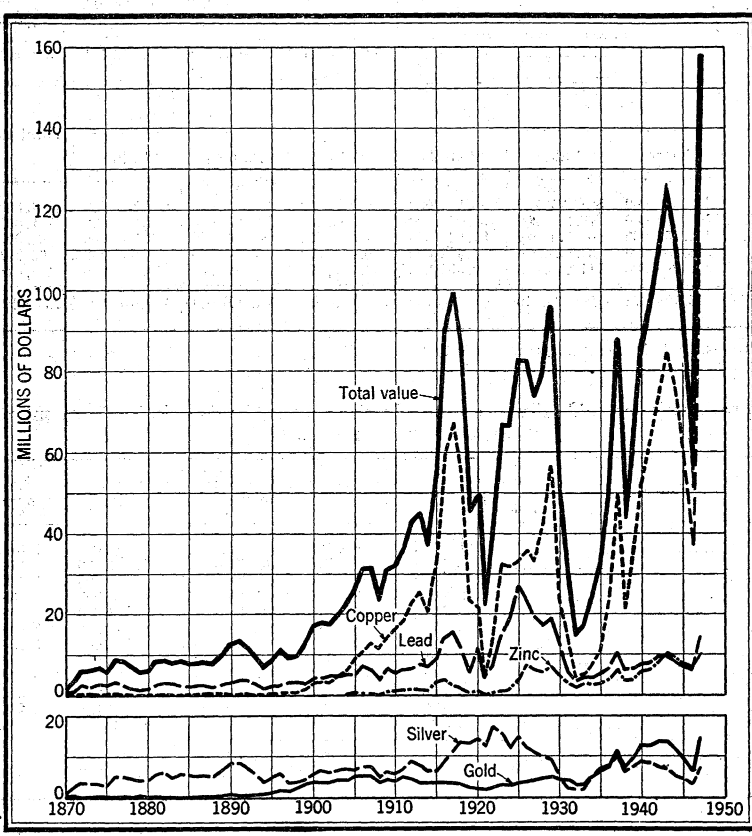

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc, and total value in Utah, 1870–1947

Silver.—The increase of 3,661,579 ounces over the 1946 output of 4,118,453 brought Utah silver production in 1947 to the highest figure since 1943. Among the larger producers of the metal, increases of 100 to 300 percent above 1946 levels were rather common. In the leading districts, gains were especially large (137 percent) in the West Mountain (Bingham) district, owing to sharp upturns in output of the metal at the Utah Copper mine, United States & Lark group, and the Butterfield property.

State producers in 1947 that had an output of more than 125,000 ounces of recoverable silver each were the Utah Copper mine, United States & Lark property, Chief Consolidated Mining Co. property, Park Utah Consolidated Mines Co. property, New Park Mining Co. property, Silver King Coalition Mines Co. property, Calumet mine, Pacific Bridge Co. property, the Butterfield property, and the Tintic Standard mine. These 10 properties furnished 89 percent of the total silver in 1947.

Zinc-lead ore, zinc ore, lead ore, and zinc-lead-copper ore together supplied 50 percent of the State silver in 1947, copper ore 40 percent, and siliceous ores 9 percent; the remainder came from copper precipitated and zinc slag fumed.

Copper.—The output of recoverable copper in Utah in 1947 was the greatest in any peacetime year and has been surpassed only in the period 1941–44. This record would have been even more impressive, except for the labor strike on the Bingham & Garfield Railroad from October 22 to November 5, which interrupted operations at the Utah Copper mine of the Kennecott Copper Corp. at Bingham. Among the five leading copper producers in 1947, only the Utah Copper mine and the United States & Lark group reported increases over 1946 output.

Utah mines that yielded over a million pounds of recoverable copper each in 1947 included the Utah Copper mine, the National Tunnel & Mines Co. property, the United States & Lark group, and the Columbia group of the Ohio Copper Co., all in the West Mountain (Bingham) district. These four properties contributed 99 percent of the State copper in 1947.

Lead.—In 1947 lead mining in Utah had its best year since 1944. Increases of 50 percent or more in output of recoverable lead, compared with 1946, were made by the Pacific Bridge Co. property, Chief Consolidated Mining Co. property, Silver King Coalition Mines Co. property, United States & Lark group, Butterfield property, and the Hidden Treasure mine in the Ophir district. Other important properties made smaller gains, and a few experienced declines.

Utah operations that yielded over a million pounds of recoverable lead each in 1947 were, in order, the United States & Lark group, Chief Consolidated Mining Co. property, Silver King Coalition Mines Co. property, New Park Mining Co. property, Park Utah Consolidated Mines Co. property, Calumet mine, Butterfield group, Tooele old slag dump, Pacific Bridge Co. property, and the Hidden Treasure mine. These 10 properties produced nearly 92 percent of the State lead in 1947.

Of the total lead output in 1947, 85 percent 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.—Zinc output in Utah in 1947 rose to the highest figure since 1943. All important zinc-producing districts made increases over 1946 yields, but gains were especially outstanding in the West Mountain (Bingham) district because of a 25,000,000-pound increase at the United States & Lark group. Standing second in increased zinc production was the Pacific Bridge Co. at Park City, with a gain of nearly 4,000,000 pounds of recoverable metal.

The leading producers of zinc in Utah in 1947, each having an output of over a million pounds of recoverable metal, were the United

States & Lark group, Chief Consolidated Mining Co. property, Tooele slag-fuming plant (yield from old slag only credited to the plant as a State producer), New Park Mining Co. property, Pacific Bridge Co. property, Park Utah Consolidated Mines Co. property, Calumet mine, Silver King Coalition Mines Co. property, Hidden Treasure mine, and the Horn Silver property. These 10 producers supplied 95 percent of the State zinc in 1947.

Zinc-lead ore concentrated was the source of nearly 87 percent of the total zinc in 1947; zinc slag fumed furnished most of the remainder.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Utah in 1947, by counties, in terms of recovered metals

County	Mines producing		Ore (short tons)	Gold		Silver	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
Beaver	8		21,640	399	$13,965	74,758	$67,656
Box Elder	4		631	39	1,365	390	353
Emery	2		9				
Garfield		1		1	35		
Grand	2		3			42	38
Iron	1		45	9	315	73	66
Juab	22		131,292	4,458	156,030	771,968	698,631
Millard		1		10	350		
Piute	5		746	139	4,865	2,484	2,248
Salt Lake	10		29,308,447	384,477	13,456,695	4,837,948	4,378,343
San Juan	2		58,733	1	35	864	782
Sevier	1		34			10	9
Summit	8		589,059	1,812	63,420	996,927	902,219
Tooele	30		162,935	4,089	143,115	401,957	363,771
Uintah	1		34			32	29
Utah	18		39,655	10,984	384,440	326,706	295,669
Wasatch	2		68,437	15,240	533,400	355,821	322,018
Washington	2		1,414	4	140	10,052	9,097
Total: 1947	118	2	30,383,114	421,662	14,758,170	7,780,032	7,040,929
1946	88	1	13,245,691	178,533	6,248,655	4,118,453	3,327,710

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaver	230,600	$48,426	1,637,000	$235,728	2,198,000	$265,958	$631,733
Box Elder	42,700	8,967	18,500	2,664	29,800	3,606	16,955
Emery	2,100	441					441
Garfield							35
Grand	900	189					227
Iron							381
Juab	463,200	97,272	10,871,500	1,565,496	7,930,000	959,530	3,476,959
Millard							350
Piute	2,200	462	17,000	2,448			10,023
Salt Lake	528,703,000	111,027,630	52,632,500	7,579,080	40,947,400	4,954,636	141,396,384
San Juan	996,100	209,181					209,998
Sevier	100	21			4,400	532	562
Summit	574,900	120,729	15,312,000	2,204,928	14,080,000	1,703,680	4,994,976
Tooele	677,300	142,233	9,890,000	1,424,160	13,366,200	1,617,310	3,690,589
Uintah	200	42	6,000	864	4,800	581	1,516
Utah	646,900	135,849	2,077,500	299,160	953,000	115,313	1,230,431
Wasatch	564,900	118,629	6,661,500	959,256	7,832,400	947,720	2,881,023
Washington	160,900	33,789	272,500	39,240			82,266
Total: 1947	533,066,000	111,943,860	99,396,000	14,313,024	87,346,000	10,568,866	158,624,849
1946	228,568,000	37,028,016	61,422,000	6,694,998	56,584,000	6,903,248	60,202,627

MINING INDUSTRY

Improvements in many of the factors affecting metal production in Utah in 1947 resulted in a tremendous increase (130 percent) in output of ore—from 13,245,691 tons in 1946 to 30,383,114 tons in 1947, a figure that has been exceeded in Utah's history only in the period 1941–44. Most of this gain was made at the Utah Copper mine, but numerous other producers pushed their tonnages considerably above 1946 levels.

Labor conditions were much improved in the State in 1947, although additional skilled miners still were needed at some places. Only one strike marred the outstanding performance of the industry during the year—a labor strike on the Bingham & Garfield Railroad, which hauls ore from the mines in Bingham Canyon to mills and smelters. The strike was called on October 22 and settled November 5; during this time no ore was produced at the Utah Copper mine.

Expiration of the Premium Price Plan on June 30 caused only two or three mines to close, but operations at some properties were curtailed or shifted to different ore. On the other hand, several small properties came into production during the second half of the year, and the total number of lode mines producing in the State in 1947 increased 34 percent—from 88 in 1946 to 118 in 1947.

Nearing completion at the end of the year were the $12,000,000 power plant of the Kennecott Copper Corp. near Magna and the $5,000,000 electric-haulage line from the company Utah Copper mine in Bingham Canyon to the company Magna and Arthur mills. The new power plant will furnish power to the copper mine, the new haulage line, and the Magna and Arthur mills.

ORE CLASSIFICATON

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Utah in 1947, 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	10	5,755	11,726	35,814	87,840	144,325	----------
Dry and siliceous gold-silver ore	19	107,064	6,861	303,756	611,008	2,497,096	----------
Dry and siliceous silver ore	31	58,922	2,218	378,654	225,526	1,901,986	1,655
	60	171,741	20,805	718,224	924,374	4,543,407	1,655
Copper	19	29,021,293	366,289	3,102,648	[1] 528,356,364	9,415	----------
Lead	51	27,194	2,031	245,351	149,671	6,467,877	335,041
Zinc	8	[2] 94,685	345	62,439	488,758	2,195,061	8,881,612
Zinc-lead	36	1,066,614	32,168	3,637,220	3,062,936	85,834,684	77,728,186
Zinc-lead-copper	4	1,587	13	14,150	83,897	345,556	399,506
Total lode mines	[3] 118	30,383,114	421,651	7,780,032	[1] 533,066,000	99,396,000	87,346,000
Placers	2	----------	11	----------	----------	----------	----------
Total: 1947	120	30,383,114	421,662	7,780,032	[1] 533,066,000	99,396,000	87,346,000
1946	89	13,245,691	178,533	4,118,453	[4] 228,568,000	61,422,000	56,584,000

[1] Includes 21,149,066 pounds recovered from mine-water precipitates.
[2] Includes 66,422 tons of zinc slag.
[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[4] Includes 10,142,892 pounds recovered from mine-water precipitates.

METALLURGIC INDUSTRY

The 30,383,114 tons of ore produced in Utah in 1947 were treated as follows: 30,145,074 tons (over 99 percent) at concentrating mills (13,055,452 tons in 1946); 171,618 tons (0.6 percent) shipped crude to smelters (107,122 tons in 1946); and 66,422 tons (0.2 percent) of old slag fumed (83,117 tons in 1946).

The 11 concentrating mills active in Utah in 1947 treated ore and old tailings as follows: 5 plants (Arthur, Magna, Ohio Copper, Tooele, and Big Indian), 29,009,573 tons of copper ore and old tailings; 5 mills (Bauer, Midvale, Pacific Bridge, Silver King, and Tooele), 1,061,254 tons of zinc-lead ore and old tailings, zinc-lead-copper ore, and zinc ore; 1 plant (Bauer), 51,987 tons of old gold-silver tailings; 1 flotation mill in Summit County, 22,000 tons of current zinc tailings; and 1 gravity mill in Utah County, 260 tons of lead ore. The custom concentration mills (3,900 tons daily capacity) in the Salt Lake area were operated at a considerably higher rate in 1947 than in 1946, yet at much below total capacity.

The Midvale 1,700-ton concentrator of the United States Smelting, Refining & Mining Co. operated all year and continued to treat largely zinc-lead ore, mostly from company-owned properties in the West Mountain (Bingham) district and from the property of the New Park Mining Co. in the Park City region. The 1,500-ton concentrator of the International Smelting & Refining Co. at Tooele operated at such times as milling ore was available; the copper unit, which treated only ore from the property of the National Tunnel & Mines Co., was closed in August. The bulk of the feed at the zinc-lead unit was supplied by the Chief Consolidated Mining Co., the National Tunnel & Mines Co., and the Park Utah Consolidated Mines Co. The 700-ton concentrator of the Combined Metals Reduction Co. at Bauer operated continuously, mainly on zinc-lead ore from company owned or operated properties in Utah and Idaho. The Silver King Coalition Mines Co. 800-ton concentrator at Park City was active throughout the year and treated only zinc-lead-silver ore from the company mine. The 1,500-ton tailing plant of the Pacific Bridge Co. at Park City operated all year.

The Garfield copper smelter of the American Smelting & Refining Co. operated throughout the year but was forced to curtail operations sharply during the Bingham & Garfield Railroad strike, when copper concentrate from the Magna and Arthur mills was cut off. The Murray lead smelter of the American Smelting & Refining Co. and the Midvale lead smelter of the United States Smelting, Refining & Mining Co. operated all year and treated lead concentrates, crude lead ore, and siliceous ores. Material for the Murray plant was supplied mainly by mines in Utah and Idaho and that for the Midvale plant chiefly from company-owned properties in Utah. The Tooele lead plant of the International Smelting & Refining Co. operated in conjunction with the company zinc slag-fuming plant and treated zinc-lead ores and old slag, lead ore and concentrates, and zinc ores, from both company-owned and custom sources. The slag-fuming plant treated a total of 160,482 tons of hot current slag, old cold slag, and crude ore in 1947, compared with 179,715 tons in 1946; the resulting zinc fume (19,657 tons), averaging 73.24 percent zinc, was shipped to the National Zinc Co. at Bartlesville, Okla., and the lead fume (2,679 tons), averaging 50.15 percent lead, was re-treated at the Tooele lead smelter or sold directly to industrial plants.

Of unusual interest was the announcement of the Kennecott Copper Corp. that late in 1948 it would begin constructing an electrolytic refinery, having an initial capacity of 12,000 tons of copper per month, at Garfield.

Mine production of metals in Utah in 1947, 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	1,019,624	399,045	6,649,816	509,378,535	85,305,449	76,287,881
Ore smelted [1]	238,040	22,605	1,130,208	2,538,399	14,090,551	11,058,119
Mine-water precipitates smelted [2]	13,305	1	8	21,149,066		
Total lode		421,651	7,780,032	533,066,000	99,396,000	87,346,000
Placer		11				
Total: 1947		421,662	7,780,032	533,066,000	99,396,000	87,346,000
1946		178,533	4,118,453	228,568,000	61,422,000	56,584,000

[1] Includes 66,422 tons of old slag. [2] All from Salt Lake County.

Gross metal content of Utah ore treated at mills in 1947, by classes of ore and methods of treatment [1]

Class of ore	Method of treatment [2]	Ore (short tons)	Gross metal content of mill feed				
			Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold-silver.	Concentration	51,987	3,000	90,000		1,500,000	2,000,000
Copper	do	29,009,573	499,066	3,450,328	559,642,690	1,000,000	
Lead	do	260	1	500	70	30,000	
Zinc	do	22,040	20	15,073	7,500	320,792	529,325
Zinc-lead	do	1,059,889	42,739	4,937,371	5,167,644	103,946,124	110,821,717
Zinc-lead-copper	do	1,325	14	11,507	84,925	310,053	431,909
Total: 1947		30,145,074	544,840	8,504,779	564,902,829	107,106,969	113,782,951
1946		13,055,452	217,354	4,299,538	241,876,959	60,578,273	65,841,438

[1] Exclusive of copper ore treated by leaching. [2] No ore treated by amalgamation or cyanidation in 1947.

Gross metal content of concentrates produced from ores mined in Utah in 1947, 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	790,257	364,977	2,995,430	516,679,533	805,826	
Lead	75,235	16,030	2,749,692	2,215,804	77,709,138	8,288,361
Zinc	72,893	6,588	547,522	1,041,825	6,645,688	76,612,888
Dry iron (from gold-silver, zinc, zinc-lead, and zinc-lead-copper ore)	81,165	11,480	373,199	460,666	4,675,978	5,856,777
Lead-copper	74	4	3,998	31,977	81,509	12,395
Total: 1947	1,019,624	399,079	6,669,841	520,429,805	89,918,139	90,770,421
1946	453,026	156,617	3,475,996	220,637,969	52,888,261	53,862,793

Mine production of metals from concentrating mills in Utah in 1947, in terms of recovered metals

	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)
BY COUNTIES							
Beaver	8,689	2,860	126	27,920	14,950	780,223	1,162,558
Juab	75,735	18,928	789	436,266	69,238	7,883,000	7,623,822
Salt Lake	29,281,523	911,441	382,244	4,705,057	507,168,204	49,221,690	40,930,895
San Juan	58,667	2,603		842	991,710		
Summit	564,005	30,877	1,243	857,202	500,976	14,445,795	14,004,459
Tooele	86,415	30,500	2,976	276,173	101,373	5,892,600	3,789,147
Utah	3,219	1,749	33	19,296	9,338	556,710	944,600
Wasatch	66,821	20,666	11,634	327,060	522,746	6,525,431	7,832,400
Total: 1947	30,145,074	1,019,624	399,045	6,649,816	509,378,535	85,305,449	76,287,881
1946	13,055,452	453,026	156,610	3,473,187	215,849,601	50,764,353	45,036,802
BY CLASSES OF CONCENTRATES SMELTED							
Copper		790,257	364,977	2,995,430	506,366,157		
Lead		75,235	16,030	2,749,692	1,651,852	75,128,932	1,389,171
Zinc		72,893	6,554	527,497	982,935	6,029,735	74,208,791
Dry iron (from gold-silver, zinc, zinc-lead, and zinc-lead-copper ore)		81,165	11,480	373,199	351,732	4,067,519	684,870
Lead-copper		74	4	3,998	25,859	79,263	5,049
Total 1947		1,019,624	399,045	6,649,816	509,378,535	85,305,449	76,287,881

Gross metal content of Utah crude ore shipped to smelters in 1947, 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	5,755	11,726	35,814	99,285	156,070	931
Dry and siliceous gold-silver	55,077	4,861	248,756	623,359	3,494,716	
Dry and siliceous silver	58,922	2,218	378,654	231,394	3,156,077	2,285
Copper	11,720	1,311	107,210	858,301	16,041	
Lead	26,934	2,031	245,065	180,822	6,616,209	580,231
Zinc [1]	72,645	341	61,283	623,027	2,344,538	12,066,314
Zinc-lead	6,725	115	49,535	134,778	1,258,355	2,632,517
Zinc-lead-copper	262	2	3,898	24,856	80,105	74,902
Total: 1947	238,040	22,605	1,130,215	2,775,822	17,122,111	15,357,180
1946	190,239	21,927	646,532	2,828,330	12,926,469	15,935,874

[1] Includes 66,422 tons of old slag.

Mine production of metals from Utah crude ore shipped to smelters in 1947, in terms of recovered metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
BY COUNTIES						
Beaver	12,951	273	46,838	215,650	856,777	1,035,442
Box Elder	631	39	390	42,700	18,500	29,800
Emery	9			2,100		
Grand	3		42	900		
Iron	45	9	73			
Juab	55,557	3,669	335,702	393,962	2,988,500	306,178
Piute	746	139	2,484	2,200	17,000	
Salt Lake	26,924	2,232	132,883	385,730	3,410,810	16,505
San Juan	66	1	22	4,390		
Sevier	34		10	100		4,400
Summit	25,054	569	139,725	73,924	866,205	75,541
Tooele	76,520	1,113	125,784	575,927	3,997,400	9,577,053
Uintah	34		32	200	6,000	4,800
Utah	36,436	10,951	307,410	637,562	1,520,790	8,400
Wasatch	1,616	3,606	28,761	42,154	136,069	
Washington	1,414	4	10,052	160,900	272,500	
Total: 1947	238,040	22,605	1,130,208	2,538,399	14,090,551	11,058,119
1946	190,239	21,916	645,266	2,575,507	10,657,647	11,547,198
BY CLASSES OF ORE						
Dry and siliceous gold	5,755	11,726	35,814	87,840	144,325	
Dry and siliceous gold-silver	55,077	4,861	248,756	611,008	2,096,696	
Dry and siliceous silver	58,922	2,218	378,654	225,526	1,901,986	1,655
Copper	11,720	1,311	107,210	841,141	9,415	
Lead	26,934	2,031	245,065	149,641	6,443,050	335,041
Zinc	72,645	341	61,283	487,558	2,180,292	8,761,107
Zinc-lead	6,725	115	49,528	114,557	1,236,044	1,906,087
Zinc-lead-copper	262	2	3,898	21,128	78,743	54,229
Total 1947	238,040	22,605	1,130,208	2,538,399	14,090,551	11,058,119

REVIEW BY COUNTIES AND DISTRICTS

BEAVER COUNTY

Granite District.—R. A. Glenny, lessee, operated the Beaver View group all of 1947 and shipped to a smelter 400 tons of zinc-lead ore containing 64 ounces of gold, 779 ounces of silver, 2,209 pounds of copper, 81,126 pounds of lead, and 106,498 pounds of zinc.

Rocky District.—The Prosper Mining Co. worked the Old Hickory group from January to July and shipped 2,025 tons of copper smelting ore containing 30 ounces of gold, 3,326 ounces of silver, and 109,357 pounds of copper.

San Francisco District.—Metal Producers, Inc., continued to operate the Horn Silver mine under lease. Output for the year (10,038 tons) comprised 8,317 tons of zinc-lead milling ore containing 164 ounces of gold, 33,360 ounces of silver, 25,437 pounds of copper, 885,448 pounds of lead, and 1,458,945 pounds of zinc; 1,678 tons of silver ore (mostly dump ore), which contained 40 ounces of gold, 6,401 ounces of silver, 8,722 pounds of copper, and 134,037 pounds of lead; and 43 tons of lead dump-ore containing 1 ounce of gold, 317 ounces of silver, 217 pounds of copper, and 7,205 pounds of lead. In December the company began building a 400-ton gravity-flotation mill near the property with expectations of beginning operations the following spring.

Star and North Star District.—James D. Williams, lessee, continued to operate the Harrington-Hickory group and produced 1,192 tons of zinc-lead ore containing 9 ounces of gold, 6,487 ounces of silver, 7,450 pounds of copper, 213,452 pounds of lead, and 287,378 pounds of zinc; 216 tons of gold-silver ore containing 56 ounces of gold, 1,444 ounces of silver, 982 pounds of copper, and 13,230 pounds of lead;

Mine production of gold, silver, copper, lead, and zinc in Utah in 1947, 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							
Beaver County:									
Granite	1		400	64	779	1,870	79,500	77,100	$24,116
Rocky	1		2,025	30	3,326	107,230			26,578
San Francisco	2		10,164	172	33,895	23,100	843,000	1,088,900	294.694
Star and North Star	4		9,051	133	36,758	98,400	714,500	1,032,000	286,345
Box Elder County:									
Crater Island	1		256	38	294	10,000			3,696
Lucin	1		222	1	63	32,500			6,917
Promontory	1		129		22	200	15,600	29,800	5,914
Sierra Madre	1		24		11		2,900		428
Emery County: Cedar Mountain	2		9			2,100			441
Garfield County: Imperial (Crescent Creek)		1		1					35
Grand County: Miners Basin	2		3		42	900			227
Iron County: Stateline	1		45	9	73				381
Juab County:									
Detroit	1		50	7	10				254
Fish Springs	2		24	2	1,432		7,500		2,446
Mt. Nebo	2		24		42		3,700		571
Tintic [1]	16		131,039	4,435	769,810	462,300	10,842,800	7,930,000	3,469,879
West Tintic	1		155	14	674	900	17,500		3,809
Millard County: House Mountain		1		10					350
Piute County:									
Gold Mountain	1		320	94	253	300			3,582
Mount Baldy	1		39	2	284	300	3,500		894
Ohio	3		387	43	1,947	1,600	13,500		5,547
Salt Lake County:									
Big Cottonwood	1		42	1	221	260	5,900	5,700	1,830
Little Cottonwood	4		909	29	17,705	66,740	227,600	2,100	64,081
Smelter	[2]		778	33	3,411	5,800	73,500	46,800	21,707
West Mountain	5		29,306,718	384,414	4,816,611	528,630,200	52,325,500	40,892,800	141,308,766
San Juan County: La Sal	2		58,733	1	864	996,100			209,998
Sevier County: Redmond	1		34		10	100		4,400	562
Summit County: Uintah	8		589,059	1,812	996,927	574,900	15,312,000	14,080,000	4,994,976

Tooele County:									
Blue Bell	1	----------	83	1	832	600	19,700	----------	3,751
Clifton	4	----------	518	12	1,147	2,700	143,300	6,800	23,483
Columbia	1	----------	40	----------	63	----------	500	7,400	1,024
Dugway	2	----------	9	----------	21	40	2,600	2,200	667
Erickson	1	----------	512	2	399	1,200	74,500	----------	11,411
Free Coinage	2	----------	255	1	716	860	36,400	1,400	6,275
Lakeside	1	----------	29	----------	31	----------	6,000	4,300	1,413
North Tintic	2	----------	633	1	390	400	40,000	86,000	16,638
Ophir	7	----------	8,904	100	90,095	222,100	1,580,000	1,974,100	598,063
Rush Valley [3]	6	----------	151,300	3,278	304,105	445,900	7,658,500	11,284,000	2,951,772
Willow Springs	3	----------	652	694	4,158	3,500	328,500	----------	76,092
Uintah County: Carbonate	1	----------	34	----------	32	200	6,000	4,800	1,516
Utah County:									
American Fork	6	----------	3,305	34	19,768	9,400	589,000	944,600	220,167
Tintic [1]	11	----------	36,345	10,950	306,916	637,300	1,488,200	8,400	1,010,159
Utah Lake	1	----------	5	----------	22	200	300	----------	105
Wasatch County:									
Blue Ledge	1	----------	68,256	15,224	355,506	546,300	6,658,800	7,828,600	2,875,423
Snake Creek	1	----------	181	16	315	18,600	2,700	3,800	5,600
Washington County: Tutsagubet	2	----------	1,414	4	10,052	160,900	272,500	----------	82,266
Total Utah	118	2	30,383,114	421,662	7,780,032	533,066,000	99,396,000	87,346,000	158,624,849

1 Tintic district is in both Juab and Utah Counties.
2 Properties not counted as mines; material credited to district came from slag dump, clean-ups, and railroad yards.
3 Includes production from Smelter district; Bureau of Mines not at liberty to publish separate figures.

and 170 tons of lead ore containing 2 ounces of gold, 1,337 ounces of silver, 1,475 pounds of copper, and 35,972 pounds of lead. The Gorge Mining Co., lessees, worked the Wild Bill mine the full year and shipped to smelters 1,235 tons of lead ore containing 29 ounces of gold, 3,630 ounces of silver, 4,309 pounds of copper, and 290,363 pounds of lead.

BOX ELDER COUNTY

Lucin District.—The Copper Mountain mine was operated for 4 months and produced 222 tons of copper smelting ore containing 1 ounce of gold, 63 ounces of silver, and 33,153 pounds of copper.

JUAB COUNTY

Fish Springs District.—District production was 17 tons of lead smelting ore from the Utah Mine group, containing 1 ounce of gold, 1,414 ounces of silver, and 6,720 pounds of lead; and 7 tons of similar ore from the Buddy claim.

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 1947, a comparison with the total in 1946, and the grand total from 1869 to 1947.

Mine production of gold, silver, copper, lead, and zinc in Tintic district, Juab and Utah Counties, Utah, 1946–47, and total, 1869–1947, in terms of recovered metals

	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1947								
Juab County	16	131,039	4,435	769,810	462,300	10,842,800	7,930,000	$3,469,879
Utah County	11	36,345	10,950	306,916	637,300	1,488,200	8,400	1,010,159
Total: 1947	27	167,384	15,385	1,076,726	1,099,600	12,331,000	7,938,400	4,480,038
1946	19	132,326	17,799	619,724	450,500	8,477,000	7,419,000	3,025,794
Total 1869–1947		(1)	2,603,758	260,892,455	243,845,164	1,876,191,079	76,932,938	398,006,950

1 Figure not available.

The Chief Consolidated Mining Co. operated its Chief No. 1, Gemini and Eureka Hill mines at a considerably higher rate in 1947 than in 1946. Output from the three mines comprised 75,086 tons of zinc-lead milling ore containing 1,516 ounces of gold, 527,096 ounces of silver, 85,011 pounds of copper, 9,581,953 pounds of lead, and 9,219,115 pounds of zinc; 14,734 tons of silver smelting ore containing 416 ounces of gold, 88,190 ounces of silver, 39,438 pounds of copper and 1,085,691 pounds of lead; and 3,856 tons of lead smelting ore containing 97 ounces of gold, 61,214 ounces of silver, 4,467 pounds of copper, 919,159 pounds of lead, and 423,166 pounds of zinc. In 1947 the properties ranked second among State producers of lead and zinc and third in silver.

The Mammoth Mining Co. produced 6,496 tons of gold-silver smelting ore containing 415 ounces of gold, 10,183 ounces of silver, 101,496 pounds of copper, and 34,781 pounds of lead. Philip P. Clark, lessee, worked the Godiva mine until his death in December and shipped to smelters 2,247 tons of gold-silver ore containing 179 ounces of gold, 11,271 ounces of silver, 1,827 pounds of copper, and 240,214 pounds of lead; and 121 tons of lead ore containing 7 ounces of gold, 705 ounces of silver, and 21,193 pounds of lead.

All output from the Tintic Standard mine of the Tintic Standard Mining Co. was shipped to smelters and comprised 9,819 tons of silver ore containing 771 ounces of gold, 103,848 ounces of silver, 44,184 pounds of copper, and 815,803 pounds of lead; and 2,058 tons of lead ore containing 108 ounces of gold, 23,972 ounces of silver, 4,950 pounds of copper, 448,611 pounds of lead, and 11,640 pounds of zinc. Other company production was 4,867 tons of silver ore from the Iron Blossom mine, 705 tons of siliceous gold-silver ore from the Harold dump, and 130 tons of silver ore from the Twentieth Century lease.

The Eureka Lilly Consolidated Mining Co. operated its group of claims all year and shipped 8,160 tons of copper smelting ore containing 1,244 ounces of gold, 95,388 ounces of silver, 461,985 pounds of copper, and 447 pounds of lead. Other production from this part of the district was gold-silver ore—2,470 tons from the Mountain View group, 919 tons from the Eureka Bullion mine, 1,914 tons from the Yankee claim, 1,738 tons from the Colorado group, and 124 tons from the Sioux claims; and 3,441 tons of gold ore from the Tintic Bullion mine.

SALT LAKE COUNTY

Little Cottonwood District.—District production in 1947 comprised 411 tons of copper ore, 352 tons of lead ore, and 21 tons of zinc-lead ore from properties of the Wasatch Mines Co.; 71 tons of lead ore from the Peruvian Consolidated group and 45 tons of similar ore from properties of the Alta United Mines Co.; and small lots of lead ore and gold ore from various producers.

Smelter District.—Output credited to the Smelter district comprised lead-plant dump slag and clean-up material shipped to smelters.

West Mountain (Bingham) District.—In 1947 the West Mountain (Bingham) district contributed 91 percent of the State gold output, 62 percent of the silver, 99 percent of the copper, 53 percent of the lead, and 47 percent of the zinc; total value of the metal output represented 89 percent of the State total value.

Output of copper at the Utah Copper mine of the Kennecott Copper Corp. was nearly 140 percent greater in 1947 than in 1946. This record would have been even more outstanding, except for the 2-week labor strike on the Bingham & Garfield Railroad, which decreased the 1947 output by an estimated 26,000,000 pounds of copper. The mine continued to be the largest copper mine in the world and contributed over 30 percent of the Nation's mine output of copper in 1947. Copper ore was milled at the Arthur and Magna plants

Mine production of gold, silver, copper, lead, and zinc in West Mountain (Bingham) district, Salt Lake County, Utah, 1946–47, and total, 1865–1947, 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
1946	6	12,572,289	140,877	2,030,182	224,166,500	24,685,500	15,186,500	$47,429,473
1947	5	29,306,718	384,414	4,816,611	528,630,200	52,325,500	40,892,800	141,308,766
Total 1865–1947	--------	(1)	6,228,443	147,941,134	[2] 4,934,636	[2] 1,588,192	[2] 500,143	1,943,735,631

[1] Figure not available.
[2] Short tons.

in 1947 at an average daily rate of 81,775 tons, compared with 67,566 tons in 1946. In addition, large quantities of copper were leached from waste dumps and precipitated in the company plant at the mouth of Bingham Canyon.

The United States & Lark property of the United States Smelting, Refining & Mining Co. remained well in the lead in 1947 among Utah producers of lead and zinc. Lead output was considerably more than twice as great, and zinc was nearly three times as much as in 1946. Over 90 percent of the ore produced in 1947 was zinc-lead ore treated at the company Midvale concentrator; but, in addition, several thousand tons of gold-silver ore and lead ore, also some zinc-lead ore, were shipped direct to smelters.

The National Tunnel & Mines Co. ceased operations at its Apex-Delaware group on September 14 because of expiration of the Premium Price Plan. Zinc output for the year was slightly greater than in 1946, but production of the other four metals declined appreciably. The bulk of the output was copper milling ore, but considerable zinc-lead ore, gold-silver ore, and lead ore also were produced.

The tailings re-treatment plant at the Columbia group of the Ohio Copper Co. was closed on December 20, after continuous operations for more than 10 years and treatment of 4,037,000 tons of old mill tailings; thereafter, all company activity was concentrated on sinking the No. 2 shaft on the property to the 1,100-foot level. In 1947 the tailings plant treated 371,477 tons compared with 515,732 tons in 1946; copper output was reduced correspondingly.

Combined Metals Reduction Co. and lessees operated the Butterfield group throughout 1947 and increased the ore output 37 percent above the 1946 level. Production comprised 17,673 tons of zinc-lead milling ore containing 1,175 ounces of gold, 150,268 ounces of silver, 69,500 pounds of copper, 3,445,106 pounds of lead, and 1,116, 257 pounds of zinc; and 66 tons of gold ore containing 53 ounces of gold, 26 ounces of silver, 373 pounds of lead, and 931 pounds of zinc.

SAN JUAN COUNTY

La Sal District.—The Big Indian open-pit mine and 250-ton flotation mill of the Ohio Copper Co. were closed November 29, because of general economic conditions. During the period of its operation in 1947, the mill treated 58,667 tons of carbonate copper ore, which yielded 2,603 tons of copper concentrate containing 842 ounces of silver and 1,011,878 pounds of copper.

SUMMIT AND WASATCH COUNTIES

PARK CITY REGION

The Park City region includes the Uintah district in Summit County and the Blue Ledge and Snake Creek districts in Wasatch County. The following table shows the production and total value of the five metals in 1947, compared with 1946, and the total from 1870 to 1947.

The Silver King Coalition Mines Co. operated its mine throughout 1947 and produced 42,102 tons of ore compared with 28,665 tons in 1946. The company 800-ton flotation mill treated 41,193 tons of zinc-lead ore containing 510 ounces of gold, 319,205 ounces of silver, 166,418 pounds of copper, 7,641,478 pounds of lead, and 4,043,504 pounds of zinc.

Park Utah Consolidated Mines Co. reported greatly increased production from its Park Utah Consolidated group in 1947 and shipped

Mine production of gold, silver, copper, lead, and zinc in Park City region, Summit and Wasatch Counties, Utah, 1946–47, and total, 1870–1947, 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
1946	9	336,474	16,956	1,009,422	892,500	16,745,000	17,752,500	$5,544,668
1947	10	657,496	17,052	1,352,748	1,139,800	21,973,500	21,912,400	7,875,999
Total 1870–1947	--------	(1)	578,858	236,127,448	69,777,213	2,430,417,434	707,723,511	375,060,320

[1] Figure not available.

41,460 tons of zinc-lead ore, compared with 28,401 tons in 1946. Gross metal content of the ore in 1947 was 985 ounces of gold, 478,013 ounces of silver, 337,321 pounds of copper, 7,120,891 pounds of lead, and 6,674,124 pounds of zinc. Of the total ore, all but 592 tons was milling ore.

The Pacific Bridge Co. operated the Grasselli tailings dump along Silver Creek all year and treated 459,944 tons of old zinc-lead tailings in the company 1,500-ton spiral concentration-selective flotation mill. Concentrates comprised 3,840 tons of lead concentrate containing 210 ounces of gold, 126,295 ounces of silver, 92,721 pounds of copper, 1,877,379 pounds of lead, and 493,018 pounds of zinc; and 5,835 tons of zinc concentrate containing 80 ounces of gold, 50,321 ounces of silver, 33,266 pounds of copper, 255,068 pounds of lead, and 6,682,658 pounds of zinc. The operation climbed from eighth place among State zinc producers in 1946 to fifth in 1947.

The New Park Mining Co., operating its Park Galena and Mayflower properties, increased its tonnage of ore produced from 61,802 in 1946 to an all-time high of 68,256 in 1947. Of this quantity, 66,802 tons were zinc-lead milling ore containing 13,311 ounces of gold, 369,658 ounces of silver, 796,208 pounds of copper, 7,316,640 pounds of lead, and 10,099,214 pounds of zinc. Remaining output was 1,454 tons of gold smelting ore.

The West Park Mining Co. operated its West Park mine for 5 months and shipped 162 tons of copper smelting ore and 19 tons of zinc-lead-copper milling ore. Reuben Garbett re-treated about 22,000 tons of current tailings from the Silver King Coalition mill in a small flotation mill and produced zinc middling for further treatment at the Midvale concentrator. McFarland & Hullinger, lessees, operated the Daly waste dump and shipped 20,877 tons of siliceous silver ore to a smelter. Remaining district production, principally siliceous material, comprised 2,676 tons of old tailings and dump ore shipped to smelters.

TOOELE COUNTY

Ophir District.—The Hidden Treasure mine, a major producer of lead and zinc in Utah in 1947, was worked all year by McFarland & Hullinger, lessees. Output comprised 4,385 tons of zinc-lead ore, 1,780 tons of lead ore, and 1,568 tons of zinc-lead-copper ore. The Treasure Hill Mines Co. operated the Shoo Fly claims for about 9 months in 1947 and shipped 627 tons of silver smelting ore containing 26 ounces of gold, 10,848 ounces of silver, 26,891 pounds of copper, and 47,490 pounds of lead. The Ophir Development Co. worked its Ophir Hill mine all year and produced 229 tons of zinc-lead milling ore and 64 tons of lead smelting ore. Remaining district production was 166 tons of zinc-lead milling ore from the Ophir Unit of the United

States Smelting, Refining & Mining Co., 38 tons of zinc smelting ore from the Queen of the Hills mine, 39 tons of lead smelting ore from the Mecca group, and 8 tons of similar ore from the Mono and Kearsarge groups.

Rush Valley District.—Output of ore from the West Calumet (Calumet) mine, operated by the Combined Metals Reduction Co., dropped from 31,502 tons in 1946 to 31,294 tons in 1947; metal content of the ore, however, was greater in 1947. Of the ore produced in 1947, 31,238 tons were zinc-lead milling ore containing 1,807 ounces of gold, 231,573 ounces of silver, 49,800 pounds of copper, 6,076,380 pounds of lead, and 4,068,324 pounds of zinc; 56 tons of silver ore went direct to a smelter. The company also operated the Honerine-Galena King group; output was 616 tons of zinc-lead milling ore and 98 tons of lead smelting ore. In addition to treating crude ores, the company mill at Bauer treated 51,987 tons of old gold-silver tailing, which yielded 17,500 tons of iron concentrate valuable chiefly for its gold and silver. The Hampton Mining Co. worked the Silver Eagle group and shipped 833 tons of zinc-lead milling ore and 10 tons of silver smelting ore. From the Blue Eagle claim, S. L. Gillette shipped 40 tons of high-grade lead smelting ore.

Smelter District.—The slag-fuming plant of the International Smelting & Refining Co. at Tooele operated 346 days during 1947 and treated 160,482 tons of hot current slag, old cold slag, and crude ore. However, only the metals recovered from fuming 66,422 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 fuming plant.

Willow Springs District.—Lessees operated the Oro Del Rey group and shipped to smelters 522 tons of lead ore containing 572 ounces of gold, 3,610 ounces of silver, 960 pounds of copper, and 334,748 pounds of lead; and 109 tons of gold ore containing 115 ounces of gold, 275 ounces of silver, 753 pounds of copper, and 10,210 pounds of lead.

UTAH COUNTY

American Fork District.—The Dutchman group was operated under lease the entire year; output was 2,478 tons of zinc-lead milling ore containing 32 ounces of gold, 19,498 ounces of silver, 12,766 pounds of copper, 566,907 pounds of lead, and 1,135,587 pounds of zinc. The Howell Mining Co. operated the Globe and the Live Yankee mines all year; the Globe produced 228 tons of zinc-lead milling ore containing 3 ounces of gold, 1,499 ounces of silver, 792 pounds of copper, 21,207 pounds of lead, and 45,978 pounds of zinc; the Live Yankee produced 249 tons of similar ore containing 8 ounces of gold, 492 ounces of silver, 431 pounds of copper, 6,551 pounds of lead, and 28,497 pounds of zinc.

Tintic District.—Mines in the Tintic district, including those in the Utah County section, are reviewed under Juab County.

WASHINGTON COUNTY

Tutsagubet District.—E. L. Cox worked the Dixie mine all year and shipped to smelters 773 tons of lead ore containing 4 ounces of gold, 9,937 ounces of silver, 1,255 pounds of copper, 278,332 pounds of lead, and 9,275 pounds of zinc; and 615 tons of copper ore containing 63 ounces of silver and 160,694 pounds of copper.

Washington
Gold, Silver, Copper, Lead, and Zinc

(MINE REPORT)

By C. E. NEEDHAM AND PAUL LUFF

GENERAL SUMMARY

WASHINGTON experienced an erratic year of metal production in 1947—lead output soared 79 percent above that in 1946, zinc gained 22 percent, and silver 11 percent; production of copper, however, dropped 51 percent and gold 32. Although average prices for silver, copper, and lead were higher in 1947 than in 1946, the sharp decreases in output of gold and copper and the small drop in the average price of zinc permitted the total value of the five metals to rise only 6 percent above that in 1946—from $6,886,748 in 1946 to $7,313,398 in 1947. Of the total value in 1947, zinc contributed nearly 46 percent, lead 21, gold 17, copper 13, and silver nearly 4 percent.

No labor strikes affected the mining industry in the State in 1947, but development and capacity production at a number of properties were hampered by labor shortages. The pronounced decline in output of gold and copper was due largely to suspension of production at the Holden mine and mill late in 1946 to develop ore; production was not resumed until August 1947.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[1] Price under authority af 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. 1943 to June 30, 1946: $0.71111111; July 1, 1946 to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

Mine production of gold, silver, copper, lead, and zinc in Washington, 1943–47, and total, 1860–1947, 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
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
1946	16	5	858,023	51,168	1,790,880	264,453	213,678
1947	25	6	676,176	34,965	1,223,775	293,736	265,831
1860–1947			(1)	2,213,635	56,232,548	13,123,609	9,375,344

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
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
1946	9,054,000	1,466,748	5,974,000	651,166	22,658,000	2,764,276	6,886,748
1947	4,480,000	940,800	10,718,000	1,543,392	27,600,000	3,339,600	7,313,398
1860–1947	[2] 81,166	21,641,309	[2] 81,122	11,690,416	[2] 151,615	25,718,248	124,657,865

[1] 1860–1903: Figures not available; 1904–47, 13,201,598 tons produced.
[2] Short tons.

Mine production of gold, silver, copper, lead, and zinc in Washington in 1947, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	1,469	13,551	2,000	662,000	2,178,000
February	1,623	18,657	2,000	684,000	2,182,000
March	2,401	25,523	2,000	968,000	2,148,000
April	1,777	21,232	2,000	898,000	2,008,000
May	2,108	31,350	2,000	766,000	1,718,000
June	1,818	18,406	2,000	744,000	2,416,000
July	2,086	25,682	2,000	1,184,000	2,110,000
August	4,254	33,369	730,000	976,000	2,610,000
September	4,285	24,372	882,000	1,042,000	2,652,000
October	4,289	27,967	960,000	958,000	2,826,000
November	4,505	25,289	950,000	846,000	2,308,000
December	4,350	28,338	944,000	990,000	2,444,000
Total: 1947	34,965	293,736	4,480,000	10,718,000	27,600,000
1946	51,168	264,453	9,054,000	5,974,000	22,658,000

Gold.—The decrease of 16,203 ounces in the State output of gold in 1947, compared with 1946, brought output of the metal in Washington to the lowest figure since 1936. This severe drop resulted mainly from suspension of production of ore from January to August at the Holden mine of the Howe Sound Co. in Chelan County. The Knob Hill mine in Ferry County made an appreciable gain over its 1946 output of gold and became Washington's leading gold producer, putting the Holden mine into second place. The Aurum group in Ferry County retained third place; its gold output in 1947 was three times that in 1946. These three properties supplied 99 percent of the State gold in 1947. Output of placer gold was 24 percent less in 1947 than in 1946. Of the State gold output in 1947, 81 percent was recovered from ore treated in concentration mills, 11 percent from ore shipped direct to smelters, and most of the remainder from current tailings cyanided.

Silver.—All leading producers of silver in Washington made gains in 1947, except the Holden mine. The Knob Hill mine (gold ore) remained in the lead, followed by the Holden group (zinc-copper ore) and the Kaaba Silver-Lead mine (zinc-lead ore) in Okanogan County. These three contributed 70 percent of the State silver in 1947. Other mines supplying important quantities were the Aurum group (gold ore), Bonanza (lead ore), Cleveland (zinc-lead ore), Deer Trail (zinc-lead ore), and Young America (zinc-lead ore), all in Stevens County except the Aurum.

Gold ore remained the leading source of silver in Washington in 1947, contributing 45 percent, followed by zinc-lead ore with 32 percent and zinc-copper ore with 17 percent; lead ore, lead-copper ore, zinc ore, copper ore, gold-silver ore, and placers together supplied 6 percent.

Of the State silver output in 1947, 87 percent was recovered from ore treated in concentration mills; 7 percent from crude ore smelted; and nearly all the remainder from current tailings cyanided.

Copper.—Copper output in Washington in 1947 declined for the seventh consecutive year and was the lowest since 1937. Output during the year was at a virtual standstill until August, when the Howe Sound Co. resumed production of zinc-copper ore at its Holden mine. No other properties contributed important quantities of the metal in 1947.

Lead.—Lead production in Washington in 1947 was the highest in any peacetime year and has been exceeded only in 1944. The Grandview mine operated by the American Zinc, Lead & Smelting Co. remained the leading lead producer, followed very closely by the property of the Pend Oreille Mines & Metals Co., both in Pend Oreille County. The Bonanza mine and the Deep Creek mine, both in Stevens County, ranked third and fourth, respectively. From these four properties came 86 percent of the State lead in 1947. About 81 percent of the total lead was derived from zinc-lead ore concentrated, and nearly all the remainder from lead ore concentrated.

Zinc.—Zinc output in Washington in 1947 also rose to the highest figure for any full peacetime year and has been surpassed only in 1941–42. Almost 97 percent of the State zinc in 1947 came from the properties of the American Zinc, Lead & Smelting Co., Pend Oreille Mines & Metals Co., Goldfield Consolidated Mines Co. (Deep Creek mine), Howe Sound Co., and the Metaline Mining & Leasing Co. Of the total zinc, nearly 82 percent was recovered from zinc-lead ore concentrated, 11 percent from zinc ore concentrated, and 7 percent from zinc-copper ore concentrated.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Washington in 1947, 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
Asotin		1	14	$490		
Benton		1	6	210		
Chelan	2		12,071	422,485	48,968	$44,316
Ferry	2		22,590	790,650	133,053	120,413
Garfield		1	1	35		
Okanogan	3	1	67	2,345	42,673	38,619
Pend Oreille	3				10,674	9,660
Snohomish		1	1	35		
Stevens	12		110	3,850	58,253	52,719
Whatcom	3	1	105	3,675	115	104
Total: 1947	25	6	34,965	1,223,775	293,736	265,831
1946	16	5	51,168	1,790,880	264,453	213,678

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Asotin							$490
Benton							210
Chelan	4,427,100	$929,691			2,000,000	$242,000	1,638,492
Ferry							911,063
Garfield							35
Okanogan	34,300	7,203	348,000	$50,112	73,800	8,930	107,209
Pend Oreille	4,400	924	6,900,000	993,600	19,508,800	2,360,565	3,364,749
Snohomish							35
Stevens	14,000	2,940	3,470,000	499,680	6,017,400	728,105	1,287,294
Whatcom	200	42					3,821
Total: 1947	4,480,000	940,800	10,718,000	1,543,392	27,600,000	3,339,600	7,313,398
1946	9,054,000	1,466,748	5,974,000	651,166	22,658,000	2,764,276	6,886,748

Gold produced at placer mines in Washington, 1943–47, 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
Dragline dredges:					
1943–45					
1946	1	10,000	85	$2,975	$0.298
1947	1	3,500	14	490	.140
Nonfloating washing plants: [1]					
1943	1	4,830	114	3,990	.826
1944	1	5,500	55	1,925	.350
1945					
1946	1	15,000	11	385	.026
1947	3	4,700	56	1,960	.417
Small-scale hand methods:					
1943	1	40	2	70	1.750
1944	2	75	4	140	1.867
1945	3	275	14	490	1.782
1946	3	115	5	175	1.522
1947	2	400	7	245	.613
Grand total placers:					
1943	2	4,870	116	4,060	.834
1944	3	5,575	59	2,065	.370
1945	3	275	14	490	1.782
1946	5	25,115	101	3,535	.141
1947	6	8,600	77	2,695	.313

[1] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."

MINING INDUSTRY

Although the number of producing lode mines in Washington in 1947 increased 56 percent from 1946, ore output for the year dropped 21 percent. This was a result mainly of development programs only at the Holden mine from late in 1946 to August 1947 and at the property of the Metaline Mining & Leasing Co. from August 1947 to the end of the year. At most other properties ore production equaled or exceeded 1946 levels.

Expiration of the Premium Price Plan June 30, 1947, had little effect on metal production in the State; its effect on exploration was difficult to evaluate.

ORE CLASSIFICATION

Details of ore classification are given in the Gold and Silver chapter of this volume.

Ore sold or treated in Washington in 1947, 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	7	63,968	22,811	133,398	100		
Dry and siliceous gold-silver ore	1	27	1	63	200		
Copper ore	1	83	106	279	31,200		
Lead ore	4	7,946		17,659	4,433	2,045,903	
Lead-copper ore	1	3		105	200	900	200
Zinc ore	2	25,357	6	630	2,842	37,015	3,068,599
Zinc-copper ore	1	232,158	11,918	48,647	4,395,800		2,000,000
Zinc-lead ore	10	346,634	46	92,945	45,225	8,634,182	22,531,201
Total lode mines	[1] 25	676,176	34,888	293,726	4,480,000	10,718,000	27,600,000
Placers	6		77	10			
Total: 1947	31	676,176	34,965	293,736	4,480,000	10,718,000	27,600,000
1946	21	858,023	51,168	264,453	9,054,000	5,974,000	22,658,000

[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 676,176 tons of lode material sold or treated in Washington in 1947, 612,175 tons (91 percent) went to concentrating mills, 48,496 tons (7 percent) to cyanidation and amalgamation mills (with or without concentrating equipment); and 15,505 tons (2 percent) to smelters, compared with 94,5, and 1 percent, respectively, in 1946.

The 612,175 tons of ore treated by concentration in 1947 were distributed among nine mills as follows: One plant, 232,158 tons of zinc-copper ore; seven plants, 345,726 tons of zinc-lead ore; one plant, 24,670 tons of zinc ore (also treated zinc-lead ore); one plant, 7,764 tons of lead ore; and one plant, 273 tons of gold ore. In addition, 897 tons of zinc-lead ore and 687 tons of zinc ore were shipped to a concentrating mill in Utah for treatment.

Mine production of metals in Washington in 1947, 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	57	625	453			
Ore and current tailings cyanided	94,392	2,092	16,485			
Concentrates smelted	46,661	28,279	256,009	4,447,912	10,586,527	27,596,752
Ore smelted	15,505	3,892	20,779	32,088	131,473	3,248
Placer		77	10			
Total: 1947		34,965	293,736	4,480,000	10,718,000	27,600,000
1946		51,168	264,453	9,054,000	5,974,000	22,658,000

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Washington in 1947, by counties, in terms of recovered metals

County	Ore treated (short tons)	Recovered in bullion: Gold (fine ounces)	Recovered in bullion: Silver (fine ounces)	Concentrates smelted and recovered metal: Concentrates produced (short tons)	Concentrates smelted and recovered metal: Gold (fine ounces)	Concentrates smelted and recovered metal: Silver (fine ounces)
AMALGAMATION MILLS						
Ferry	15	612	448			
Stevens	40	9	5	1	9	20
Whatcom	2	4				
Total: 1947	57	625	453	1	9	20
1946						
CYANIDATION MILLS						
Ferry	48,439	2,092	16,485	2,501	16,242	97,335
Total: 1947	48,439	2,092	16,485	2,501	16,242	97,335
1946	[1] 44,217	13,758	61,077	1,021	5,607	38,024
Grand total: 1947	48,496	2,717	16,938	2,502	16,251	97,355
1946	[1] 44,217	13,758	61,077	1,021	5,607	38,024

[1] Includes 1,110 tons of flotation concentrates cyanided.

Mine production of metals from concentrating mills in Washington in 1947, by counties, in terms of recovered metals

County	Ore treated (short tons)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
		Concentrates smelted and recovered metal					
Chelan	232,158	11,906	11,918	48,647	4,395,800		2,000,000
Okanogan	19,826	412		42,528	34,100	347,100	73,600
Pend Oreille	295,015	23,377		10,674	4,400	6,900,000	19,508,800
Stevens	64,903	8,443	52	56,763	13,612	3,339,427	6,014,352
Whatcom	273	21	58	42			
Total: 1947	612,175	44,159	12,028	158,654	4,447,912	10,586,527	27,596,752
1946	806,147	46,013	29,881	151,984	9,037,468	5,931,400	22,621,350

Gross metal content of concentrates produced from ores mined in Washington in 1947, 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	2,523	16,309	97,397			
Copper	9,672	11,777	46,823	4,475,812		593,860
Lead	7,510	30	50,418	15,292	10,193,940	371,410
Lead-copper	333		41,830	35,295	348,359	21,000
Zinc	26,368	156	6,708	58,775	490,207	30,648,412
Zinc-lead	155	3	11,413	1,488	60,709	47,770
Iron	100	4	1,420	320	6,292	15,380
Total: 1947	46,661	28,279	256,009	4,586,982	11,099,507	31,697,832
1946	47,034	35,488	190,008	9,345,341	6,109,104	25,662,830

Mine production of metals from Washington concentrates shipped to smelters in 1947, in terms of recovered metals.

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Chelan	11,906	11,918	48,647	4,395,800		2,000,000
Ferry	2,501	16,242	97,335			
Okanogan	412		42,528	34,100	347,100	73,600
Pend Oreille	23,377		10,674	4,400	6,900,000	19,508,800
Stevens	8,444	61	56,783	13,612	3,339,427	6,014,352
Whatcom	21	58	42			
Total: 1947	46,661	28,279	256,009	4,447,912	10,586,527	27,596,752
1946	47,034	35,488	190,008	9,037,468	5,931,400	22,621,350
BY CLASSES OF CONCENTRATES						
Dry gold	2,523	16,309	97,397			
Copper	9,672	11,777	46,823	4,350,400		
Lead	7,510	30	50,418	12,710	9,860,403	237,265
Lead-copper	333		41,830	30,350	342,760	17,000
Zinc	26,368	156	6,708	52,952	317,965	27,306,842
Zinc-lead	155	3	11,413	1,260	59,585	35,645
Iron	100	4	1,420	240	5,814	
Total 1947	46,661	28,279	256,009	4,447,912	10,586,527	27,596,752

Gross metal content of Washington crude ore shipped to smelters in 1947, 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	15,199	3,785	19,063	155		
Dry and siliceous gold-silver	27	1	63	250		
Copper	83	106	279	32,166		
Lead	182		111	448	128,110	3,552
Lead-copper	3		105	240	920	313
Zinc-lead	11		1,158	38	5,040	3,812
Total: 1947	15,505	3,892	20,779	33,297	134,070	7,677
1946	8,769	1,821	13,347	17,010	43,424	45,865

Mine production of metals from Washington crude ore shipped to smelters in 1947, in terms of recovered metals

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Chelan	164	153	321	31,300		
Ferry	14,951	3,644	18,785			
Okanogan	80	54	145	200	900	200
Stevens	283	40	1,465	388	130,573	3,048
Whatcom	27	1	63	200		
Total: 1947	15,505	3,892	20,779	32,088	131,473	3,248
1946	8,769	1,821	13,347	16,532	42,600	36,650
BY CLASSES OF ORE						
Dry and siliceous gold	15,199	3,785	19,063	100		
Dry and siliceous gold-silver	27	1	63	200		
Copper	83	106	279	31,200		
Lead	182		111	358	125,641	
Lead-copper	3		105	200	900	200
Zinc-lead	11		1,158	30	4,932	3,048
Total 1947	15,505	3,892	20,779	32,088	131,473	3,248

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Washington in 1947, 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							
Asotin County:									
Snake River		1		14					$490
Benton County:									
Columbia River		1		6					210
Chelan County:									
Chelan Lake	1		232,241	12,024	48,926	4,427,000		2,000,000	1,636,788
Peshastin Creek (Blewett)	1		81	47	42	100			1,704
Ferry County:									
Republic (Eureka)	2		63,405	22,590	133,053				911,063
Garfield County:									
Snake River		1		1					35
Okanogan County:									
Conconully (Ruby)	1		3		105	200	900	200	290
Loomis-Oroville	2		19,903	54	42,568	34,100	347,100	73,600	106,464
Similkameen River		1		13					455
Pend Oreille County:									
Metaline	3		295,015		10,674	4,400	6,900,000	19,508,800	3,364,749
Snohomish County:									
Sultan		1		1					35
Stevens County:									
Bossburg	2		8,661	13	28,379	5,800	2,020,000	209,200	343,549
Deer Trail	2		5,405	23	26,831	4,000	434,500	232,000	116,567
Kettle Falls	1		130	58	221				2,230
Northport (Aladdin)	7		51,030	16	2,822	4,200	1,015,500	5,576,200	824,948
Whatcom County:									
Mount Baker	2		29	5	63	200			274
Slate Creek	1	1	273	100	52				3,547
Total Washington	25	6	676,176	34,965	293,736	4,480,000	10,718,000	27,600,000	7,313,398

ASOTIN COUNTY

Snake River District.—Clyne J. Johnson operated his dragline dredge only in the spring of 1947; the washing of 3,500 cubic yards of gravel yielded 14 ounces of gold.

BENTON COUNTY

Total metal production in Benton County in 1947 was 6 ounces of gold, recovered by J. A. Matney from placers along the Columbia River.

CHELAN COUNTY

Chelan Lake District.—Until August 1947, development only was carried on at the Holden mine of the Howe Sound Co. During the remaining 5 months of the year, the company 2,000-ton flotation mill treated 232,158 tons of zinc-copper ore, compared with 491,402 tons in 1946; gross metal content of the ore treated in 1947 was 14,393 ounces of gold, 69,415 ounces of silver, 4,736,023 pounds of copper, and 3,389,500 pounds of zinc. The mill yielded 9,672 tons of copper concentrate and 2,234 tons of zinc concentrate.

Peshastin Creek (Blewett) District.—Carl W. Fackler, lessee, operated the Polepick mine and shipped 81 tons of high-grade gold ore to a smelter.

FERRY COUNTY

Republic (Eureka) District.—Knob Hill Mines, Inc., operated its mine and 400-ton mill throughout 1947 at a substantially higher average rate than in 1946. Gold concentrate from the flotation section of the mill was shipped to a smelter, and the flotation tailing was cyanided. Late in the year, a jig was interposed between the ball mill and the classifier, and the jig concentrate was amalgamated. The mine was Washington's leading producer of gold and silver in 1947. The Aurum group of claims of the Aurum Mining Co. was worked the entire year by lessees and the company; production in 1947 was 14,951 tons of gold smelting ore compared with 4,541 tons in 1946.

OKANOGAN COUNTY

Loomis-Oroville District.—The Kaaba mine and the 150-ton flotation mill of the Kaaba Silver-Lead Mines, Inc., were operated throughout 1947 at about the same average rate as in 1946. The mill treated 19,826 tons of zinc-lead ore containing 57,000 ounces of silver, 79,000 pounds of copper, 460,000 pounds of lead, and 200,000 pounds of zinc. R. D. Hefferman worked the Alice and Black Bear mines and shipped 77 tons of gold ore to a smelter.

Similkameen River District.—D. N. Reeder operated a nonfloating washing plant on the Similkameen River from August to December and recovered 13 ounces of gold from about 500 cubic yards of gravel.

PEND OREILLE COUNTY

Metaline District.—The Grandview mine of the American Zinc, Lead & Smelting Co. continued to be Washington's leading producer of lead and zinc in 1947. Ore production was 68 percent greater than in 1946; the ore was slightly leaner in lead content but was appreciably higher in zinc content.

The Pend Oreille Mines & Metals Co. operated its properties all year and treated 116,695 tons of zinc-lead ore in the company 750-ton flotation mill, compared with 122,106 tons in 1946. Although the tonnage was less than in 1946, lead content of the ore rose from 1,680,000 pounds in 1946 to 3,400,000 in 1947, and zinc from 7,400,000 pounds to 7,610,000 pounds.

The Metaline Mining & Leasing Co. conducted only development after August 21; consequently, production of ore and metals was considerably less than in 1946.

STEVENS COUNTY

Bossburg District.—Bonanza Lead operated its Bonanza mine and 100-ton flotation mill throughout 1947. The mill treated 7,764 tons of lead ore containing 20,000 ounces of silver, 7,000 pounds of copper, 2,150,000 pounds of lead, and 60,000 pounds of zinc. Morris & Leighton, lessees, worked the Young America mine and produced 897 tons of zinc-lead milling ore, which contained 15 ounces of gold, 12,271 ounces of silver, 2,590 pounds of copper, 111,445 pounds of lead, and 265,200 pounds of zinc. In December, a new 30-ton flotation mill was put into operation on the property.

Deer Trail District.—Base Metals, Inc., operated its Cleveland mine all year and treated about 5,000 tons of zinc-lead ore in the company 75-ton flotation mill. W. R. Borkey worked the Deer Trail claims from April to late December and produced 405 tons of zinc-lead ore.

Kettle Falls District.—The Reef Mining Co. worked the Gold Reef mine until October and treated 130 tons of gold ore in the 15-ton amalgamation-flotation mill on the property.

Northport (Aladdin) District.—The Deep Creek mine was worked 10 months by the Jamison-Higginbotham Mining Co., after which ownership passed to the Goldfield Consolidated Mines Co. During the year, 24,670 tons of zinc ore and 24,485 tons of zinc-lead ore were produced and treated in the company Blue Ridge flotation mill. Last Chance Consolidated Mines, Inc., operated the Last Chance group and treated about 1,000 tons of zinc-lead ore in the gravity mill erected on the property in 1947; a flotation unit was to be added early in 1948. The Admiral mine of the Admiral Consolidated Mining Co. was worked all year, but the 100-ton flotation mill erected on the property in 1947 was not put into operation until fall. Production from the mine was 687 tons of zinc ore containing 2 ounces of gold, 178 ounces of silver, 735 pounds of copper, 10,340 pounds of lead, and 470,000 pounds of zinc. Remaining district output, all shipped to smelters, was principally lead ore—121 tons from the Gladstone Mountain mine and 57 tons from the Electric Point claim.

WHATCOM COUNTY

Mount Baker District.—The Silver Tip mine produced 27 tons of gold-silver ore and the Red Mountain mine 2 tons of gold ore.

Slate Creek District.—The Slate Creek Mining Co. developed the Bonita, New Light, and Eureka Gold claims and tested 273 tons of gold ore in a concentration mill. J. R. Wemlinger worked placer deposits along Slate Creek and recovered 42 ounces of gold and 10 ounces of silver.

Wyoming
Gold, Silver, Copper, and Lead

(MINE REPORT)

By A. J. MARTIN

GENERAL SUMMARY

THE only significant activity in gold mining in Wyoming in 1947 was in the South Pass district, Fremont County. Of the 1,486 fine ounces of gold produced during the year, 1,455 ounces (98 percent) came from the Carissa mine in this district. The State output of silver was 95 ounces, of which 84 ounces came from the Carissa mine. No recoverable copper, lead, or zinc was produced in the State in 1947 and no lead or zinc in 1946. The output of gold in 1946 was 105 fine ounces, silver 26 fine ounces, and copper 2,000 pounds. Only a small output of lead and no output of zinc has been reported in Wyoming in the past.

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, 1943–47

Year	Gold [1] (per fine ounce)	Silver [2] (per fine ounce)	Copper [3] (per pound)	Lead [3] (per pound)	Zinc [3] (per pound)
1943	$35.00	$0.711+	$0.130	$0.075	$0.108
1944	35.00	.711+	.135	.080	.114
1945	35.00	.711+	.135	.086	.115
1946	35.00	.808	.162	.109	.122
1947	35.00	.905	.210	.144	.121

[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. 1943 to June 30, 1946: $0.71111111; July 1, 1946, to Dec. 31, 1947: $0.905.
[3] Yearly average weighted price of all grades of primary metal sold by producers; price includes bonus payments by Office of Metals Reserve for overquota production.

MINE PRODUCTION

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 1943 to 1947; it also gives the total production of metals from 1867 to 1947.

Mine production of gold, silver, copper, and lead in Wyoming, 1943–47, and total, 1867–1947, 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	
1943										
1944	6	20	$700	3	$2					$702
1945	52	2	70	31	22			6,000	$516	608
1946	61	105	3,675	26	21	[1] 2,000	$324			4,020
1947	6,059	1,486	52,010	95	86					52,096
1867–1947	(2)	79,527	1,891,773	74,787	51,883	[3] 16,326	5,684,372	[3] 14	1,486	7,629,514

[1] Includes less than ½ ton of recoverable copper produced in 1945 from the Bartlett (Copper King) mine in Laramie County.
[2] Figure not available.
[3] Short tons.

REVIEW BY COUNTIES

The entire output of gold and silver in Wyoming in 1947 came from Fremont County.

The Mica Mountain Mines, Inc., completed a 70-ton amalgamation-cyanidation mill at its Carissa mine, South Pass City, in March 1947 and treated 5,999 tons of ore during the year. Mill bullion produced contained 1,421 fine ounces of gold and 80 fine ounces of silver; an additional 34 ounces of gold and 4 ounces of silver were contained in material sold to a smelter. About 35 percent of the gold was recovered by amalgamation of jig concentrates removed from the ball-mill discharge before it reached the general cyanide circuit; the total mill recovery was 92 percent. The company suspended milling operations on October 1 because of the unsatisfactory labor supply and the failure to complete a new highway for winter use. Plans for winter operations included the sinking of the No. 2 shaft an additional 200 feet and making connections from it to the third and fourth levels.

A mill clean-up by Chas. F. Brown at the Duncan mine 1½ miles southwest of Atlantic City yielded 24 ounces of gold and 10 ounces of silver.

No placer mine was reported in operation in the State in 1947, but 7 ounces of gold and 1 ounce of silver produced near Atlantic City in 1946 were sold in 1947 and credited to the production of that year.

PART IV. FOREIGN REVIEWS

The Mineral Industry of
Middle and South America

By SUMNER M. ANDERSON

GENERAL SUMMARY [1]

THE cumulative mineral production of Middle and South America was, in the main, larger in 1947 than in 1946. Among the ores and metals most in demand, antimony, bauxite, copper, iron ore, lead, vanadium, and zinc responded with substantially higher tonnages, while chromite, manganese, mercury, tin, and zirconium failed to reach the levels of the previous year. The production rate for arsenic and tungsten remained virtually static, and output of nickel in Cuba and titanium ores in Brazil was completely arrested. Of the precious metals, gold production was down, except in Mexico and Bolivia; and platinum production was down in Colombia, whereas silver was up because of increased base-metal operations in Mexico, Bolivia, Chile, and Cuba. Among the nonmetallic minerals, cement production and producing capacity continued to rise in an effort to meet seemingly insatiable demands for new construction, barite output responded to the stepped-up drilling programs of the oil companies, and fluorspar and graphite mining received impetus from a favorable market in the United States for those products of Mexico. The Chilean nitrate industry was stabilized at the 1946 level. Diamond production was down despite a spectacular rise in the Venezuelan fields, and salt recovery dropped nearly 30 percent. Brazilian quartz-crystal exports were only 70 tons above the average for the

[1] Metric tons are used throughout this chapter. 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.

14-year period preceding 1938. Notable advances were made in the output of hydrocarbons. Coal tonnages increased in every producing country but Brazil and Peru, crude petroleum [2] output from every producing country but Ecuador, and petroleum refinery products from every refining country but Peru. The important growth of the refining industry is reflected in the ratio of refined products to crude petroleum production, which amounted to 68 percent in 1946 and 74 percent in 1947.

American corporate and individual investors placed an estimated US$636,400,000 in direct investments in foreign enterprises and securities (exclusive of US$30,000,000 in insurance-company investments) in 1947—the largest net outflow of private American capital directly invested on record.[3] Most of the capital (US$407,900,000) went to Middle and South America, and much of the increased mineral production can be attributed directly to the US$263,300,000 that went to the petroleum industry and the US$18,400,000 to mining and smelting enterprises.

The United States continued to be the principal country of destination for mineral exports from Middle and South America.

BRITISH WEST INDIES

After 2 years of delay, the Jamaican House of Representatives and Legislative Council passed a minerals (vesting) law, 1947, and a mining law, both effective October 13, 1947, clearing the way for the advancement of development of aluminum ore and whatever other mineral deposits may be found. A brief summary of the provisions of these laws has been published.[4]

METALS

Bauxite.—In 1947 Permanente Metals Corp. obtained bauxite concessions on the island of Jamaica, following similar acquisitions in 1944 by the Reynolds Metals Co. and Jamaica Bauxites, Ltd. (Aluminum Co. of Canada). A description of the deposits, discovered in 1942, was published in 1948.[5] Plans for developing the properties have not crystallized, and at the end of the year no applications for mining had been tendered to the Government.

In 1940 an announcement was made of discovery of bauxite deposits in the eastern part of Santa Lucia, in the Windward Islands. Discovery is credited to an engineer of the Demarara Bauxite Co., Ltd. (Aluminum Co. of Canada), which operates in British Guiana. The company renewed investigations in 1947 and revealed the strong possibility of large deposits of very good quality bauxite in several parts of the island. Samples were taken to British Guiana for testing, and if results are favorable a more intensive exploration program is anticipated.

NONMETALLIC MINERALS

Cement.—Cement has never been produced in any of the British West Indies. Associated Portland Cement Manufacturers, Ltd.,

[2] For a detailed report of developments in the petroleum industry see the 1948 World Oil Atlas, published as sec. 2 of World Oil (Houston, Tex.), July 1948, from which much of the material on petroleum in this review was condensed.

[3] Abelson, Milton, Movement of Private U. S. Capital to Foreign Countries in 1947: Foreign Commerce Weekly, U. S. Dept. of Commerce, vol. 32, No. 8, Aug. 21, 1948, pp. 3–4, 44–45.

[4] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 2, August 1947, pp. 35–36.

[5] Schmedeman, O. C., Caribbean Aluminum Ores: Eng. and Min. Jour., vol. 149, No. 6, June 1948, pp. 78–82.

which hoped to establish a plant on the island of Jamaica in 1947, withdrew its application after failure to reach an agreement with the local Government on income tax concessions. At the end of the year negotiations were proceeding with the World Commerce Corp. Although essential raw materials, except fuel, are available locally, it is believed that an economical cement plant necessarily would be too large for the Jamaican market and would have to depend largely on exports to the other British West Indies.

Gypsum.—Gypsum was discovered in Jamaica almost a century ago but remained uninvestigated until 1947, when it was found that millions of tons of the mineral at Bull Bay, 11 miles east of Kingston, contain less than 1 percent impurities. The locally organized Jamaica Gypsum Co. announced that its new plant would produce 3,000 tons of finished plaster in 1948 (Jamaica's estimated requirements), in addition to wallboard and hollow plaster blocks. Bellrock Construction, Ltd., a British firm, also announced plans for a plant to manufacture prefabricated wall and roof panels and building blocks.

Limestone and Lime.—Both limestone and lime are produced on the islands of the Bahamas, Barbados, Bermuda, Jamaica, and Trinidad. In the Bahamas in 1947, most of an estimated 135,600 tons of quarried limestone went into building and road construction. Conch shells and a small quantity of limestone were used to produce 2,425 tons of lime. This compares with 1946 production of an estimated 89,270 tons of limestone and 1,633 tons of lime. Bermuda has one Government-owned quarry that crushes about 75,000 tons of limestone annually, of which 18,000 to 27,000 tons are burned in small local kilns to produce 10,000 to 15,000 tons of lime, the remainder being used for roads and possibly concrete aggregate. Barbados and Jamaica do not report their production quantitatively, although both islands have many quarries, and output is believed to be relatively large. Trinidad does not report its lime regularly; limestone production amounted to 667,000 tons in 1946 but has not yet been reported for 1947.

Phosphate rock.—Phosphate-rock deposits have been found on Jamaica, and a few sources are being worked privately. Production is believed to be small, and because of the local need for fertilizers exports have been forbidden.

Salt.—Salinas in the Bahamas produced 60,963 tons of salt in 1947 compared with 36,578 tons in 1946. The 1947 figure represents total production of the British West Indies, as the Turks and Caicos Islands (Jamaican dependencies), which recovered 31,571 tons from sea water in 1946, were not permitted to produce in 1947 because of heavy surplus stocks.

Other Nonmetallic Minerals.—Earth, sand, and sandstone are obtained locally as needed in Barbados but are of slight commercial importance. In Jamaica a small Government tile factory, initiated as a relief measure, was abandoned in 1947. A proposal was being considered to establish a glass factory near Kingston, using domestic quartz sand.

HYDROCARBONS

Asphalt.—Production of natural asphalt from Trinidad Lake reached 92,160 tons in 1946 but has not yet been reported for 1947. Production of manjak on the island of Barbados dwindled to insignificance in 1946 and ceased by 1947.

Natural Gas.—In connection with oil-field operations on the island of Trinidad, about 9 billion cubic feet of natural gas annually is treated and returned to the ground for pressure maintenance. On Barbados 7,064,971 cubic feet of gas in 1946, and 17,819,298 cubic feet in 1947 were produced by a branch of the British Union Oil Co., Ltd., from two wells. The gas is sold for local use.

Petroleum.—Petroleum production in Trinidad has departed very little from a range of 20 to 22 million barrels since 1938. Figures for the past 2 years show an output of 20,173,021 barrels in 1946 and 20,520,554 barrels in 1947. By means of an intensive drilling program, war-depleted reserves were being gradually replaced by tapping new areas around the edges of old fields; of 82 wells completed during the first 7 months of 1947, only 3 were dry holes. Geophysical work was intensified in the central and southern parts of the island; but no operating concessions were granted by the end of the year in the Gulf of Paria, where interest is still keen. Virtually all of Trinidad's crude petroleum is processed in four refineries, only two of which are operating on a full-time schedule.

On the island of Barbados the British Union Oil Co., Ltd., produced and refined only 309 barrels of crude petroleum in 1947, compared with a scant 1,278 barrels in 1946. Crude was produced from two wells, and refinery sales of gasoline, kerosine, diesel oil, and fuel oil were made to local users.

In the Bahamas the end of 1947 saw completion of an air-borne magnetometer survey of the entire group of islands and surrounding waters. The first completed test well yielded valuable stratigraphic information to a depth of 14,587 feet. Plans for further activity in 1948 by the one local, three American, and three British oil companies owning concessions were awaiting a full report on this survey and on gravity-meter and seismograph work on Andros Island.

CUBA

The most notable changes in the Cuban mineral industries in 1947 were: The total absence of manganese nodules production due to closing and dismantling of the Cuban Mining Co. plant beginning December 31, 1946; the suspension of operations of the Nicaro Nickel plant on March 31, 1947; the resumption of Mayarí iron-ore production for the first time since 1943; and suspension of the production of natural asphalt. Mineral production in 1946–47 is presented in the accompanying table. The total value of Cuba's mineral production decreased from $26,133,156 in 1946 to $22,288,437 (exclusive of iron ore, for which value was not available) in 1947.

METALS

Chromite.—Mining of refractory-grade chromite continued the decline started in mid-1946 and produced in 1947 the smallest tonnage of ore since 1940. Cía. Cubana de Minas y Minerales, S. A. (E. J. Lavino & Co.), operated its Lolita mine in Camaguey Province at less than half its 1946 rate, accounting for most of the total decrease in output. The Juragua Mining Co. (Bethlehem Steel Co.) operated its low-grade Amores mine in Oriente Province at substantially the same rate as in 1946 but closed at the end of 1947, with no plans for reopening. Cía. Minera Moa, S. A., a Cuban organization, in ad-

Mineral production of Cuba, 1946–47, in metric tons (unless otherwise indicated)

Mineral	1946	1947	Change, percent
ORES AND CONCENTRATES			
Chromite:			
Refractory grade [1]	169,938	152,767	−10
Metallurgical grade [2]	4,412	6,442	+46
Total chromite	174,350	159,209	−9
Copper, in concentrates	11,323	13,549	+20
Gold, in gold-silver concentrates ... troy ounces	1,105	364	−67
Iron ore, 34 percent Fe		63,276	
Lead:			
In lead-zinc concentrates		19	
In gold-silver concentrates	5	1	−80
Total lead	5	20	+300
Manganese ore:			
Metallurgical, crude, 45 percent Mn	35,617	45,555	+28
Metallurgical, sintered nodules, 48.39 percent Mn	89,537		−100
Total metallurgical grade	125,154	45,555	−64
Chemical grade, 51.5 percent Mn	5,610	4,842	−14
Total manganese ore	130,764	50,397	−61
Nickel:			
Ore	1,254,590	303,603	−76
Oxide	14,551	2,617	−82
Nickel (plus cobalt) content of oxide	11,242	2,014	−82
Silver:			
In gold-silver concentrates ... troy ounces	4,745	1,855	−61
In copper concentrates ... do	122,477	144,841	+18
In lead-zinc concentrates ... do		236	
Total silver ... do	127,222	146,932	+15
Zinc, in lead-zinc concentrates		30	
NONMETALLIC MINERALS			
Cement	240,406	276,369	+15
Gypsum, crude (estimates)	14,300	14,900	+4
Gypsum, calcined	4,344	3,077	−29
Salt	59,913	[3] 54,431	−9
Stone (estimates):			
Limestone	(4)	350,900	
Marble	6,350	540	−91
Crushed stone	2,385,000	3,180,000	+33
HYDROCARBONS			
Asphalt, natural:			
Gilsonite	1,827		−100
Other	254		−100
Total	2,081		−100
Petroleum:			
Naphtha (Motembo field) ... barrels (42 gal.)	68,242	[3] 51,000	−25
Gas oil (Jarahueca field) ... do	200,289	[3] 250,400	+25

[1] 1946—34.48 percent Cr_2O_3; 1947—35.17 percent Cr_2O_3.
[2] 1946—45.93 percent Cr_2O_3; 1947—46.30 percent Cr_2O_3.
[3] Estimated.
[4] Not reported.

dition to continuing activity at its principal Cayoguan mine, revived two mines in the same district in Oriente Province: the Narciso mine, closed by its previous operator, Primativo Portal, at the end of September 1946 and reopened under the new management in mid-1947, and the Cromita mine, which, after several years of inactivity, produced in September and was under development for the remainder of the year. Production was resumed during the first quarter of 1948. Throughout 1947 the company also successfully operated the new Delta 2 mine in Oriente Province. Cía. Minera Moa, S. A., is Cuba's largest producer of refractory-grade chromite, accounting for 77 percent of the total output in 1947.

For the second consecutive year the Caledonia mine of the Mayarí Mining Co., S. A., Oriente Province, was Cuba's sole producer of metallurgical-grade chromite. Output of ore of 46.5-percent average grade was well in advance of 1946 but was hampered by cavings caused by heavy rains and the August 6 earthquake.

Copper.—Copper production continued to advance throughout 1947. Operations by Minas de Matahambre, S. A., Pinar del Rio Province, were slowed somewhat in the latter half of 1947 by absenteeism and labor disagreements. The Matahambre mine was the only copper property operating in the Republic in 1945 and 1946; its output was augmented slightly by 14 small mines in 1944 and by Arozena y Suarez Somoano, S. L., during the fourth quarter of 1947, when a new concentrating mill started treatment of ores obtained from an old stock pile and renewed mining of the Mercedes mine, Pinar del Rio Province.

The Cristina mine near Bayamo, Oriente Province, produced about 100 tons of copper ore during World War II and became dormant in 1944. During 1947 the leaseholders incorporated in the United States as Cristina Mines, Inc., and in Cuba as The Garland Corp. of Cuba (the operating company). The new company engaged in exploration work, and a substantial reserve of ore is said to have been developed without diamond drilling. The mine began production with 1,452 metric tons of selected 10-percent copper during the first quarter of 1948, from a 160-foot shaft that connects with 450 feet of adit.

Iron.—The Juragua Iron Co. closed its Felton nodulizing plant in 1941 but continued to mine nickel-bearing iron ore from its deposit near Mayarí, Oriente Province, through 1943 and magnetite and hematite ores from its Firneca mine east of Santiago de Cuba, in the same Province, through 1944. Operation of the Mayarí mines and the Felton nodulizing plant was resumed in 1947, increasing to maximum output in the fourth quarter. The grade of ore is raised from about 34 percent iron, as mined, to about 54 percent iron after processing.

Lead-Zinc.—In 1942 a 40-foot shaft was sunk by the first operator of the Lola mine, 35 kilometers by road from the town of Guane in Pinar del Rio Province. A sample shipment of approximately 70 tons was made to the United States, and the mine was closed. During the second quarter of 1947 a new local group leased the mine and renewed operations, having made arrangements to ship 400 to 500 tons of ore per month to an American smelter in Utah. Actually, only 83 metric tons of lead-zinc ore were produced during the second and third quarters of the year (none in the fourth quarter), containing 19 tons of lead, 30 tons of zinc, and 236 ounces of silver. Mining was renewed in the first quarter of 1948, but prospects for developing a successful and continuous operation were not favorable. A small, additional byproduct mining of lead followed the decrease in production of gold and silver concentrates.

Manganese.—The tremendous drop in the production of metallurgical-grade manganese ore in 1947, as compared with 1946, resulted from closing of the sintering plant of the Cuban Mining Co. at Cristo, Oriente Province, on December 31, 1946, following exhaustion of ore suitable for treatment from the Quinto and Ponupo mines. Early in 1947 the Cuban Mining Co. started dismantling this nodulizing plant for sale of all equipment.

The Charco Redondo mine of Marsden Leeder produced direct-shipping metallurgical-grade manganese ore steadily throughout the first three quarters of 1947 but was slowed during the fourth quarter by mine inundations following heavy rains. Beginning in April and continuing for the remainder of the year, the Charco Redondo production was supplemented by renewed output of the Cañada and Lego mines of the Taratana group, Cristo, Oriente Province, operated by Cía. Minera Marta, S. A. These two mines were closed indefinitely at the end of 1947; all known reserves of 45-percent or better shipping-grade ore are said to have been exhausted, and initiation of an exploratory program is being considered.

Between 275 and 300 men employed at approximately 20 mines in Oriente Province mined slightly less chemical-grade ore in 1947 than in the preceding year. As in the case of metallurgical-grade ore, a larger tonnage production was prevented by heavy rains during the latter part of the year.

Nickel.—Production of nickel oxide was terminated on March 31 at the Nicaro Nickel Co. nickel oxide plant at Nicaro, Oriente Province. The plant was idle and in charge of a small maintenance crew for the remainder of the year, pending decision as to its final disposal.

Precious Metals.—The total Cuban output of 364 ounces of gold in 1947 was contained in 65 tons of concentrates processed during the first quarter by Cía. Minera de Isla de Pinos, S. A., from ores taken from the Delita mine on the Isle of Pines. The concentrates also contained 1,855 ounces of silver and 1,353 kilograms of lead and were shipped to El Paso, Tex., for refining. The concentrating plant was shut down on February 28 and continued inactive for the remainder of the year. On June 30 the property was taken over by Productos Minerales de Isla de Pinos, S. A. (controlled by the newly organized Isle of Pines Mining Co., Ltd., of Canada), which company engaged in exploratory and development work for the remainder of 1947 without undertaking commercial production.

During the second quarter the Freeport Sulphur Co. initiated a detailed gold-exploration program at Guaimaro in Camaguey Province. Very little progress was made during the year, pending settlement of certain legal problems pertaining to surface rights.

Minas de Matahambre continued to be Cuba's leading byproducer of silver. Output rose compatible with the increase in production of copper concentrates and was supplemented slightly by the previously mentioned silver content of gold-silver and lead-zinc concentrates.

NONMETALLIC MINERALS

Cement.—Although La Cía. Cubana de Cemento Portland, sole domestic cement manufacturer, pushed its Mariel Bay plant to a new all-time production record, cement output was still inadequate to meet the requirements of the Republic and had to be supplemented by imports from the United States. Company production of limestone and clay has not been reported. The 1947 cement output is not expected to be equalled in 1948, as the plant had to be shut down for powerhouse repairs between January 27 and February 23.

Diamonds.[6]—Cuba's war-born diamond-cutting industry reached

[6] See also Aronheim, Walter, Cuban Diamond Picture: Jewelry, vol. 5, No. 5, Apr. 15, 1948, pp. 36, 40, 76, and 77.

its maximum development in 1945. Its precipitous decline since is reflected in the following table:

Diamond-cutting industry	1945	1946	1947
Number of workshops	52	13	5
Number of workers employed, approximate	3,500	600	250
Average weekly production—carats	1,800	500	215
Exports, cut and polished stones—carats	59,747	56,079	[1] 5,000
Exports, cut and polished stones—US$ value	9,925,715	8,436,153	[1] 800,000

[1] Estimate.

The collapse resulted mainly from failure of most of the industry to adopt and maintain standards of cutting quality and operating efficiency competitive with the revived cutting industry of postwar Europe. However, the largest of the remaining factories has earned an excellent reputation for efficiency and high quality of cutting and may survive as an established small-scale industry. Most of the other workers have either migrated to Europe and the United States or are unemployed.

Gypsum.—Production of gypsum in Cuba for the past 2 years was as follows, in metric tons:

	1946	*1947*
Raw gypsum production (estimated):		
For manufacture of portland cement	7,200	8,300
For manufacture of calcined gypsum	5,200	3,700
For all other uses	1,900	2,900
Estimated total production	14,300	14,900
Calcined gypsum production	4,344	3,077

Raw gypsum is quarried from the Corral Nueve deposits of Matanzas Province.

Salt.—Salt is obtained by evaporation of sea water at about 20 salinas at Sagua la Grande, Las Villas, and Caimanera, in Oriente Province. Recovery in 1947 was slightly less than in 1946.

Other Nonmetallic Minerals.—No reports have been received on lime, sand, gravel, clay, and pigment earths, which are known to be produced on the island. The crushed-stone figures represent the estimated weight of 1,500,000 and 2,000,000 cubic meters reportedly produced in 1946 and 1947. The increase resulted from the expansion of the Government's public works program and the increased construction of large office buildings.

HYDROCARBONS

Asphalt.—None of Cuba's deposits of natural metamorphosed asphalt were worked during 1947, although a project for beneficiating asphalt into petroleum products is still being studied by a private group.

Petroleum.—A declining petroleum yield in relation to number of wells drilled, increased material and labor costs, and abundant supplies of imported gasoline (a more efficient motor fuel than natural naphtha), combined to lower the total output of the Motembo field in 1947 as compared with 1946.

The 1947 production of Jarahueca was the record for the field and would have been even larger but for the limited capacity of the two small skimming plants. Full operation of a new refinery of about

500 barrels capacity at Cavaiguan, Las Villas Province, was expected in early 1948, and further production increase was anticipated to feed this added capacity.

In 1947 Cuba imported from the United States 1,416,600 barrels of crude petroleum and 9,933,000 barrels of refinery products. Approximately 1,722,000 barrels of crude oil were refined in Cuba.

In March 1947 the Standard Oil Co. of Cuba (a Standard Oil Co. of New Jersey subsidiary) announced its withdrawal from petroleum explorations initiated approximately 3 years earlier. The company abandoned two unsuccessful test wells near Los Palacios, Pinar del Rio Province, and near Recreo, Las Villas Province. Cía. Petrolera la Estrella de Cuba (Cía. Petrolera Shell-Mex de Cuba—Atlantic Refining Co.—Standard Oil Co. of New Jersey) completed a dry hole on Cayo Coco, off the north coast of Camaguey Province, and one core test. Geological and geophysical investigations extended throughout 1947, but at the end of the year continuation of exploration throughout 1948 appeared doubtful. In April 1947 Cía. Petrolera Eureka (Gulf Oil Co.) initiated an extensive program of geological and geophysical investigations along the north coast of Matanzas, Las Villas, and Camaguey Provinces. By the end of the year a substantial amount of offshore gravimetric work and an aerial magnetometer survey had been completed.

DOMINICAN REPUBLIC

METALS

Bauxite.—During the first half of 1947 the Alcoa Exploration Co., acting in accordance with the terms of its concession, selected 3 land areas totaling 2,892 hectares (7,146 acres) in the municipality of Enrique, Province of Barahona, for the exploitation of bauxite and other aluminum ores. No date has been announced for the inauguration of production. The deposits were described in 1948.[7]

Gold.—Gold washed by hand methods in Seybo Province and elsewhere has dropped from 15,614 ounces in 1941 to an estimated 650 ounces annually in 1946 and 1947. For the first time in many years, no gold was exported from the Dominican Republic in 1947.

Iron.—Early in 1947 American interests explored the possibility of obtaining a concession to work iron-bearing beach sands on the Samaná seacoast near Matanzas and Villa Julia. Before the end of the year interest dropped.

NONMETALLIC MINERALS

Cement.—The Dominican Republic's first cement plant, near Ciudad Trujillo, started in 1944 by the Foundation Co. of New York, was completed for the Government-owned Cía. Dominicana de Cemento in November 1946. Various mechanical difficulties, which developed during the first trial run and subsequently, delayed initial production until February 27, 1947, and retarded operations throughout the remainder of the year. Small production was reported, but not quantitatively.

Gypsum.—The Barahona gypsum mines of Banco Agrícola e Hipotecario surpassed their previous peak production of 10,974 tons

[7] Schmedeman, O. C., Caribbean Aluminum Ores: Eng. and Min. Jour., vol. 149, No. 6, June 1948, pp. 78–82.

of gypsum in 1946 with 13,393 tons in 1947. The gypsum is sold in Puerto Rico and to the new domestic cement plant.

Lime.—A primitive system of beehive ovens supplies the Republic with lime estimated at 25,000 tons in 1945 and only 11,000 tons in 1947. Ordinarily about 85 percent of the product is used by the sugar industry and 15 percent by construction.

Salt.—The salt concession of Banco Agrícola e Hipotecario produced in 1947 (compared parenthetically with 1946) 2,084 (2,370) tons of salt from the Barahona mines and 11,435 (12,979) tons by the evaporation of sea water, a total of 13,519 (15,349) tons of salt.

Marble.—Marble production from the quarries of Samaná was reported as being sufficient to meet only the requirements of the domestic building trade.

HYDROCARBONS

Petroleum.—Since June 1939 the Cía. Seaboard de Petroleo, C. por A. (Standard Oil Co. of New Jersey), has drilled 15 test wells, largely in the southwestern part of the Republic. The first two wells produced 12,966 and 4,553 barrels of oil, respectively, before they were exhausted. The subsequent 13 tests, ranging to 8,769 feet in depth, were dry holes. The last hole found salt water and hydrogen sulfide at 5,682 feet in June 1947, and the company gave up its search; all concession rights were surrendered in December 1947.

FRENCH WEST INDIES

There is no known mineral industry in the French West Indies.

HAITI

Bauxite.—The Reynolds Mining Co. confined activities in connection with its bauxite holding to experimental work throughout 1947. No date has been announced for beginning production. The deposits were described in 1948.[8]

Gold.—Small-scale gold production by hand panning diminished from 432 ounces in 1942 to a mere 41 ounces in 1946, when it ceased; none was produced in 1947.

Building Material.—Local production of limestone and lime, construction stone, and clay for brick making is not reported quantitatively.

Salt.—Recovery of crude salt by evaporation of sea water amounted to an estimated 8,000 tons in 1947, the annual average since 1941.

Petroleum.—In 1947 the Atlantic Refining Co. completed its exploration program, begun in 1943, after having drilled 86 shallow core tests and 4 deep dry holes. The year witnessed abandonment of the Cul de Sac well, 5 miles east of Port au Prince, at 8,064 feet in April, the unproductive completion of the final well near St. Marc at 4,099 feet in September, and the surrender of concessions to the Haitian Government in December.

NETHERLANDS WEST INDIES

Gold.—Aruba Combined Goldfields, Ltd., of Toronto, working through its wholly owned subsidiary, Aruba Gold Mines Operating Co., Ltd., of Willemstadt, Curaçao, N. W. I., devoted the last part

[8] Work cited in footnote 7.

of 1946 and all of 1947 to surface work and diamond drilling in its four concessions (approximately 40 square miles) on Island of Aruba.

Phosphate, Limestone, and Lime.—A hillside phosphate-rock quarry at Newport, 10 miles east of Willemstadt and at the eastern end of Island of Curaçao, is owned and operated by N. V. Mijnmaatschappij Curaçao, of Newport and Amsterdam. The quarry and plant produced in 1947 at the annual rate of about 80,000 to 100,000 tons of rock phosphate for export. Byproducts include about 36,000 tons of crushed limestone and 2,500 tons of hydrated lime a year for local consumption.

Salt.—Salt production for 1947 has not been reported. The 1946 total of 2,017 tons was from Island of Bonaire only.

Petroleum.—Refining activities on the Island of Curaçao have not been reported for 1947; refinery products exported in 1946 amounted to 99,286 thousand barrels derived from Venezuelan crude petroleum. Similar exports from the Aruba refineries amounted to 128,311 thousand barrels in 1946 and 142,018 thousand barrels in 1947. The Aruba products were derived from Venezuelan crude entirely in 1946 and predominantly in 1947, when crude imports included 83,000 barrels from Colombia.

MEXICO

Because virtually all mines (except copper) in Mexico were closed by strikes during most of the first quarter of 1946, it was to be expected that the general over-all mineral output of 1946 would be exceeded in 1947, as it was. This explanation, however, cannot disguise the actual improvement revealed by comparing the 1947 quarterly average with the average of the last three quarters of 1946, which discloses marked advances in the production rates of antimony, bismuth, iron, lead, zinc, manganese, tungsten, silver, and graphite. The 1947 production of iron ore, bismuth, cement, and graphite was the highest on record; fluorspar was the highest since the peak war year 1944, lead the highest since 1938, copper the highest since 1930, and petroleum the highest since 1927. The general improvement resulted principally from sustained high prices, which stimulated maximum activity at the large mines and permitted marginal producers, largely Mexican-owned, to come into production. Labor difficulties continued sporadically, but not with the devastating effects on the industry attained in 1946.

Comparison of mineral production and exports in 1946 and 1947 is presented in the accompanying table.

METALS

Aluminum.—Mexico produces no aluminum ore or metal. In 1947 Reynolds Internacional de Mexico, S. A. (Reynolds Metals Co.), began operating its new rolling mill at Tlalnepantla, about 10 miles from Mexico City. The plant is designed to manufacture aluminum sheet and foil, lead-composition foil, lead sheet, and miscellaneous fabricated products from imported aluminum and from lead and tin obtained (if possible) locally.

Antimony.—During the year the National Lead Co. acquired control of Cía. Minera y Refinadora Mexicana, operating at Estación Wadley, San Luis Potosí, and Cía. Minera de Oaxaca, S. A., operating in the

Mineral production and exports of Mexico, 1946–47, in metric tons (unless otherwise indicated) [1]

Mineral	Production			Exports		
	1946	1947	Change, percent	1946	1947	Change, percent
ORES AND METALS						
Antimony (metal content)	6,572	6,925	+5	5,906	6,058	+3
Arsenic oxide (white arsenic)	9,648	9,685	(2)	9,357	9,124	−2
Bismuth, in impure bars ... kilograms	[3] 76,139	256,000	+236	76,139	197,000	+159
Cadmium:						
In zinc concentrates exported ... kilograms	[4] 686,000	[4] 870,000	+27	[4] 686,000	[4] 870,000	+27
In flue dust ... do	[3] 717,188	778,000	+8	717,188	752,000	+5
Total ... do	[4] 1,403,000	[4] 1,648,000	+17	[4] 1,403,000	[4] 1,622,000	+16
Copper	61,054	64,811	+6	49,548	53,900	+9
Gold ... troy ounces	420,500	464,739	+11	66,584	75,233	+13
Iron and steel:						
Iron ore [5]	275,445	332,446	+21	4,429	46,243	(6)
Iron content	170,775	226,063	+32	2,746	31,445	(6)
Pig iron	282,243	235,620	−17	(7)	11,008	(7)
Steel	(7)	273,000	(7)	(7)	(7)	(7)
Lead (metal content)	140,143	223,665	+60	167,859	187,369	+12
Manganese ore (estimate)	25,000	31,307	+25	25,000	31,305	+25
Manganese content	[3] 11,342	[3] 14,182	+25	11,342	14,181	+25
Mercury ... 76-pound flasks	11,661	9,700	−17	11,632	9,656	−17
Molybdenum concentrates, Mo content	818	136	−83	817	132	−84
Silver ... troy ounces	43,263,132	58,843,863	+36	37,253,804	44,415,382	+19
Tin	[8] 267	[8] 174	−35	72	41	−4
Tungsten concentrates, 60 percent WO_3 equivalent	[3] 99	[3] 96	−3	99	96	−3
Zinc (metal content)	139,535	195,814	+40	130,198	187,636	+44
NONMETALLIC MINERALS						
Cement (estimate)	1,072,500	1,150,000	+7	(7)	(7)	(7)
Fluorspar	[4] 22,260	[4] 48,000	+116	20,114	45,737	+127
Graphite	[3] 21,949	[3] 27,984	+27	21,949	27,984	+27
Mica	(7)	(7)	(7)	81	231	+185
Salt	131,972	122,235	−7	(7)	(7)	(7)
Strontium concentrates (celestite)	[3] 1,639	[3] 3,494	+113	1,639	3,494	+113
Sulfur	(7)	19,416	(7)	1,254	1,172	−7
HYDROCARBONS						
Coal	977,330	[8] 1,055,000	+8	3,927		
Coke	384,000	[8] 420,394	+9			
Natural gas ... 1,000 cubic feet	1,937,101	2,207,467	+14			
Petroleum, crude ... barrels (42 gals.)	49,235,421	55,917,395	+14	3,301,991	6,694,292	+103
Petroleum refinery products ... barrels (42 gals.)	59,753,708	65,952,146	+10	6,104,371	7,301,545	+20

1 Other minerals and mineral products known to be produced but in quantities that have not been reported include selenium, tellurium, vanadium, chalk, clay, diatomaceous earth, gypsum (raw and calcined), lime, limestone, building and ornamental stone, sodium carbonate, and talc.
2 Less than 0.5 percent.
3 Approximate production.
4 Estimate.
5 Indicated grade of ore: 1946, 62 percent Fe; 1947, 68 percent Fe.
6 More than 500 percent.
7 Not reported.
8 Official figures, believed to be inaccurate. See text.

Chicahuaxtla district, Oaxaca. This places about 90 percent of Mexican antimony production capacity under the control of National Lead, which accounted for the 1947 production increase by accelerating operations at its new properties. The States of Querétaro and Sonora contributed to the remainder of the 1947 output.

Of the 1947 exports, 5,979 metric tons went to the United States, 46 tons to Great Britain, and 33 tons to Belgium.

Arsenic.—Production of white arsenic showed virtually no change from 1946 to 1947, contrary to the great increase in output of the lead-zinc and lead-silver ores, of which arsenic is a byproduct. The recovery of arsenic is partly determined by demand and does not necessarily parallel the swelling of supply of parent ores but can do so if increased production is desirable. As usual, the total 1947 output was divided between the San Luis Potosí plant of Cía. Minera Asarco (American Smelting & Refining Co.) and the Torreon plant of Cía. Minera de Peñoles (American Metal Co.). The United States received most of the white arsenic exported; less than 100 tons each went to Canada, Uruguay, and the Netherlands.

Bismuth.—The recovery of bismuth in impure bars at the Monterrey plant of American Smelting & Refining Co. is essential to the purification of lead and followed the great increase in lead refining upward in 1947. Exports were to the United States only.

Cadmium.—Recovery of cadmium flue dust at the Rosita plant of Cía. Minera Asarco (American Smelting & Refining Co.) followed the increased refining of zinc ores, of which it is a byproduct operation. All of the flue dust, plus the cadmium contained in 2,362 tons of zinc ores and 288,005 tons of zinc concentrates, was shipped to the United States.

Copper.—Copper production attained its highest record in 18 years despite a slow-down in the third quarter of 1947 occasioned by a change in operational procedure at the Cananea, Sonora, mine of Cananea Consolidated Copper Co., Mexico's largest producer. The new Asociación Boleo-Estrellas, formed jointly by Cía. Minera de Boleo, S. A., and Cía. Minera Dos Estrellas, S. A., have joined with Ernesto Rios in the development of the old Santa Fé copper-gold-silver properties at Solosuchiapas, Chiapas. A 28-mile road is being constructed to the railway station at Pichucalco; some ore was shipped by jeep and airplane during the year, and regular shipments of concentrates were expected by mid-1948. Another new truck road, advanced in 1947 and completed during the first half of 1948, connects El Carmen gold-silver-copper mine in western Chihuahua with Estación Creel on the Kansas City, Mexico & Oriente Railway. El Carmen was recently taken over by El Potosí Mining Co. (The Howe Sound Co.), and it was expected that a new mill would be turning out a substantial tonnage of concentrates before the end of 1948.

Cobre de Mexico, S. A., solved the various technical difficulties that had appeared following completion in 1946 of its small copper refinery in Mexico, D. F., and by September 1947 was engaged in intermittent production of satisfactory wire bars for La Consolidada, S. A., the local steel and wire mill, and electrolytic cathodes for domestic remelting. Theoretical capacity of the plant is 10,000 metric tons of electrolytic copper a year, but it seemed doubtful that 1948 production would exceed half that figure. Financial control of the company apparently has passed to Nacional Financiera, the Mexican Government financial organization.

Mexican exports of copper in 1947 were destined to the United States exclusively.

Gold and Silver.—Although gold production advanced nearly 11 percent in 1947, the average quarterly production rate in 1947 was 3 percent less than the average rate for the last three quarters of 1946. The anticipated continued decrease in output from gold and gold-silver mines probably will be largely or completely offset, at least for the time being, by gold and particularly silver recovery from larger tonnages of lead, zinc, and copper ores.

The Comisión Fomento Minero, a Government organization, poured funds into the operation of Dos Estrellas, La Esperanza, and El Oro gold mines at El Oro, Michoacán, and received on request the advisory services of an engineer from the United States Bureau of Mines to aid in reorganizing the properties. The mines were taken over in 1946 from cooperatives and now show some prospect of maintaining production at a reasonable level.

A 165-kilometer road, which eventually will be a main highway, was constructed from Iguala to Coyuca de Catalán, Guerrero, giving transport access to the Balsas River district and reviving hope of the successful exploitation of precious and base-metal deposits known to be in the area.

Cía. del Real del Monte y Pachuca and its great Real del Monte silver mine at Pachuca, Hidalgo, were sold on September 9, 1947, by the United States Smelting, Refining & Mining Co. to the Mexican Government, which continued operation of the property through its Nacional Financiera. A significant decline in production within the next few years is expected unless new ore bodies are discovered. Cía. Minera Pánuco, S. A., was forced to suspend operation of its silver properties at Pánuco, Sinaloa, on May 30, 1947, because of inability to profit in the face of increased wage demands. The property was reopened on June 24 under Government subsidy.

Gold exports depend almost exclusively on the management of gold reserves within the Republic. Fluctuations of silver exports closely follow fluctuations of price, rather than of production. All of the gold and 94 percent of the silver exported from Mexico in 1947 went to the United States. Three percent of the silver went to Great Britain, 2 percent to Portugal, and 1 percent to Belgium, Poland, Colombia, Brazil, Guatemala, Norway, and Sweden.

Iron and Steel.—The iron-ore production figure of 332,446 metric tons in 1947 is based on the official report of 226,063 tons of iron contained in 68 percent iron ore. Another official figure showing 412,652 tons of ore consumed by the iron and steel industry in 1947 is believed to be too high. Cía. Fundidora de Fierro y Acero de Monterrey, S. A., and Altos Hornos de Mexico, S. A., both mine ore for their own use, and Fundidora also sells to Altos Hornos. The official figure of 337,532 tons for pig-iron production has been corrected by the same two companies (Mexico's only producers) to 235,620 tons. A similar check against the 1946 pig-iron figure has not been made; and it may well be that the change from 1946 to 1947 was actually upward, in line with the increased coal and coke production, on which iron and steel production depend. Exact information on steel production is difficult to obtain. Fundidora and Altos Hornos are primary steel makers, La Consolidada, S. A., smelts domestic and imported scrap with some additions of local pig iron, and a number of small plants smelt scrap or operate "package plants" where scrap is made up into bundles and rolled at welding heat. Approximate steel production in 1947 was as follows:

Company:	*Metric tons*
Cía. Fundidora de Fierro y Acero de Monterrey, S. A	135, 000
Altos Hornos de Mexico, S. A	65, 000
La Consolidada, S. A	43, 000
Other small plants	30,000
Total	273, 000

Lead and Zinc.—The larger lead producers have been operating at capacity for some time, but the 1947 high price level (15 cents a pound throughout the last 9½ months of the year) brought out an avalanche of direct-shipping ores from the small producers, swelling mine output to the highest point since 1938. The three primary smelters accumulated a large backlog of ore but continued to purchase as a matter of business and national policy. Smelting capacity, partly limited by coke supply, was expanded by both Cía. Minera Asarco and Cía. Metalúrgica Peñoles (American Metal Co.) to meet the situation, but remained somewhat of a bottleneck. Of the total reported mine production, 217,827 tons (97 percent) represented refined and semirefined forms smelted in Mexico. Lead is the only one of Mexico's principal metals that is exported in large quantities to destinations other than the United States, prices being higher in many of the other countries. Exports in 1947 showed 121,795 tons (65 percent of the total) going to the United States, 20,443 to the Netherlands, 10,991 to France, 10,869 to Great Britain, 4,321 to Argentina, 4,139 to Brazil, 4,082 to Sweden, 2,023 to Switzerland, 1,601 to Belgium, 1,152 to Czechoslovakia, 1,003 to Portugal, 915 to Norway, 887 to Denmark, 646 to Italy, 638 to Uruguay, 506 to Finland, and 1,358 to Colombia, China, Turkey, Africa, Arabia, Netherlands West Indies, and various unspecified European countries. The figure for the United States apparently includes shipments in bond to Brownsville and New Orleans for reexport.

The tremendous proportionate increase in the marginal mining of direct-shipping lead ores represented a regrettable loss in zinc. Some zinc is associated with all Mexican lead ores and is lost when direct smelting is employed. Consequently the effective increase in zinc production in 1947, though large, was not proportionate to the rise in lead. Possibly the largest single contribution to both the lead and zinc increases came from the stepped-up production in the Concha and San Antonio mines in the Taxco district, which are being developed currently by the American Smelting & Refining Co. Of total zinc production, 56,749 tons were refined in slabs and 139,065 tons shipped as ores and concentrates. Ninety-nine percent of the exports went to the United States and well under 500 tons each to Brazil, Argentina, Sweden, France, China. Portugal, Norway, Belgium, Netherlands, Nova Scotia, Chile, Peru, Italy, and Cuba.

Manganese.—Aside from the gratifying increase in production, very little has been reported on specific activity in manganese mining during 1947. Most of the production was from the Lucifer mine near Santa Rosalia, Baja California. Some operations are also known to have been active in the Abundancia district, Zacatecas; Montaña de Manganeso, San Luis Potosí; and an area northeast of Guadalajara, Jalisco. Substantially the entire output was exported, all to the United States.

Mercury.—Mexican mercury mining is unable to compete on a large scale in the world market at peacetime prices as determined by the great producing centers of Spain and Italy and has declined precipitously since 1944, although Mexico is still the largest producer in the Western Hemisphere outside the United States. Operations in the Huahuaxtla district of Guerrero and the Sin Alto district of Zacatecas are expected to decline further unless stimulated by higher prices. Of Mexico's 1947 mercury exports, only 2,454 flasks (25 percent) were destined for the United States; 5,580 flasks (58 percent) went to Great Britain, 889 flasks (9 percent) to Sweden, 165 flasks to Argentina, 125 flasks to India, and 443 flasks to Switzerland, the Netherlands, Belgium, Uruguay, Venezuela, and unspecified countries of Europe.

Molybdenum.—Although the Cananea Consolidated Copper Co. boosted its 1947 output of copper concentrates, the byproduct recovery of molybdenum concentrates was 83 percent less than in 1946. During the year Cananea stepped up operation of its low-grade open pit but shut the old mill, which had heretofore been treating the ores from underground mines. The change-over lowered the production ratio between underground and open-pit ores. The corresponding decline in production of molybdenum concentrates is due to the fact that molybdenum is a constituent part of the deeper ores only and that consequently its future production is expected to be insignificant. In 1947 all exports went to the United States, with the exception of 1 ton of molybdenum contained in concentrates shipped to Sweden.

Tin.—Official figures purporting to represent Mexican tin production are based on tax collections and are consequently unreliable, inasmuch as illegal production and sale of tin long have been common practices. Estimates of various engineers range from a conservative 500 tons to a more hopeful 1,000 tons a year from small producers in five States—Durango, Guanajuato, Jalisco, San Luis Potosí, and Zacatecas. In 1947, 41 tons of tin were exported to Great Britain.

Tungsten.—Tungsten mining was maintained through 1947 at a reduced rate; and total output for the year, as measured by exports, was virtually the same as that in the last 3 months of 1946. Exports, principally of scheelite, were destined to the United States exclusively.

NONMETALLIC MINERALS

Cement.—Cement-production capacity was expanded in 1947 and by early 1948 caught up with Mexican requirements, with 17 plants operating and 4 more still under construction, compared with only 8 operating plants in 1940. A careful study of the cement situation in Mexico indicated that the official 1947 production figure of 708,000 metric tons probably is too low and that actual production was somewhere between 1,000,000 and 1,300,000 tons. With completion of the four new plants, effective capacity—on an annual basis of 300 workdays—will be approximately 1,898,700 metric tons, and Mexico's import requirements should disappear unless possibly for small tonnages of special grades.

Fluorspar.—The more-than-doubled output of fluorspar in 1947, as compared with 1946, showed the effect of the reopening on July 19 of the Azul mine near Taxco, Guerrero. Inasmuch as this one mine produced at a rate of approximately 2,500 tons of ore a month, it appears that production was also expanded in other parts of the southern district and in the Chihuahua-Durango district to the north. About 2,150 tons of fluorite are sold annually for domestic consumption; the remainder is exported.

Graphite.—Production and exports of graphite by the Sonora Graphite Co., S. A., and Cía. Minera de San José, S. A., were limited only by production capacity and fell considerably below the 1947 demand. Both companies hoped to be able to expand output in 1948 to meet the requirements of the United States market.

Mica.—Since 1945 a few tons of sheet mica—mostly phlogopite with very little muscovite—have been mined each year by individuals living close to mines of Oaxaca. The mica is sent to Mexico City for use in the manufacture of heating units. The Ashville & Schoonmaker Co. has a splitting plant (Leo Frammery, general manager) in the city of Queretaro, where crude mica, currently imported in bond from Argentina, Brazil, and India, is processed for reexport. The plant employes about 200 workers.

Salt.—Salt production from about 52 salinas in 15 States has not been previously reported quantitatively, but output for the past 4 years has been recently revealed as follows:

Mexican salt production, in metric tons

Year	Edible salt	Industrial salt	Total
1944	112,135	14,132	126,267
1945	121,705	8,675	130,380
1946	114,627	17,345	131,972
1947	106,250	15,985	122,235
1948 (estimate)	(1)	(1)	156,685

[1] Figures not available.

Strontium.—The doubling of Mexican exports of celestite from 1946 to 1947 did not appear to be justified by the uniformly quiet market in the United States and has not been explained.

Sulfur.—Most of the domestic sulfur was produced in the Cerritos district, S. L. P., and sent to the new plant of Cía. Minera Asarco, S. A., at San Luis Potosí for use in manufacturing sulfuric acid.

HYDROCARBONS

Coal and Coke.—A field study of the coal and coke situation in Mexico in 1947 yielded production estimates of 1,200,000 tons for coal and 530,000 tons for coke, believed to be more accurate than the official figures showing 1,055,000 tons of coal and 420,394 tons of coke. Even at these record levels, coal and coke are critically short in Mexico and form the bottleneck that is limiting the expansion of steel and base-metal production in the smelters. The problem is actually one of coal production, as coke-oven capacity is large enough to receive a much greater tonnage of coal than is available. American Smelting & Refining Co. operations near Rosita supplied nearly half the total 1947 output of coal and 70 percent of the coke.

Petroleum.—Improved petroleum production was brought about by boosting the output of all the major districts except the Southern (Golden Lane), with the large Pozo Rico taking the burden of increase. Fifty new wells, of which 18 were wildcats, were drilled in 1947 compared with 49, of which 12 were wildcats, in 1946; and extensive exploration planned by Pemex was postponed until 1948, when the start of a program to include 75 wildcat wells a year is scheduled. In the latter part of 1947 Mexico, for the first time since 1938, showed signs of interest in attracting foreign capital into its petroleum program. A drilling and field development contract was signed between the Mexican Government and J. Edward Jones of the United States, and negotiations with similar ends in view were entered with the

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Cities Service Co. Early in 1948 the heads of Pemex submitted terms under which reentry of American companies would be permitted.[9]

Petroleum refining increased substantially but was unable to keep pace with crude production. The difference was reflected in a doubling of crude exports.

BRITISH HONDURAS

Increased road building in 1947 spurred operation of the Government-owned quarries to an output of 36,000 cubic yards of limestone and 51,000 cubic yards of limestone marl. Comparison with 1946 was as follows:

Production	Cubic yards (as reported)	Metric tons (estimated)	Value (as reported)
1946			
Limestone	25,400	31,000	$38,100
1947			
Limestone	36,000	44,000	28,800
Limestone marl	51,000	62,500	7,650
Total	87,000	106,500	36,450

The sharp decrease in unit value has not been explained.

British Honduras has no other mineral production.

COSTA RICA

Gold and Silver.—The 1947 production of precious metals, as measured by United States imports from Costa Rica, amounted to 1,988 ounces of gold and 1,470 ounces of silver, showing gains of 59 and 143 percent, respectively, over the 1,251 ounces of gold and 604 ounces of silver similarly routed in 1946. Eighty-seven percent of the gold and 99 percent of the silver were produced in the form of unrefined gold-silver bars, the remainder in gold concentrates. Siliceous gold ore is found in three principal areas at Abangares, Miramar, and Aguacate. The Abangares Gold Mine, Ltd. (Cía. Minas Abangares, S. A.), which has the only stamp mill in the country, remained idle throughout the year. Mines in the other two areas grind the ore in ball mills; they produce by flotation all the concentrates shipped (53 metric tons in 1947) and also recover gold by riffling and amalgamation. A small cyanide plant was operated at the Union de Aguacate mine throughout 1946 and early 1947. The New York & Honduras Rosario Mining Co., canceled its options on Union de Aguacate in March 1947, following unfavorable development work. Placer mining on a small scale continued on the Osa Peninsula.

Production in 1947 broke a downward trend that had lasted 5 years for gold and 2 years for silver. Foreseeable future improvement in precious-metal mining depends on materialization of a reported plan of one group to bring in a dredge to operate on rivers in an area on Osa Peninsula known as Playa Madrigal.

Diatomaceous Earth.—Production of diatomite (kieselguhr) in small quantities has been reported for several years, without official confirmation. Estimates of annual output range from 2 to 5 tons.

[9] For further details see The Oil World, 1948 World Oil Atlas: Sec. 2, July 1948, pp. 81–91.

Lime and Cement.—Limestone is quarried from several places on the Meseta Central near San José for the manufacture of quicklime. The quantity of limestone burned has always been small; but in 1947 a much larger kiln than any used previously was constructed, and production of lime reached an estimated 20,000 tons. This tonnage was expected to be increased 50 to 75 percent in 1948.

Plans were completed for construction, to start in 1948, of a cement plant near Cartago. The plant will use limestone and clay from local deposits.

Salt.—Recovery of salt from sea water at salinas centering around Puntarenas, on the Pacific coast, amounted to 6,252 metric tons in 1947, compared with 8,000 tons in 1946.

Petroleum.—Interest in possible petroleum concessions died in 1947, as the Costa Rican Congress failed to act on a proposed basic petroleum law that was presented to the Congress on September 1, 1946. Costa Rica produces no petroleum, but imported 404,727 barrels of liquid refinery products plus 9,100 metric tons of asphalt and paraffin wax in 1947.

EL SALVADOR

METALS

Gold and Silver.—Gold exports, indicative of production in El Salvador, slumped from 21,798 ounces in 1946 to 10,755 ounces in 1947, while silver exports dropped less spectacularly from 313,180 ounces in 1946 to 265,104 ounces in 1947. Shipments were in the form of 8,211 kilograms of bullion containing 2.3 percent gold, 91.44 percent silver, and 6.26 percent (514 kilograms) of base metals.

Of the nine mining enterprises in El Salvador, only three—El Hormiguero mine of Comacaran Gold Mining Co., the Montecristo mine of Minas Montecristo, S. A., and the San Sebastian mine of Butters Salvador Mines, Ltd.—were in continuous production throughout the year 1947. The sharp drop in gold output was due to the reduced output of the country's most important gold-mining enterprise—the Potosí mine of Cía. Minera de Oriente, S. A.—which curtailed its mining activities and concentrated on exploratory work, but expected to resume normal operations in 1948.

The New York & El Salvador Mining Co. (subsidiary of New York & Honduras Rosario Mining Co.) continued favorable development of its El Dorado mine near San Isidro but extended the anticipated date for completion of its new concentrating mill into 1948.

Copper.—Copper in ore has been produced in insignificant quantity since 1943 by only one mine, the San Sebastian gold-silver mine of Butters Salvador Mines, Ltd. Output in terms of copper content, as measured in kilograms, has been as follows: 1943—231; 1944—2,738; 1945—2,577; 1946—1,124; 1947—605. Future production is not expected to increase significantly.

Lead and Zinc.—Minas Metapán, a local company owned by René Keilhauer, continued exploration of the San Juan mine near Matapán and announced that the production of lead and zinc ore is expected to begin sometime in 1948. No indication was given as to the anticipated size of the new operation.

NONMETALLIC MINERALS

Lime and Limestone.—Limestone is quarried and burned to lime by numerous small concerns in various sections of the country. Heavy demands for lime by the construction industry have stimulated increased lime production since 1943, but the 1947 level is not expected to be surpassed appreciably and probably will decline, with an expected slacking off of construction activities. El Salvador has no cement industry, and most of the limestone quarried is believed to be used for the production of lime, which has been as follows, in metric tons, for the past 5 years:

Year:	Production of lime [1]	Production of limestone [2]
1943	5, 761	10, 300
1944	10, 370	18, 500
1945	7, 767	13, 900
1946	10, 996	19, 600
1947	15, 949	28, 500

[1] Officially reported.
[2] Estimated.

Salt.—As in the case of lime, salt is produced by many small concerns, none of which employ machinery or modern methods. Recovery is entirely by evaporation of sea water. Production during the past 5 years was as follows, in metric tons: 1943—1,868; 1944—13,328; 1945—18,004; 1946—27,700 (estimated); 1947—16,484.

GUATEMALA

METALS

Although mining maintained a minor part in the economy of Guatemala in 1947, the operations of a new company in 1948 and particularly 1949 should bring this activity into a more prominent role. Several other firms, with both domestic and foreign interests, have requested mining concessions in different areas of the country. A new mining law under consideration during 1946 was not completed by mid-1948, and contracts were made under the old law, Legislative Decree 2000.

Chromite.—Production of chromite ore in the Department of Jalapa stayed at about the 600-ton annual level attained in 1946; content was slightly more than 300 tons of chromic oxide. Total production in both 1946 and 1947 was stocked; no chromite has been exported since 1945.

Gold.—Alluvial gold panning has dwindled to a point too low to be officially reported. Imports into the United States from Guatemala amounted to only 36 ounces in 1946 and 35 ounces in 1947.

Iron.—Approximately 1,800 tons of iron ore is mined annually from a deposit near Zacapa for use in the Guatemala City cement plant.

Lead and Zinc.—Production of lead ore in the vicinity of Huehuetenango has been reported as amounting to 131 tons in 1946, 110 tons in 1947. Lead from these ores is smelted in small local furnaces for domestic use only.

Following negotiations that extended throughout most of 1947, a 40-year contract was signed on February 22, 1948, between the Government of Guatemala and Cía. Minera de Guatemala (a corporation of American capital), granting the company exclusive exploitation rights in an area comprising five contiguous lead-zinc mines at San Juan Chamelco in the Department of Alta Verapaz, several miles from the town of Cobán. Extensive exploratory work was done during 1946 and 1947, and production from the first large-scale mining venture in the history of the Republic is expected to be initiated by the end of 1948 or early 1949. A particularly heavy investment of capital will be required for the development of adequate transportation facilities from the mines to the railway at Pancajché. Principals of the new company are Herbert Hoover, Jr., Allan Hoover, and John K. Stewart.

Other Metals.—Exports from Guatemala in 1947 included a 21-ton shipment of lead-copper-silver ore for assaying and testing in the United States.

NONMETALLIC MINERALS

Cement.—The increased production of cement during the past 3 years measures the increase in effective capacity of the country's only cement plant near Guatemala City, operated by La Fabrica Nacional de Cement de los Señores Novella y Cía. Supplementary imports have been inadequate to bridge the gap between production and demand. In an attempt to meet the heavy requirements of Government projects and private construction as fully as possible, the Guatemalan Congress passed bills in mid-1946 and again in September 1947, removing import duties on all types of cement and in 1947 permitted a moderate price increase [10] in exchange for a commitment to expand production by the importation of more and newer equipment. Guatemala is expected to attain self-sufficiency in cement with the expansion of plant capacity and relaxation of the construction boom. The changing status of the industry during the past 3 years is indicated by the following figures:

Guatemalan cement supply, 1945–47, in metric tons

	1945	1946	1947
Production	26,351	27,765	28,117
Imports	707	6,079	4,783
Total available supply	27,058	33,844	32,900
Exports	3,752		736
Apparent consumption	23,306	33,844	32,164

The cement plant also produces substantial but unreported quantities of lime.

Mica.—Small-scale mica mining in the Departments of Quiché and Baja Verapaz appears to have ceased. The only measure of production has been United States imports from Guatemala, which amounted to 1,156 kilograms (2,549 pounds) in 1945, 3,689 kilograms (8,133 pounds) in 1946, and none in 1947.

Salt.—A resolution of December 27, 1947, provided for the establishment of a National Association of Salt Producers of broad regulatory powers, in which the Government is to be represented. In effect, this revives Consorcio Salinero de Guatemala (the salt producers'

[10] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 6, December 1947, pp. 23–24.

pool) that was established in August 1940 and dissolved as a monopoly, at the request of small producers, on March 31, 1945. Since then and until the end of the 2-month period provided for organization of the national association, regulation has been by the inspector general of salt mines, under the Department of Agriculture. The reason for the revival is not clear. Quantitative output from evaporation of sea water and the boiling of coastal marine earths has not been reported since 1944, when about 12,600 tons annually was produced for domestic use. Guatemala does not produce highly refined or iodized salt, which is imported.

Other Nonmetallic Minerals.—Guatemala produces for local use about 10 tons of crude sulfur of volcanic origin annually and small quantities of mineral pigments.

HYDROCARBONS

Petroleum.—Interest in Guatemala as a possible source of petroleum was strong throughout 1947; and several large concessions—mostly speculative—were issued in the Departments of El Petén, Alta Verapaz, and Izabal. Enthusiasm was considerably dampened, however, with the passage early in 1948 of the new petroleum law, which does little to encourage development by outside capital. The most discouraging feature of the law is a provision that an exploration concession be posted for public auction to the highest bidder on application by the holder for an exploitation concession. As long as this new law is in effect, large oil companies are expected to show little further interest in Guatemala.

HONDURAS

METALS

The mining industry, which ranks second in importance in the Honduran economy, showed little change in 1947 in actual production, but development activities completed or nearly completed during that year may result in a significant future increase in the production of precious metals.

Gold and Silver.—Of the 12,037 ounces of gold produced in Honduras in 1947, 11,929 ounces in doré bullion were derived from 199,900 tons of ore broken from the San Juancito mine and milled by the New York & Honduras Rosario Mining Co., and 108 ounces came from a new gold-mining enterprise in the Department of Olancho that began operations in December. The total output of the Republic was 6 percent less than the 12,833 ounces recovered in 1946.

The Rosario Co. doré bullion also contained 2,403,500 ounces of silver in 1947, 10 percent less than the 2,682,910 ounces so produced in 1946, and represented the total output of the Republic.

Exploration work of the Rosario Co. outside the San Juancito district was partly disappointing: at the close of the year this company, which had relinquished its option on the small Liquidambal property, was considering installing a small plant to salvage some of its investment in the adjoining gold-silver mines at Yuscaran, Department of El Paraiso. The company also withdrew its interest in El Transito gold property near the Bay of Fonesca, Department of El Valle, when it was found that the high-grade surface ore did not continue in depth. However, development results were more favorable at El Mochito silver-lead mine near Lake Yojoa, Department of Santa Barbara, and the Rosario Co. expected to start operation early in 1948.

The Agua Fria Mining Co., which has been slow in resuming production since its wartime shut-down, extended its development work through 1947 and expected to begin milling 100 tons of ore daily before the end of March 1948.

A new enterprise, the New Idria Honduras Mining Co., virtually completed exploration and development of its gold mine at San Andres in the Rio Higuito Valley, Department of Copan, and anticipated gold production by early 1948.

NONMETALLIC MINERALS

Clay.—A new ceramic factory of Vidreria y Loceria Copantl, S. A., was completed at Tegucigalpa in 1947 and sold its first chinaware in January 1948. Production is expected to attain 7,000 pieces monthly. Accessible deposits of suitable clays in Honduras are said to have been exhausted; and coloring oxides, glaze materials, pottery plasters, and most of the clays to be used by the new plant are to be imported, largely from the United States.

Salt.—Recovery of salt by the evaporation of sea water, for domestic use only, continued to decrease from 2,700 metric tons in 1944 to 900 tons in 1945, 850 tons in 1946, and 726 tons in 1947.

HYDROCARBONS

Petroleum.—Although lack of adequate transportation continues to be a major handicap to petroleum exploration in Honduras, several United States-owned oil companies continued geological investigations during 1947. Results have not been reported.

NICARAGUA

METALS

Gold and Silver.—Production of gold and silver as measured by exports to the United States amounted to 211,539 ounces of gold and 214,363 ounces of silver in 1947, compared with 206,389 ounces of gold and 260,637 ounces of silver in 1946. La Luz Mines, Ltd., Neptune Gold Mining Co., Empressa Minera de Nicaragua, Cía. Minera de La India, Cía, Minas Matagalpa, and Cía. Minera San Gregorio contributed to the total. The San Juan Mines Co., which produced 1,770 ounces of gold and 2,208 ounces of silver in 1946, closed its mine at La Libertad, Chontales, in 1947 and began dismantling the property. The neighboring Esmeralda mine, a very small producer, is also believed to have been inoperative in 1947.

The New York & Honduras Rosario Co. increased its interest in the Neptune Gold Mining Co., which, in addition to its own mines at Bonanza, Zelaya, operates under contract La Reina mine of Cía. Minas Matagalpa at San Ramon, Matagalpa. At Bonanza on March 20, 1946, the Siempre Vida hydroelectric plant was completely buried and partly destroyed by a landslide caused by an earthquake. New equipment was purchased, and the plant resumed operation in the summer of 1947. Shortage of power during the shut-down had a serious adverse effect on all mining operations; but considerable new ore was developed, and output of this relatively large producer should be back to normal or better in 1948.

NONMETALLIC MINERALS

Cement.—Despite the ever-present problem of obtaining spare parts or machinery, production by Nicaragua's only cement plant at San Raphael del Sur was the highest in its 6 years of operation (with the possible exception of 1945, for which accurate figures are not available), rising 60 percent from 9,975 tons in 1946 to 15,959 tons in 1947. Cement output was 620 tons in 1942, 10,627 tons in 1943, and 10,034 tons in 1944. Further increase was anticipated for 1948. All raw materials are obtained locally, and demand has consistently exceeded production.

Salt.—West-coast salinas recovered 7,503 tons of salt from sea water in 1947, or somewhat more than the 6,000-ton annual rate of production that has prevailed for the past several years. Production normally has to be supplemented by imports to meet domestic demand.

Other Nonmetallic Minerals.—Unspecified quantities of gypsum and clay were produced in 1947, and at least enough limestone to produce the 15,959 tons of cement at San Raphael del Sur plus 5,987 tons of lime.

HYDROCARBONS

Petroleum.—The American International Petroleum & Refining Co. (Gulf Oil Corp. and Atlantic Refining Co.) continued exploration started in 1945 in the Punta Gorda area on the east coast of Nicaragua. On the basis of information yielded by the first test hole (abandoned in 1945 at 6,735 feet), drilling of a second test was begun in 1947.

PANAMA

METALS

Gold.—Gold has not been produced in Panama since 1942, when recovery by placer operations had dwindled to 98 ounces. A revival of mining was initiated in 1947 by the Capira Mines Corp., which completed installation of machinery and equipment, including a 200-ton mill, necessary for treating gold ores in the Campana district, Panama Province, about 30 miles southwest of Panama City. Mining properties were also acquired in the adjoining Capira and Chame districts from the Panama Corps. (Canada), Ltd., successor to Panamá Corps., Ltd. (British). Gold-production prospects for 1948 were regarded as excellent. The last previous lode mining in the Republic was in the San Francisco and Santa Fé districts, Veraguas Province, and ceased in 1937.

Manganese.—Early samplings of manganese deposits in the Portobelo district near Nombre de Diós, Colon Province, yielded assays ranging from 47 to 55 percent Mn; but further investigations failed to corroborate these results, and commercial production was not attempted. Plans were announced for additional attempts to locate minable manganese areas during 1948.

NONMETALLIC MINERALS

Cement.—Cemento Panama, S. A., completed installing machinery, equipment, and a power system at its new plant near Chilibre during 1947 but did not begin production until January 31, 1948. The estimated initial daily production rate of 3,000 94-pound bags (128 metric tons) represents about one-half the total capacity of the plant. The 1947 rate of cement consumption in Panama was about 175 tons daily. An increase in cement import tariff from $0.15 to $1.00 per 100 kilograms (or from $0.064 to $0.426 per bag), plus a 5-percent consular fee, will protect production for 25 years. Production costs are high because of the necessity to import gypsum, Diesel oil, and bags.

Salt.—Since 1943, Panama's reported mineral production has been limited to salt. Recovery from sea water in 1947 amounted to 4,412 metric tons, equivalent to 55 percent of the 1946 output of 7,958 tons. Production is determined in advance by quotas established by the Banco Agro-Pecuario e Industrial, which controlling agency announced a 1948 limit of approximately 3,300 tons. Operating salinas are in Cocle Province at Aguadulce and Los Santos Province at Los Santos, Guarare, and Las Tablas.

Other Nonmetallic Minerals.—Several quarries are operated in Panama, but statistics are not available relative to their number or type and quantity of production. Quantitative information is also lacking on the local production of lime and clay.

HYDROCARBONS

Petroleum.—The Sinclair-Panama Oil Corp., which began drilling north of the town of Bocas del Toro, Isla de Colon, on the Caribbean side of Panama, in August 1947 as part of its petroleum-exploration operations, announced in March 1948 that the first and only well drilled had reached a depth of 7,600 feet without productive results.

Petroleum exploration was also begun by the same company in 1947 on the Pacific side, in Darien Province near El Real.

ARGENTINA

Some relaxation of the regulations against release of mineral statistics now permits tabulation of a considerable part of Argentina's mineral production for the years since 1942, when information was last published in detail.[11] Partial mineral production for the years 1943 through 1947 is presented in the accompanying table.

The mining industry of Argentina is notable for its variety of products but is relatively insignificant in the national economy. In recent years it has yielded only 3.8 percent of the national income, 2.5 percent of total employment, and 1.1 percent of total exports. About 14 percent of Argentina's total imports is comprised of minerals and mineral products, including petroleum and solid fuels. The major mineral products of Argentina include lead, zinc, silver, sulfur, salt, sand, and stone. The Government took steps in 1947 to assure an adequate supply of some minerals produced locally in deficient quantities. In the treaty with Bolivia, the latter agreed to sell to Argentina 3,500 tons of lead metal, 300 tons of asbestos, and 8,000 tons of tin in concentrates

[11] Anderson, S. M., Minerals Review of Latin America, 1939–44 Bureau of Mines, Foreign Minerals Survey, vol. 2, No. 4, October 1945, pp. 5–6.

Mineral production of Argentina, 1943–47, in metric tons (unless otherwise indicated) [1]

Mineral	1943	1944	1945	1946	1947
ORES AND METALS					
Beryllium ore, 11 percent BeO	881	342	190	130	10
Bismuth:					
In bismuth concentrates	25	(2)	31	(2)	(2)
Refined from tungsten-bismuth ores	18	14	20	22	22
Total bismuth	43	(2)	51	(2)	(2)
Gold ... troy ounces	14,467	12,100	9,700	8,038	(2)
Iron ore	150	1,921	43,353	55,400	60,500
Lead concentrates	25,599	26,887	24,424	[3] 22,700	[4] 27,500
Lead content	18,718	(2)	18,526	[3] 18,200	[4] 21,175
Lead, refined:					
From Argentine concentrates	(2)	(2)	15,140	15,225	[4] 19,418
From Bolivian concentrates	(2)	(2)	6,019	965	582
Total refined lead	23,913	[3] 19,100	21,159	16,190	[4] 20,000
Manganese ore, 38–48 percent Mn	1,645	3,155	4,272	[4] 4,000	(2)
Silver ... troy ounces	2,319,194	[4] 2,000,000	[4] 1,700,000	(2))	(2)
Tin, mined	804	775	1,075	[4] 850	(2)
Tin, refined	560	673	477	[4] 500	(2)
Tungsten, 60 percent WO_3 equivalent	2,420	2,043	1,067	457	33
Zinc concentrates	37,343	37,492	26,551	30,300	[4] 32,500
Zinc content	20,480	20,246	13,807	[4] 16,360	[4] 16,900
NONMETALLIC MINERALS					
Barite	11,009	14,405	8,585	[3] 10,000	[3] 35,000
Borates	6,954	5,559	----------	5,250	7,000
Cement	959,478	1,079,974	1,087,578	1,140,529	(2)
Clays	193,533	178,231	[3] 206,800	(2)	(2)
Feldspar	2,940	3,468	5,375	4,755	[3] 5,000
Fluorspar	1,713	2,674	3,012	2,133	[3] 2,400
Gypsum, crude	87,461	106,313	91,504	(2)	(2)
Limestone	2,492,705	3,140,400	2,785,801	[3] 3,065,000	(2)
Mica:					
Sheet	392	454	709	420	(2)
Scrap	10	140	10	10	10
Total mica	402	594	719	430	(2)
Quartz	34,270	36,025	37,296	26,212	[3] 30,000
Salt:					
Rock salt	751	2,237	3,273	(2)	(2)
From saline waters	441,016	446,772	443,116	[3] 384,000	[3] 384,000
Total salt	441,767	449,009	436,389	(2)	(2)
Sulfur	10,820	11,270	9,218	(2)	(2)
Sulfates:					
Aluminum (alum)	603	800	430	110	367
Iron (melantorite)	----------	----------	50	(2)	(2)
Magnesium (epsomite)	1,694	1,996	4,300	2,108	2,106
Sodium (mirabilite)	12,656	6,702	13,366	7,345	9,457
Talc	3,557	3,421	2,681	3,760	(2)
HYDROCARBONS					
Asphaltite (raphaelite)	559	1,853	1,495	(2)	1,323
Solid fuels:					
Asphaltites, highly altered	105,625	98,614	126,100	83,800	80,900
Lignite (approximate figures)	7,515	9,046	6,718	2,500	13,900
Total solid fuels	113,140	107,660	132,818	86,300	94,800
Natural gas ... 1,000 cu. ft.	676,575	662,353	608,777	(2)	(2)
Natural gasoline ... barrels (42 gal.)	106,600	92,338	76,970	77,266	80,078
Petroleum, crude ... do	24,835,511	24,230,198	22,880,007	20,799,445	21,845,600

[1] Minerals produced in Argentina either regularly or occasionally but not listed here because of incomplete recent reporting and relative unimportance include: antimony, arsenic oxide, chromite, copper, columbite-tantalite concentrates, vanadium, asbestos, corundum, diatomite, dolomite, foundry earth, garnet, graphite, calcined gypsum, lime, marble, mineral water, ocher, pumice, serpentine, tripoli, vermiculite, wollastonite, zeolites, and such building and construction materials as sand, gravel, and stone of various types.

[2] Not reported.

[3] Approximate.

[4] Estimate.

annually for a period of 5 years, and to allow Argentina to buy up to an annual quantity of 1,600 tons of antimony, 2,000 tons of sulfur, 250 tons of calcium arsenate, and 250 tons of arsenious acid (white arsenic).

Activity during 1947 was spotty, being particularly pronounced in some lines and weak in others. Quartz, feldspar, limestone, and gypsum were particularly affected by shortages of transportation equipment, and some mills were forced to close during several weeks due to lack of material. Although the mining industry was not paralyzed at any time by strikes, the wages in that industry, in keeping with the general trend, rose considerably during the year. The Argentine Industrial Credit Bank, created in 1944, took an interest in fostering the development of mining. During 1947 it granted 72 loans to miners or mining companies, totaling nearly $1,250,000, or 13 times the amount so loaned in 1946. The outlook for 1948 was fairly bright, with prospects for the opening of new mines and a general increase of output.

METALS

Antimony production, estimated at 80 tons in 1946, was limited though of unreported quantity in 1947, and most of the demand was satisfied with Bolivian ore.

Beryl production was very small, inasmuch as the internal market price was not high enough to compensate for mining costs, while exportation was still prohibited by the Government.

Mine production of bismuth was said to differ only slightly from that of 1946, although a new bismuth mine was opened at San Francisco de los Andes, San Juan Province.

Argentine chromite production has diminished from the 960 tons (Cr_2O_3 content) of 1945, although the extent of the decrease has not been reported.

Copper production is limited to about 50 tons a year. The Argentine Military Factories requested bids on delivery of 100,000 tons of copper but received no response.

Argentina is seriously short in supply of iron and steel and has to depend substantially on imports. In 1944 the Department of Military Factories began exploitation of the low-grade iron veins at Zapla, Jujuy Province. A blast furnace utilizing this ore has operated continuously since October 11, 1945, at Palpalá, 11 kilometers from Jujuy. Under a "metallurgical plan," the Government has organized the Argentine Mixed Steel Corp., with ambitious plans to expand the steel industry to include four Siemens-Martin furnaces to process ore imported from Brazil and Chile and scrap, coal, limestone and other raw materials from whatever sources may be made available. There appears to be little possibility that these furnaces and a proposed steel-mill unit will be in operation by the end of 1951.

Although the 1947 official Government price for lead metal was maintained at $248.75 per ton, lead concentrates on the black market reached the highest price ever paid in Argentina—$325.00 per ton of contained metal. This high price led to the opening of many new mines, and large stocks of concentrates accumulated because smelter capacity was limited. The Government was building a reserve of 7,000 tons of lead ore, and no ore was exported.

Manganese-ore production in 1947 has not been reported but is known to have increased in response to announced plans for erecting a manganese metallurgical plant at Tres Lomitos.

Refined silver production amounted to approximately 1,157,000 troy ounces against a consumption of roughly 965,000 ounces. The Government was laying aside a reserve of this metal, and no exports were permitted.

Tin production declined during 1947 by an unreported tonnage. Prospects for 1948 were considered better in view of increased prices in the international market.

Tungsten mining dropped sharply, and many mines closed following sudden termination of foreign purchases at the close of the war. However, several mines in Cordoba reopened during 1947 owing to the increase in market price and the prospects of Government subsidies. In order to help the tungsten-mining industry and at the same time build a stock pile, a bill was introduced in congress authorizing the Argentine Industrial Credit Bank to buy a minimum of 50 percent of local tungsten production up to a maximum of 3,000 tons, at prices no less than the prevailing United States prices and in no case less than $1.75 per kilo. Free exports of the surplus at a preferential rate of exchange for 5 years would be authorized. Favorable action on the bill was expected in 1948.

Of the 1947 output of zinc concentrates, about 12,000 tons were exported, of which about half went to Belgium. Argentina's two smelters were incapable of meeting the local demand for refined zinc, and the principal zinc-mining company began to construct a smelter at Comodoro Rivadavia which is expected to start operating in 1949 and will have a capacity adequate for all local needs.

NONMETALLIC MINERALS

Production of asbestos amounts to only about 150 tons a year and is confined to the short-fiber variety. A considerable amount of long-fiber asbestos was imported in 1947.

Production of barite jumped to about 35,000 tons in 1947 and at the present rate of development is expected to exceed domestic demands soon.

As the production of borates (ulexite or boronatrocalcite) rose in 1947, the Provincial Government of Salta started to stock pile the material. Although demands for borates for Czechoslovakia amounted to 20,000 tons, no exports were made because the mines could not handle the production and shipment of such a large quantity.

Cement output has not been reported for 1947 but is known to exceed a million tons a year from 27 plants.

The opening of new ceramic factories increased the production of clays. The tonnage extracted is not known, but quality is said to have been generally better than in prior years.

Large quantities of Argentine mica were bought by the United States during the last several years, but purchases were confined to large sheet, which constitutes only 9 percent of the total production. This left a very large accumulation (estimated at several million pesos worth) of small sheet and scrap. There was a good demand for this type of mica in Europe, but lack of exchange prevented significant purchases.

The mica producers therefore requested of the Government that revisions be made in the financial-commercial treaties with European countries in order that part of the peso loans be set aside for purchasing mica. However, by the close of the year the only Government action had been the granting of a preferential exchange rate for mica exports.

The sulfur mine at San Antonio de los Andes diminished production in 1947, but a new mine opened at El Sosneado in northwest Argentina within a few miles of the Chilean border and delivered the first carlots late in the year. Total sulfur production in 1948 was expected to meet one-third of the country's requirements.

Plans were made during the year for the formation of a half-million dollar mixed company for the erection of a plant at Calingasta, San Juan Province, for manufacturing aluminum and magnesium sulfates. It is claimed that the plant will be able to produce these materials cheaper than any other plant in the world, and the company will endeavor to capture a large part of the international trade in these materials.

HYDROCARBONS

Both imports and domestic production of coal during 1947 increased over 1946. Metallurgical coke has been in relatively short supply, and certain segments of industry have suffered as a result; however, it is confidently felt that relief in this direction may emerge as a result of trade negotiations recently completed with the British. It is not solely through imports, however, that the Argentine Government plans to solve its solid-fuels problem. The year 1947 brought considerable activity in development of the new Patagonian coal fields of Rio Turbio. Though production only reached 50 tons daily, ambitious plans were under way for large-scale exploitation of these fields, which are estimated to contain 200,000,000 tons of minable coal in proved areas. Development of the fields has been placed under the jurisdiction of the Ministry of the Navy, and in 1948 work was advanced on construction of a railroad linking Rio Turbio and the Port of Santa Cruz, some 400 kilometers east of the mines. Although some private observers have expressed skepticism as to the magnitude of the deposits and the feasibility of their economic exploitation, it appears that the authorities intend to spare no expense or efforts to tap the full potentialities of this region, which offers Argentina the only apparent hope of self-sufficiency in solid fuels.

Through the receipt of some new drilling and oil-field equipment in late 1946 and 1947, Argentina was enabled to increase its crude-petroleum production despite some slow-downs occasioned by labor disputes. The greater part of the increase came from exploratory drilling of the Cañodon Seco field south of (and possibly connected with) Comodoro Rivadavia. However, it is apparent that more new reserves must be found if production is to be maintained. Argentina's policy of retaining national reserves for operation by the Government has not been altered, but it is significant that during the year the Government signed a contract with an American drilling contractor for the drilling of 40 wells along the Andean slope from Bolivia to Patagonia, and for the importation of substantial quantities of drilling equipment for the use of Yacimientos Petrolifera Fiscales. A contract was also signed by YPF with an American engineering firm for constructing three new refineries with a total capacity of 53,100 barrels daily. Construction was started during the year on a 1,100 mile pipe line to carry natural gas from the Comodoro Rivadavia fields to Buenos Aires for industrial and domestic users.

BOLIVIA

The year 1947 in Bolivia was one of economic uncertainty, depressed business activity, a measure of political instability, and considerable labor strife. As the year opened, the question of the disposal of about one-half of the nation's tin production was unresolved, and shipments from Pacific ports were halted pending its solution in March. Unfavorable factors continued to have a marked effect on Bolivian economy until the last quarter of the year, when better labor relations, improvement in the exchange outlook, rising mineral production, and conclusion of a 2-year tin agreement considerably brightened the prospects for 1948.

Comparative mineral production in 1946 and 1947 appears in the accompanying table.

Mineral production of Bolivia, 1946–47, in metric tons (unless otherwise indicated)[1]

Mineral	1946	1947	Change, percent
METALS IN CONCENTRATES (EXPORTS)			
Antimony	6,964	10,857	+56
Columbite concentrates (gross) kilograms	3,116		−100
Copper	6,127	6,241	+2
Gold (production) troy ounces	(2)	20,627	(2)
Lead	8,434	11,310	+34
Silver troy ounces	6,106,165	6,234,093	+2
Tin	38,222	33,800	−12
Tungsten, 60 percent WO_3 equivalent	2,113	2,635	+25
Zinc	19,188	14,612	−24
NONMETALLIC MINERALS (PRODUCTION)			
Asbestos		76	
Cement	30,742	38,828	+26
Fluorspar		28	
Sulfur	471	2,287	+386
HYDROCARBONS (PRODUCTION)			
Petroleum, crude barrels (42 gal.)	362,699	374,694	+3
Petroleum refinery products do	223,934	250,584	+12

[1] Exclusive of bismuth, for which export figures are not believed to be indicative of production; and of clay, lime, salt, and stone, which are produced for domestic use in quantities not reported.
[2] Not reported.

METALS

Antimony.—Under a price guaranteed by the Banco Minero, antimony production rose to the highest level since 1943. England received 7,653 tons of the exports and the United States 2,539 tons; the small remainder was divided fairly evenly between Argentina and Belgium. A description of the antimony deposits was published in November.[12]

Bismuth.—Exports of bismuth in concentrates jumped 219 percent from 27,867 kilograms in 1946 to 88,964 kilograms in 1947. It is not known how much of the exports in either year was from concurrent production and how much from stocks that accumulated in the country after 1943, when the purchase agreement with the United

[12] Ahlfeld, Federico (translated by G. W. Creswell and C. E. Nighman), Geology of the Antimony Deposits in Bolivia: Bureau of Mines, Mineral Trade Notes, Special Suppl. 20 to vol. 25, No. 5, November 1947, 11 pp.

States Commercial Company terminated. Of the total exports, 86,748 kilograms went to England in 1947 and only 2,216 kilograms to the United States.

Columbite.—It appears that the Bolivian Development Corp. either discontinued operation of its La Verde mine, near Santa Cruz or stocked production for future shipment. No exports of columbite were made in 1947; the United States received 3,116 kilograms from Bolivia in 1946.

Copper.—Copper production, led by the Corocoro mine of the American Smelting & Refining Co., the Pulacayo mine of Cía. Minera Huanchaca de Bolivia, and the Animas mine of Cía. Aramayo de Minas en Bolivia, was maintained at the even level of the previous 7 years. Virtually all of the exports were to the United States.

Lead and Zinc.—No explanation has been offered as to why shipments of zinc dropped in 1947 while those of lead increased; Cía. de Huanchaca de Bolivia is the principal producer of both concentrates. Except for 5 tons to England, all exports of zinc in concentrates were to the United States. Most of the lead in concentrates has customarily gone to Argentina for smelting. In 1947, however, the pattern changed somewhat; the United States received 8,925 tons, Argentina only 2,261 tons, and England 124 tons.

Precious Metals.—Reported production of 20,627 ounces of gold in 1947 may be fairly accurate, as smuggling and illegal sales are believed to have been reduced to relative unimportance by action of the Government. Gold exports amounted to only 7,956 ounces in 1947, bearing no relationship to production. Silver is not refined within the Republic, and its production is reasonably well measured by the silver content of base-metal concentrates exported.

Tin.—Bolivian tin production has declined every year since 1943 when the wartime output reached its peak. The Bolivian industry faced 1947 with misgivings. Producers of tin—the metal accounting for approximately 85 percent of the Government's income—had been unable to obtain a renewal of the Reconstruction Finance Corporation purchase contract that expired December 31, 1946. In the absence of a contract with a fixed price, producers allowed their concentrates to accumulate within the country and at Pacific ports. The impasse was resolved by a trade agreement with Argentina, signed on March 26, by which that country agreed to purchase 8,000 tons of fine tin a year at $0.76 per pound. The Reconstruction Finance Corporation met the Argentine price, and normal shipments of concentrates were resumed. A new contract with the RFC was signed on December 31, 1947, to run for 2 years and provide for a basic price of $0.90 per pound of fine tin, ex ports, with adjustments corresponding to fluctuations from RFC's price of $0.94 for Grade A tin, ex dock, New York. The continuity of production in 1947 was interrupted by two or three strikes, most serious of which was a general strike in September which affected, among others, the largest producer of tin at Catavi. A complete reorganization at Catavi appeared to be successful, and the resulting peace and increased tin production there were considered an example for the remainder of the industry. The San José mine at Cía. Minera de Oruro (Hochschild group) was taken over by the Bolivian Government and has been operated through the Banco Minero since August. Without the multiple restrictions and requirements imposed against private companies, production at San José has almost doubled.

On September 7, President Hertzog issued a decree ordering the Banco Minero to sell to the small and previously dormant Oruro smelter an unlimited amount of tin concentrates. The plant was operated on an experimental scale and actually shipped 22 tons of refined bars in 1947, representing all the deliveries that were made against the Argentine commitment. Of the exports of tin in concentrates, 19,481 tons went to the United States, 14,266 tons to England, 29 tons to Chile, and 2 tons to the Netherlands.

Tungsten.—Stimulated by a purchase agreement with Banco Minero and waiver of the export tax, the production of wolframite, principally by the Caracoles-Tazna mine of Cía. Aramayo de Minas en Bolivia, advanced 25 percent in 1947. Exports, on a 60-percent WO_3 equivalent basis, amounted to 2,134 tons to the United States, 224 tons to England, 171 tons to Sweden, 102 tons to France, and 4 tons to the Netherlands. The geology of the Yungas mines (Chojlla, Barco, and Enramada) of the International Mining Corp. was described in September.[13]

NONMETALLIC MINERALS

Asbestos production was resumed in 1947, following a year of inactivity, with shipments of 72 tons to Belgium, 43 tons to Argentina, and 26 tons to Chile. Exports of 141 tons exceeded the 76 tons reportedly produced and may have been in part from stocks. Fluorspar production was also resumed on the usual small scale, with total output exported to Chile. Sulfur production was nearly quadrupled to fill orders from neighboring countries; 1,443 tons were delivered to Brazil, 794 tons to Chile, and 50 tons to Argentina.

Bolivia's only cement plant, operated by Sociedad Boliviana de Cemento at Viacha, 30 kilometers from La Paz, established a new production record in 1947 under the urgent demand of various construction projects. Consideration was given to addition of a third kiln to expand plant capacity.[14]

HYDROCARBONS

Petroleum.—Bolivia's 3-percent increase in crude petroleum production was less than the potential increase insured by the successful completion of six new wells in 1947. The Camiri field, where three of the wells were brought in, will be unable to realize its potential before completion of a 375-mile pipe-line system under construction to link the field with Cochabamba, Sucre, and other consuming centers. The Bermejo and Sanandita fields were increased by one well each, and the sixth well discovered the first new field, at Guyrúy, 15 miles south of Camiri, since the industry was nationalized in 1937. An exploration concession to the Superior Oil Co. was disapproved by the Bolivian Congress, and all production activities remained exclusively in the hands of Yacimiento Petrólifera Fiscales Bolivianos.

BRAZIL

With the exception of iron and steel, cement, monazite sand, and crude petroleum, Brazilian mineral production in general was somewhat lower in 1947 than in 1946. Comparison of the 2 years, insofar as they have been reported, is presented in the accompanying table.

[13] Bellows, Geo. D. Chojlla Mine Unusual in Geologic Features: Eng. and Min. Jour., vol. 148, No. 9, September 1947, pp. 68–70.
[14] Bureau of Mines, Mineral Trade Notes: vol. 26, No. 1, January 1948, p. 36.

Mineral production of Brazil 1946–47, in metric tons (unless otherwise indicated)

Mineral	1946	1947	Change, percent
ORES AND METALS			
Aluminum metal	[1] 250		−100
Arsenic oxide (white arsenic)	829	(2)	(2)
Beryllium concentrates (exports)	1,294	1,027	−21
Chromite	[1] 3,600	(2)	(2)
Columbite (exports)	7		−100
Gold (estimated) troy ounces	175,000	167,000	−5
Iron ore	[1] 1,000,000	926,625	−7
Iron and steel:			
Pig iron	365,345	480,638	+32
Steel ingots and billets	342,643	388,024	+13
Rolled steel products	311,515	315,773	+1
Manganese ore, 38-50 percent Mn (exports)	149,149	142,092	−5
Silver troy ounces	21,968	20,293	−8
Tantalite (exports)	44	33	−25
Titanium concentrates (exports):			
Ilmenite	[1] 4,000	(2)	(2)
Rutile	28	5	−82
Tin, in ore	150	120	−20
Tungsten ore, 60 percent WO_3 equivalent (exports)	1,623	1,328	−18
Zirconium concentrates (exports)	4,453	3,977	−11
Ores, type not specified (exports)	6,475	14,404	+122
NONMETALLIC MINERALS			
Agate, ornamental (exports)	41	5	−88
Asbestos (exports)		15	
Barite	10,326	(2)	(2)
Cement	825,869	913,525	+11
Diamonds (estimated) carats	325,000	275,000	−15
Mica (exports)	1,148	857	−25
Monazite sand (exports)	1,250	1,751	+40
Phosphate rock (apatite)	10,621	[1] 10,600	
Quartz crystal (exports)	161	369	+129
Salt	609,198	(2)	(2)
Stones, semiprecious (exports):			
Agate, gem grams		690	
Aquamarine do	93,693	14,999	−84
Amethyst do	318,478	182,681	−43
Cat's eye do	302		−100
Citrine do	183,312	53,246	−71
Garnet do	53,023	13,161	−75
Topaz do	18,880	2,308	−88
Tourmaline do	10,543	7,550	−28
Other, kind not specified do	1,069,627	775,534	−27
Total exported do	1,747,858	1,050,169	−40
HYDROCARBONS			
Coal, net weight	1,273,708	1,254,550	−2
Petroleum, crude barrels (42 gal.)	66,697	96,806	+45
Petroleum refinery products do	376,600	(2)	(2)

[1] Approximate production.
[2] Not reported.

Drafting of a new mining code is believed to have been completed but had received no action from the Brazilian Congress by mid-1948. A new petroleum bill, likewise designed to conform with the Brazilian Constitution of 1946, was presented to the Congress February 16, 1948. Throughout 1947 Government control of mineral exportation, through export licenses, remained in effect.

METALS

Beryl and Tantalite.—Beryl and tantalite are believed to have been produced at about the effective capacity of the mines. No shipments of columbite were reported, although this mineral is commonly mined in conjunction with beryl. All of the tantalite and 929 tons of the beryl exported went to the United States; 98 tons of beryl were shipped to France.

Chromite.—Chromite is not known to have been exported from Brazil during 1947, but the chemical industry in São Paulo consumed 271 metric tons produced by Cromita do Brazil from its mine near Campo Formoso in Bahia. At the end of the year, Cromita do Brazil had 1,700 metric tons in stock, with the expectation of exporting it to the United States.

Gold, Silver, and Arsenic.—The St. John del Rey Mining Co. and Cia. Minas de Passagem were the major producers of gold in 1947 and of silver and arsenic as byproducts. Placer production is believed to have comprised about 20 percent of the total gold output. Cia. Mineração Gurupí, the Brazilian subsidiary of the Anaconda Copper Co., carried out an intensive program of diamond drilling and examination of the series of claims covering 25 square kilometers of a gold-bearing lode on the Gurupí River. Anaconda then withdrew from all activity in Brazil without announcing results but has maintained the company charter of its Brazilian subsidiary.

Iron and Steel.—Cia. Vale do Rio Doce, S. A., is the only important iron-mining company in Brazil that produced iron ore for export; the mines along the Central Railway in Minas Gerais have access to no point to load ships except at the Rio de Janeiro dock, which does not have facilities capable of handling large-volume shipments of ore. The Central Railway is considering a proposal to build an independent coal and ore dock at Itacurussa between Rio de Janeiro and Angra dos Reis. This would greatly facilitate both the importation of coal and the exportation of iron ore and manganese from Minas Gerais; the establishment of improved rail and port facilities is about the only possible way of increasing such exports. In 1947 Brazil exported 196,737 tons of iron ore, of which 74,637 tons went to the United States, 56,781 tons to Canada, 44,694 tons to Belgium, and 20,625 tons to the Netherlands.

Iron ore production rate at Cia. Vale do Rio Doce, S. A., increased from about 600 tons per day to about 1,200 tons per day by the end of 1947. The company reconstructed the section of the railroad from the terminus at Vitoria to Colatina, thus eliminating the worst grades in the entire line and permitting the movement of 1,500-ton trains. Funds for capital expenditure were exhausted, however, and portions of the railway from Colatina to Drummond that have deteriorated badly have not been improved. The mine production rate at the end of the year represented effective railroad capacity.

The Federal Geological Survey program of cooperation with the Brazilian Departmento Nacional de Produção Mineral on investigation of the iron-ore resources of Minas Gerais got under way actively in 1947.

Beginning in August, the output of steel by the Volta Redonda plant of Cia. Siderurgica Nacional was reduced from 500 tons to about 325 tons per day, as there was a poor market for structural shapes. With an adequate supply of metallurgical coal, Volta Redonda could supply 150,000 tons of pig iron or steel annually for export during the current period of short supply and high price but it has not indicated any intention of doing so. At the end of 1947 the mill had 130,000 metric tons of steel in stock, for which there was no demand in Brazil. Total Brazilian exports of pig iron in 1947 amounted to 29,464 metric tons, of which 97 percent went to Argentina.

Cia. Aços Especiais de Itabira, S. A., made progress in installing a 50,000-ton-per-year special steel plant at Coronel Fabriciano, Minas

Gerais. The plant will include a 200-ton-per-day blast furnace, and initially it is planned to produce pig iron for sale; the normal production of steel must await completion of a hydroelectric power plant to be built near Sá Carvalho, 23 kilometers upstream from the steel plant on the Piraçicaba River. Ore for the mill will be taken from the company property near Itabira, formerly owned by the Brazilian Iron & Steel Co.

The charcoal iron industry does not appear to have been adversely affected by the recent expansions of the steel industry. A new 50-ton blast furnace was blown in at the Mineração Geral do Brasil plant near Mogi das Cruzes, São Paulo; and the Monlevade plant of the Cia. Siderúrgica Belgo Mineira in Minas Gerais started construction of an intermittent Greenawalt plant to produce 600 metric tons of sinter per day, utilizing fine hematite and charcoal.

Lead.—The management of Cia. Plumbum, S. A., which operates a single Mace blast furnace at its Panelas smelter at Bocaiuva, Paraná, announced its intention to order 2 more blast furnaces of a larger size to permit smelting a total of 200 tons of charge per day. The present output capacity is 5 tons of 99.99-percent refined lead and 5 kilos of silver per day. Refined-lead production is not reported but is believed to have exceeded 1,500 tons a year since 1945. The Government of São Paulo announced that the Apiai smelter, closed since 1942, is scheduled to reopen using high-grade ore from the São Rafael mine, Iporanga Municipality, São Paulo, where several outcrops are being prospected in the hope of meeting the smelter capacity of 10,000 tons a year.

Manganese.—The Hanna Exploration Co. and two other American concerns failed to obtain mining rights to a manganese-ore deposit of several million tons in Amapá Territory, 180 kilometers from a proposed port on the Amazon River. Following competitive bidding, the Government of Amapá Territory assigned mining rights to a Brazilian organization, Industria e Comercio de Minérios, Ltda., of Belo Horizonte, Minas Gerais. Although the Brazilian organization has had some success at iron-ore mining in central Minas Gerais, it remains to be demonstrated whether it has the capital and organization for an enterprise of this magnitude.

Discovery of a new body of manganese ore was reported near Alvanopolis, Minas Gerais. The principal producer of manganese ore was Cía. Mineração Meridional, S. A., which exported its entire 1947 output to the United States.

Tin.—Several small Brazilian companies were actively engaged in mining alluvial tin in Amapá Territory in 1947. By midyear the average monthly production rate was about 20 tons. Deposits are said to be high grade but small and pockety and apparently not amenable to profitable operation on a large scale.

Titanium and Zirconium.—Whatever ilmenite may have been separated from the beach sands of Esperito Santo in 1947 must have been stocked for future sale, as none was exported. Five tons of rutile shipped to the Netherlands was from stocks mined alluvially in central Goiaz in 1945.

Cía. Mineração Atlantica, a subsidiary of Duperial, S. A. (E. I. DuPont de Nemours and Imperial Chemical Co.), was chartered as a Brazilian mining company in 1947. The company obtained claims on beach sands of Esperito Santo and the northern portion of Rio de Janeiro, which it proposed to work for ilmenite, recovering zircon and monazite as byproducts. Cía. Foote Minérios Industrializados, a subsidiary of the Foote Mineral Co., has also been authorized to function as a mining company. By early 1948 the company had started production of zircon sand, with some monazite as a byproduct, by hydraulic mining and gravity concentration of beach sands at Ponta da Fructa, Esperito Santo.

Brazilian exports of zirconium ore derived from the Esperito sands amounted to 3,879 tons to the United States and 98 tons to Great Britain.

Tungsten.—Of the 1947 production of tungsten ores, as measured by exports, 1,208 metric tons of 60 percent WO_3 equivalent ore was scheelite mined in northeastern Brazil and 120 tons was wolframite from the Irhandjara mine in São Paulo. Seventy-two percent of the exports went to the United States and the remainder to Great Britain, France, the Netherlands, and Belgium.

NONMETALLIC MINERALS

Asbestos.—S. A. Mineração de Amianto, which operated a chrysotile asbestos mine at Djalma Dutra (formerly Poçõe͂s), Bahia, produced 134 tons during the final quarter of 1947 and during the same period shipped 146 metric tons. The entire production was utilized by a cement-asbestos production company in São Paulo. Another manufacturer of similar products in Rio de Janeiro—Cía. Brasileira de Produção em Cimento Armado—sought to insure itself a permanent supply of asbestos by installing a compressor and rock drills on a property near Governador Valadares, Minas Gerais. The total production of the country is not known. In 1947, 10 tons of asbestos were exported to Argentina and 5 tons to Finland.

Barite.—Barite production at Camamú Island, Bahia, by Cía. Pigmentos Minerais Industrial e Comercial Pigmina, S. A., amounted to 7,643 tons for the first half of 1947. Figures for the remainder of the year are not available, but it is believed that several thousand tons were in stock awaiting shipment at the end of the year.

Cement.—The demand for portland cement remains greatly in excess of supply, despite the 1947 advance in output. Brazil's largest cement mill began installation of a fourth kiln to increase production by 200,000 bags per month.

Diamonds.—It is always difficult to know what is taking place in the diamond trade because of the nomadic nature of the miners in remote localities of six States, as well as the secretiveness of the trade itself. It is rumored that many "garimpeiros" have deserted the Marabá and Bõa Vista districts on the lower Rio Tocantins and upper Rio Branco, respectively, to go into Venezuela, where the fields are more easily productive and the diamonds bring a better price. Production is estimated to have declined from 325,000 carats in 1946 to 275,000 in 1947, although exports in the same period showed a 10-percent increase. Nearly half the legitimate exports of rough diamonds and virtually all the cut diamonds and carbonados went to the United States; Great Britain took most of the remaining rough stones.

Exports of diamonds, in carats, were as follows:

	1946	*1947*
Gem stones, rough	113, 815	133, 075
Gem stones, cut	12, 645	10, 325
Carbonados	14, 070	10, 620
Total diamonds	140, 530	154, 020

Graphite.—Cía. Nacional de Grafite, Ltda., continued to operate its graphite mine near Itapecerica, Minas Gerais. Graphite exports (not indicative of production) amounted to 92 tons in 1946 and 129 tons in 1947. Of the 1947 exports, 98 tons went to Argentina, 30 tons to Sweden, 1 ton to Venezuela, and less than one-half ton to the United States and Paraguay.

Mica.—Empresa Cosmopolitana de Comércio Geral Limitada became the principal producer of strategic mica during the war through control and operation of the Cruzeiro mine north of Governador Valadares, Minas Gerais. Mica mines are generally short-lived, but this one has been characterized as one of the world's important mines. During 1947 the company announced that it had opened the new nearby Sexta Feira mine, said to be equal to the Cruzeiro. Of 1947 exports, 651 tons went to the United States, 140 tons to Great Britain, 30 tons to France, 16 tons to Mexico, 14 tons to Czechoslovakia, and less than 3 tons each to Italy, Sweden, Portugal, Switzerland, and Belgium.

Monazite.—Exports of monazite derived from the beach sands of Esperito Santo (see Titanium and Zirconium) were shipped to the United States, except for 1 ton shipped to Canada.

Phosphate.—Serrana, S. A., produced 10,621 tons of apatite concentrates in 1946 from its Ipanema and Jacupirana deposits in São Paulo and is believed to have produced about the same tonnage in 1947, although figures have not been submitted. The State of Minas Gerais acquired the mining rights to a large deposit of apatite near Araxá, following the practice of the Amapá Territory in regard to hematite and manganese deposits.

Quartz Crystal.—Although Brazil in 1947 more than doubled its quartz-crystal exports of 1946, sales were barely more than half those of 1945—the first year of the postwar slump. Exports in 1947 show 209 tons to the United States, 149 tons to Great Britain, 10 tons to the Netherlands, and small amounts to France, Switzerland, and Sweden.

Semiprecious Stones.—Legitimate trade in semiprecious stones was dull throughout 1947. As usual, the bulk of export sales went to the United States, except for topaz to Sweden and gem agate to Switzerland, but distribution of moderate to small quantities has become world-wide, with the European countries predominating.

HYDROCARBONS

Coal.—Coal production for 1947 in Rio Grande do Sul fell to about 200,000 tons below full capacity because of labor difficulties and work slow-downs during the second quarter. The Santa Catarina, Paraná, and São Paulo fields operated at the capacity levels of the previous year. In addition to coal, the São Paulo field produced 10,529 tons of lignite. Total Brazilian production was less than half domestic requirements and was supplemented by the importation of 1,431,160 tons of coal and 24,783 tons of coke.

Petroleum.—The year 1947 was the peak in Brazil's 8-year petroleum-producing history. The increase over 1946 was brought about by completion of 17 new producing wells in the Candeias field and the opening of the Lobato-Joanes field, which was shut in during the preceding year. A new field was opened with four producing wells at Dom Joao, northwest of Candeias, in April. Exploration by six geological parties and two seismograph geophysical crews was mostly restricted to reconnaissance work in 1947, with more detailed exploration scheduled for 1948 and 1949. The new petroleum bill sent to the Congress early in 1948 provides for participation of foreign capital in Brazil's oil industry under specified conditions.

BRITISH GUIANA

METALS

Bauxite.—Production and exports of bauxite (reported as identical in each of the past 2 years) advanced from 1,137,991 metric tons in 1946 to 1,318,190 tons in 1947—the highest output since the war year 1943. Exports were sent to Canada, the United States, and the United Kingdom, in that order of tonnages. Demerara Bauxite Co., Ltd. (Aluminum Co. of Canada), and Berbice Co., Ltd. (American Cyanamid & Chemical Corp.), were the only active producers in the colony; the Reynolds Metals Co. and Permanente Metals Corp.[15] continued explorations begun in 1946 in the Essequibo district.

Gold.—Gold output maintained its steady increase from 19,793 fine ounces (24,741 ounces crude) in 1946 to 21,111 fine ounces (26,389 ounces crude) in 1947. In view of the entry of at least two new companies in 1946—Rupununi Gold Mining Co. and Wairiri Gold Mines—supplementing the output of the long-established Cuyuni Goldfields, Ltd., and British Guiana Consolidated Goldfields, Ltd., the 1947 figure was less than had been anticipated. The Anaconda Mining Co. started exploration activities. In mid-1947 Rupununi Gold Mining Co., a Canadian concern, announced discovery of an exceedingly rich gold vein in the vicinity of its Marudi Mountain property near the Rupununi River in southwestern British Guiana, though development has not advanced far enough as yet to insure prospects as indicated by very high initial assays.

NONMETALLIC MINERALS

Diamonds.—Diamond mining failed to sustain the production rate reached in 1946 and dropped from 30,958 carats in that year to 24,669 carats in 1947. Exports of 26,553 carats included some stones mined in 1946. No explanation of the decline has been offered.

Granite.—Production of quarried stone (chiefly granite) for local construction amounted to 44,805 metric tons in 1946 and 38,998 tons in 1947.

CHILE

On the basis of value, the over-all production of minerals in Chile increased 13½ percent in 1947 as compared with the previous year, placing mine production at approximately the same level in terms of value (though lower in tonnage) as in 1942. Although the tonnage for copper and nitrates increased, the industry was unable to take full advantage of world demand and high prices because of deliberate work slow-downs and prolonged labor difficulties. The outlook for 1948 was optimistic, provided that labor can be kept satisfied under the rising living costs.

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15 Bureau of Mines, Mineral Trade Notes: vol. 25, No. 5, November 1947, p. 3.

Payments that accrued to the Government from the sales of copper and nitrate went a long way toward alleviating Chile's acute foreign-exchange situation. Until September 12, 1947, the Government collected 50 percent of the difference between $0.10 per pound and the actual sales price of copper; on that date an emergency law increased this extraordinary tax by 20 percent, although the increase remained in effect only through December 1947.

A comparison of Chilean mineral production in 1946 and 1947 is presented in the accompanying table.

Mineral production of Chile, 1946–47, in metric tons (unless otherwise indicated)

Mineral	1946	1947	Change, percent
ORES AND METALS			
Copper:			
In ore	358,848	414,478	+16
Refined	351,989	399,415	+13
Gold ... troy ounces	212,014	148,741	−30
Iron ore	1,352,886	1,737,553	+28
Iron:			
Pig	(1)	11,394	(1)
Rolled	(1)	9,427	(1)
Steel bars	(1)	11,589	(1)
Lead, refined	86		−100
Manganese ore:			
Metallurgical grade	15,659	19,352	+24
Battery grade	4,879	(1)	(1)
Total	20,538	(1)	(1)
Mercury ... 76-pound flasks	827	445	−46
Molybdenum, in concentrates	560	402	−28
Silver ... troy ounces	869,437	981,048	+13
NONMETALLIC MINERALS			
Asbestos	280		−100
Barite	3,752	2,546	−32
Borates	1,477	477	−68
Cement	579,906	602,299	+4
Clay:			
Kaolin	6,464	8,575	+33
Other	570	(1)	(1)
Dolomite	25	(1)	(1)
Feldspar	44	217	+393
Iodine, crude	620	1,263	+104
Kieselguhr (diatomite)	70	62	−11
Limestone:			
For lime	81,976	(1)	(1)
For cement	803,576	1,121,445	+40
Agricultural	35,153	40,429	+15
Other	4,085	62,202	(2)
Nitrates	1,617,717	1,638,231	+1
Phosphate rock (apatite)	15,210	13,994	−8
Potassium chloride	(1)	3,259	(1)
Quartz	46,022	50,456	+10
Salt, common	59,405	58,903	−1
Sodium sulfate	13,198	114,142	(2)
Sulfur:			
Contained in crude caliche (sales)	9,213	11,905	+29
Granular and sublimate	6,216		−100
Talc	640	1,085	+70
HYDROCARBONS			
Coal, net weight	1,740,213	1,849,703	+6

[1] Not reported.
[2] More than 500 percent increase.

METALS

Copper.—During the year a series of discussions was held between representatives of the large copper interests and the Chilean Government in an attempt to clarify the position of the copper companies in Chile. These talks were especially significant in view of the approaching necessity of the Chile Exploration Co. to invest an additional

$120,000,000 in plant renovations for the treatment of sulfide copper ores at Chuquicamata. Attempts of the industry to combine the several taxes now paid by the companies into one general tax were unsuccessful, as was a campaign to form a copper sales corporation.

As usual, the Chile Exploration Co., Andes Copper Co., and Braden Copper Co. provided more than 95 percent of the total copper output. During the year the Chilean Government approved a project for creating a national copper smelter of 400 tons daily capacity at Paipote; construction was begun in May 1948. A contract for machinery and equipment has been signed with an American concern. The project is designed to stimulate production of small mines.

Of the 399,255 tons of copper exported during 1947, 231,992 tons were electrolytic copper, 155,270 tons standard copper, 1,027 tons copper bars, and 10,966 tons contained in ores, concentrates, precipitates, and copper cement. The United States received 213,933 tons of the total, Great Britain 56,486 tons, France 44,705 tons, Argentina 21,467 tons, and Italy 19,547 tons; the remainder of the shipments, each less than 14,000 tons, were distributed among Sweden, Czechoslovakia, Brazil, Switzerland, Netherlands, India, Algiers, China, Denmark, Belgium, Germany, Norway, Canada, Bolivia, and Uruguay.

Gold and Silver.—Although gold production has been reported as normal throughout the year, official statistics show complete nullification of substantial increases in gold-mine and placer production by an abrupt decline in the gold content of copper and other base-metal ores. Such a change, if true, remains unexplained, but it is believed that future releases will show an upward revision of the gold production figure.

The increase in silver output was in line with that of copper, from which more than half of the silver is derived.

Iron and Steel.—Under the pressure of demand from the United States and with adequate shipping facilities, iron-ore production increased for the fourth consecutive year to very near the level of 1940. Total production was from El Tofo mines of the Bethlehem Steel Corp. Iron and steel production was from Chile's only operating plant at Corral, owned by Cía. Electro Siderurgica y Industrial de Valdivia. Early estimates of Cía. de Acero del Pacifico that its 180,000-ton steel plant near Concepción, begun in 1946, would be completed in 1949 were apparently optimistic. A report received in mid-1948 indicated that the project was only 10 percent completed.

Lead and Zinc.—In 1946 Cía. Minera Punitaqui, Cie. Minière du M'Zaite, and a group of Chilean shareholders formed the Cía. Minera Aysen to explore and develop lead-zinc deposits north of Lago Buenos Aires, in southern Chile. Transportation to the region is difficult, and the deposits are pockety but said to be very rich. Exploration was engaged in throughout 1947, and enough ore was found to justify preliminary plans for a mill and active development of the mine.[16]

The usual recovery of small quantities of lead from gold-silver and other concentrates apparently was not carried out in 1947, although lead content was reported at 3,507 tons.

Manganese.—Production of metallurgical-grade manganese ore by the Coquimbana mine of Manganeso de Atacama, S. A., Chile's only

[16] Fritas C., Ricardo, and Milon, Chas., Chilean Mineral Area Offers New Field for Exploration: Eng. and Min. Jour., vol. 149, No. 4, April 1948, pp. 92–94.

producer, responded to active demand in the United States with a moderate increase. The same company averaged approximately 250 tons per month of battery-grade ore during the first part of the year, but output dwindled to virtually nothing during the last quarter. Battery-grade tonnage for the total year has not been reported. Total exports of both grades amounted to 26,628 tons. The United States received 24,596 tons, and the remainder went to Norway.

The Chilean Department of Mines and Petroleum completed a manganese study and announced an estimate of reserves at 300,000 tons of 35-percent grade and 1,200,000 tons of 30-percent grade, mostly in Atacama and Coquimbo Provinces.

Mercury.—The Punitaqui mine, Coquimbo Province, found it difficult to meet the reopened competition of Spain and Italy in the world mercury market and curtailed production 46 percent. There is no other active mercury mine in Chile. Of 290 flasks exported, 174 flasks went to Argentina and 116 flasks to the United States.

Molybdenum.—Molybdenum production was confined to separation of concentrates from El Teniente copper ores of the Braden Copper Co. and has been decreasing since 1945.

NONMETALLIC MINERALS

Cement.—Cement production increased for the third consecutive year to a new all-time record in 1947. A new plant under construction at Polpico near Santiago and being equipped with United States machinery was expected to enter production about the end of 1948 or early 1949, with a capacity of 200,000 metric tons annually.

Nitrates and Associated Salts.—Nitrate production during 1947 showed very slight improvement over the high level established in 1946. During the year a new process for producing potassium nitrate was announced, and the two largest mechanized oficinas proceeded with plans to install a solar evaporation system for recovering nitrate byproducts. There was an unexplained drop in the output of borates, while that of iodine doubled and sodium sulfate increased nearly ninefold. Comparative figures for the 2 years are not available for calcium sulfate, potassium chloride, and sodium carbonate. The Department of Mines announced an actual reserve in Chile of 2,000,000 tons of 33-percent borax.

Exports of nitrate in 1947 were distributed to 41 countries throughout the world and totaled 1,673,787 tons. The United States, Egypt, and France were the only countries receiving more than 100,000 tons each. Of the total exports, sodium nitrate comprised 1,623,332 tons and potassium nitrate 50,455 tons.

Other Nonmetallic Minerals.—No information other than the production figures shown has been received relative to activity in asbestos, barite, clay, dolomite, feldspar, gypsum, kieselguhr, limestone, mineral pigments, phosphate rock, quartz, salt, sulfur, and talc.

HYDROCARBONS

Coal.—Output in 1947 followed the fairly even level of the past 8 years. Production was supplemented by 107,000 tons of imported coal, and 14,653 tons were exported, virtually all to Argentina. The new Pacific steel plant at Concepción presented a petition to the Government requesting a coal concession of 24,000 hectares on the Arauco Peninsula.

Petroleum.—The development program of the Corporacion de Fomento de la Produccion resulted in further definition of the productive area of the Springhill oil field on the island of Tierra del Fuego. Four new wells were completed, and two others were being drilled at the close of the year. Early prospects have been somewhat disappointing, but enough oil has been discovered and shut in to justify shipping after construction of appropriate facilities. A 50-mile 6-inch pipe line has been authorized from the field to Caleta Percy for loading to tankers.

COLOMBIA

METALS

Precious Metals.—Gold and silver occur together in both the lode and placer deposits of Colombia. The decline in production of both metals has been continuous since 1941 owing primarily to steadily increasing labor and material costs and has caused grave concern in financial and Government circles by its growing adverse effect on foreign exchange and the general national economy. Monthly gold production reached a 15-year low in December 1947, and as the year closed the Colombian Congress enacted laws making gold certificates negotiable on the free exchange market and consequently deriving greater exchange benefits to the producers, who previously sold their certificates directly to the bank at a fixed rate. Thus the industry faced 1948 with a feeling of general optimism. Fifty-seven percent of the gold and 61 percent of the silver produced in Colombia during 1947 were from Antioquia.

Although platinum output also dropped in 1947, it remained well above the 34,500-ounce level of the 1943–45 period. Production was entirely from the Pacific slope streams of Choco, mainly from the gravels of the San Juan River.

Mineral production of Colombia 1946–47 in metric tons (unless otherwise indicated)

Mineral	1946	1947	Change, percent
METALS			
Precious metals:			
Gold, troy ounces	437,176	383,027	−12
Silver, do	152,651	110,122	−28
Platinum, do	44,539	40,537	−9
NONMETALLIC MINERALS			
Barite	[1] 2,600	2,800	+8
Cement	[1] 328,000	343,228	+5
Emeralds, gem grade, carats		5,400	
Gypsum	[1] 18,300	17,372	−5
Limestone, for cement	(2)	502,030	(2)
Salt:			
Terrestrial	92,460	94,989	+3
Marine	31,907	26,258	−18
Total salt	124,367	121,247	−3
HYDROCARBONS			
Coal (estimated)	550,000	850,000	+55
Petroleum, crude (including natural gasoline), barrels (42 gal.)	22,518,174	25,882,100	+15
Petroleum refinery products, do	5,241,720	7,862,076	+50

[1] Estimate.
[2] Not reported.

Iron and Steel.—Plans for an iron and steel industry at Paz del Rio reached the point of authorization by the Congress for the establishment of a semiofficial entity to be known as Empresa Siderúrgica de Paz de Rio, with a capital of 100 million pesos and Colombian Government ownership of at least 51 percent of the capital investment. A project involving construction of a plant with an annual capacity of 85,000 tons of steel was under consideration. Present production in Colombia is limited to 5 tons of pig iron per day from one small furnace at Pacho and 250 tons of steel reinforcing bars per month by a plant in Medellín. From its inception in 1944 until mid-1947, Empresa Siderúrgica de Medellín operated the latter plant on scrap material. It then began smelting low-grade iron ore from deposits in Antioquia about 70 miles north of Medellín, a source that is expected to be developing on a larger scale in the future.

NONMETALLIC MINERALS

Cement.—The Colombian cement industry has established a new peak of production every year since 1942 without being able to keep up with the expanding demands of the construction industry. Completion or progress toward completion of additional manufacturing facilities during 1947 included new ovens and mills at Medellín by Cemento Argus and plant expansion at Cali by Cemento del Valle, at Apulco by Cemento Diamante, and at Bogotá by Cemento Samper. Two completely new plants approached completion at Barranquilla by Cemento Caribe and at Medellín by El Cairo.

Emeralds.—Sales of emeralds during the war and postwar years reduced Government stocks to the point where it was believed economic to reopen the Government-controlled emerald mines in 1947. Exploration and development work were begun at both mining districts in March. The Muzo mines, closed since 1938, produced no stones during the year. The Chivor mine, under lease to Chivor Emerald Mines, Inc., but inoperative since about 1940, actually produced 5,400 carats of commercial gem stones and approximately 12,000 carats of very low grade "moralla" during November and December. The Chivor mine reportedly was subject to pilfering during the "closed" period, and a black market in emeralds has been flourishing in recent years. In an effort to suppress this black market, the Government promulgated Executive Decree 1986 on June 17, 1947, strictly regulating the mining, cutting, sale, and export of unmounted emeralds. Enforcement of the decree may prove to be somewhat difficult.

Other Nonmetallic Minerals.—No information has been received relative to activities in the barite and gypsum industries, other than that shown by the figures in the production table. The Banco de la Republica announced that it would extend its refined salt operations to 200 tons daily and build a plant to produce soda ash, caustic soda, and chlorine. This will be the first plant to produce alkalies in Colombia and is expected to be in operation by 1949.[17]

HYDROCARBONS

Coal.—Official coal statistics have not been made available since 1944, but estimates indicate continuation of an upward production trend that began in 1941 in response to expanding domestic demands,

[17] Bureau of Mines, Mineral Trade Notes: Vol. 25, No. 6, December 1947, p. 41.

particularly by the railroads and the cement-manufacturing industry. The trend should be further stimulated with realization of proposed expansion of the iron and steel industry and establishment of an alkali industry. Output of the three principal fields adjoining Cali, Bogotá, and Medellín [18] is determined by domestic requirements, with occasional small surpluses exported. The quality of the coal is good, and reserves are large; but expansion of production for suggested development of an important export market must await solution of difficult problems involving transportation and docking facilities.

Petroleum.—Colombia's 1947 crude-petroleum production record established a new all-time high, surpassing the previous peak of 1940 by 317,445 barrels. The increase of 3,363,926 barrels over 1946 was not a true measure of advance in production potential but rather of production uninterrupted by shut-downs caused by labor difficulties. Fifty-one percent of the 1947 output was from the De Mares concession of the Tropical Oil Co. (Standard Oil of N. J.), 30 percent from the Barco concession of Colombia Petroleum Co. (Texas and Socony-Vacuum Cos.), and 18 percent from the Yondo concession of Cía. El Condor (Shell Oil Co.). The remaining 1 percent was from El Dificíl concession of Cía. La Estrella (Shell Oil Co.), the Terán Guaguaquí freehold of the Texas Co., and the Cantagallo, La Monas, and Floresanto concessions of the Socony-Vacuum Co. Of the two fields discovered in 1943, the Cantagallo was connected into the Andian pipe-line system late in 1947, and work was advanced toward similarly linking in El Dificíl. The Floresanto concession, operating since 1944 with only two producing wells in the Sinú field, has proved disappointing and was surrendered by Socony-Vacuum before the close of 1947. Late in the year the distribution problem was substantially eased by completion of a products pipe line from the Tropical Oil Co. Barranca-Bermeja refinery to Puerto Berrío, a rail terminal connected directly to Bogotá.

ECUADOR

METALS

Unwillingness of the Ecuadoran Government either to modify an operational contract or to negotiate a new and more favorable one led to the closing of the Cotopaxi Exploration Co. operation at Macuchi in August 1946. Since that time, production of metallic minerals in Ecuador has declined steadily, while the search for new deposits on a commercial scale has virtually ceased.

The year 1947 saw the beginning of gradual curtailment of operations that may result in closing of the Portovelo mines of the South American Development Co. Efforts of the company to secure an adjustment of the Government's royalty rate and to draft a new transactional contract were unavailing . It is believed highly possible that by the end of 1948 or 1949 there will be no large mining enterprises operated in Ecuador by foreign capital, which has always accounted for the bulk of metallic production.

In April 1947 the Cotopaxi Exploration Co. rejected an offer by the Ecuadoran Government of a contract for exploration and exploitation of gold-bearing deposits in the Toache River region of Cotopaxi and

[18] Fraser, Thomas, Coal in South America: Pan Amer. Inst. Min. Eng. and Geol., New York, Tech. Paper 6, 1948, pp. 10–12.

Mineral production of Ecuador 1946–47, in metric tons (unless otherwise indicated)

Mineral	1946	1947	Change, percent
ORES AND METALS			
Copper:			
In concentrates [1]	40	172	+330
In blister bars [1]	2,659	----------	−100
Total copper [1]	2,699	172	−94
Lead, in concentrates [1]	308	224	−27
Gold (estimate) troy ounces	75,254	57,250	−24
Silver (estimate) do	192,200	156,931	−18
NONMETALLIC MINERALS			
Cement	38,497	29,808	−23
China clay	46	181	+293
Geyserite [2]	21	----------	−100
Iron oxide [2]	17	5	−71
Salt, marine	35,090	24,940	−29
Sulfur, crude [2]	26	24	−8
HYDROCARBONS			
Petroleum, crude barrels (42 gal.)	2,322,569	2,282,410	−2
Petroleum refinery products do	1,065,024	1,270,987	+19

[1] United States general imports from Ecuador, regarded as more nearly indicative of actual production than Ecuadoran official figures.
[2] Mining ceased in 1947.

Pichincha. The company concluded its operations in Ecuador and left the country. In December part of the abandoned concession was taken up by the Sociedad Aurifera Nacional, an Ecuadoran limited partnership.

The Calera Exploration Co., an associate of the South American Development Co. and the Cotopaxi Exploration Co., attained first commercial production from its Minas Nuevas concession in August 1947. The operation is on a relatively small scale but is located near enough to Portovelo to utilize machinery and installations located there.

NONMETALLIC MINERALS

Cement.—Ecuador's only producing cement plant, operated by La Cemento Nacional, was unable to maintain its production rate of the past 2 years. Its output, supplemented by 7,446 metric tons of cement imported chiefly from the United States, failed to meet the local demand; the shortage resulted in a continued slow-down of construction. In August of 1946 a new affiliate of La Cemento Nacional, known as Canteras Nacionales, C. A., was formed in Guayaquil. Canteras Nacionales has not yet been able to begin production because of the difficulty of obtaining the necessary machinery, which is in short supply in the United States. On April 17, 1947, the Government took steps to ease the shortage by permitting the importation of 60,000 bags of cement from the United States free of custom duties and other fees and taxes.

Gypsum.—To facilitate cement production, a contract was signed by the Government on December 5, 1947, granting La Cemento Nacional and Canteras Nacionales joint exploration and exploitation rights to gypsum deposits in Guayas. The deposits are scattered pockets, and large-scale commercial operations will be difficult, but exploitation was under way before mid-1948.

Sulfur.—In late 1946 the sulfur deposits on the Guayaquil-Quito Railroad near Tixán were nationalized by the Government, and sulfur production was begun in early 1947. Because of high costs of operation and transportation, the operation never reached commercial proportions and was discontinued during the fourth quarter of the year, when the deposits were declared open for concession by private companies.

Other Nonmetallic Minerals.—Salt output from the Government-owned salinas at Punta Arenas and privately owned salinas at Santa Elena was reduced under Government control. China-clay production increased but continued in very minor tonnage. The mining of geyserite and iron oxide was discontinued early in the year.

HYDROCARBONS

Crude-petroleum production declined mildly in 1947 and was confined to that of five companies operating in six fields on the Peninsula of Santa Elena, of which the Ancón field of Anglo-Ecuadoran Oil Fields, Ltd., contributed more than three-fifths of the total. In 1947 the Shell Co. of Ecuador, Ltd., expanded rapidly its exploration operations in its 25,000,000-acre concession in the remote Oriente region east of the Andes. It is believed that any substantial new petroleum deposits found in Ecuador will be in this great jungle area.

The total output of refinery products was made by the La Libertad plant of Anglo-Ecuadoran Oil Felds, Ltd., and the Cautivo plant of Ecuador Oil Fields, Ltd.

FRENCH GUIANA

Little is known specifically of the mineral resources of French Guiana. It is hoped that this deficiency will be partly corrected by discoveries of an exploration expedition composed of photographers, journalists, botanists, and geologists that entered the Tumuc-Humac Mt. region in the fall of 1947 under the leadership of Hassoldt Davis, an American citizen.

Bauxite.—Compagnie Francaise Reynold (COFREY) has been established in French Guiana for the exploration of bauxite deposits. The Reynolds Metals Co. holds 55 percent of the capital stock, and Compagnie des Mines de Bor the remainder.[19]

Gold.—Placer-gold production dropped from 19,749 ounces in 1946 to 14,184 ounces in 1947, the lowest in many years. The gold ranges from 915 to 950 fine and is mostly from the Territory of Inini.

PARAGUAY

METALS

Paraguay has no known ore deposits.

NONMETALLIC MINERALS

Calcite and Quartz.—Discovery of a deposit of crystalline calcite has been claimed on the Puente Sinho concession near the Brazilian border. The deposit lies on the Paraguayan side of the Rio Apa, southwest of Bella Vista, and is the same from which some mica has been mined. The concession is also said to enclose quartz de-

[19] Bureau of Mines, Mineral Trade Notes; Vol. 24, No. 6, June 20, 1947, p. 4.

posits along the Rio Apa, but specific information regarding quantity and grades of both the quartz and the calcite is lacking.

Cement.—Paraguay does not produce cement. In 1945, the latest year for which foreign trade statistics are available, 7,357 metric tons were imported, principally from Uruguay, and in quantities of less than 450 tons each from Argentina, United States, and England. The new Administración de Empresas Fiscales contemplates eventual construction of a Government-owned cement plant at the Itapucumí limestone quarries.

Clay.—Production of clay in 1946 was enough to manufacture at least 23,930,000 bricks valued at about US$290,000 (900,000 guaranies). These official figures may represent considerably less than the actual volume, since brick manufacture is scattered among so many small producers, operating on a home-industry basis, that recorded statistics are unreliable. Production in 1947 was probably at about the 1946 level. Foreign trade figures for 1945 showed exports of 53 tons of kaolin and 12,000 units of refractory brick; no imports.

Lime.—Production of lime at Itapucumí declined from about 9,600 metric tons in 1946 to 2,700 tons in 1947. The limestone area was occupied by insurgent forces during the March-August period of civil war, and the quarries were not operated from May to October; by the end of December lime production is believed to have reached the normal output rate of about 800 tons per month. The Itapucumí kilns, supplemented by small imports from Argentina, supply the lime used by the Paraguayan construction industry.

Mica.—The Puente Sinho concession (see Calcite and Quartz section) yielded some 50 tons of mica in 1947, from which 12½ tons were placed on deposit with the Banco Agrícola del Paraguay as security for financial assistance. The 37½-ton remainder was sold in Brazil at prices said to be very low. Specific information as to grade and quantities potentially available has not been received. This is the first known production of mica in Paraguay, aside from sample shipments made from the same deposit in 1944 and 1945.

Salt.—The recovery of salt by evaporation of water from small wells continued on a home-industry basis at Lambaré, near Asunción. Quantity of production is small but not reported. In 1945 Paraguay imported 14,040 tons from Argentina and 5 tons from England and the United States.

Stone.—Sales of rock from the Tacambú quarry are estimated at US$32,000 (100,000 guaranies) or more annually. The quarry is one of several public-owned properties now operated by the new Administración de Empresas Fiscales (Administration for Public Enterprises) created by the decree law of August 30, 1947. Most of the stone is used locally for building construction and street paving. In 1945, 200 cubic meters of stone blocks and 60 metric tons of crushed rock were exported, as against 27 tons of rough marble imported from Argentina.

HYDROCARBONS

Coal.—Discovery of coal deposits in the Upper Paraná region north of Colonia Hohenau was reported in 1947. No systematic investigation of the deposits has been made.

Petroleum.—Exploration and test drilling by the Union Oil Co. of California continued throughout 1947, virtually unaffected by the

March–August civil war, although supply difficulties were somewhat troublesome. Company operations in the field were entirely within territory controlled for nearly 6 months by the insurgent military forces. The first test well at Santa Rosita, begun July 16, 1946, was abandoned at about 7,600 feet in February 1947 without finding oil. A second test well was begun at La Paz and had reached about 7,000 feet by early 1948 without positive results. On October 15, 1947, the Chaco operations were taken over by Union Oil Paraguay, which was organized as a subsidiary of the Union Oil Co. of California. Late in the year a third geophysical exploration crew began work in the Chaco.

At present Paraguay does not produce petroleum and has no refining facilities. A movement toward nationalization of petroleum distribution services and eventual establishment of a Government-owned petroleum refinery began in August 1947. This change in policy was brought about in part by the failure of private marketing companies to supply motor-fuel requirements during the civil war. Paraguayan imports of petroleum products in 1947 amounted to nearly 95,000 barrels.

PERU

Peru experienced a moderate improvement in 1947 in the mining of its large-tonnage minerals, and consequently in its over-all mineral output position, although labor troubles and scarcity and the lack of important development of new ore reserves held production well below that of the best war years. Nineteen forty-seven brought an upward reversal of the declining trend of the previous year in the production of antimony, lead, vanadium, tungsten, zinc, sulfur, and crude petroleum. The upward trends for bismuth and coal were reversed, and declining trends were unchecked for arsenic, cadmium, copper, gold, molybdenum, silver, aluminum sulfate, cement, limestone, mica, and natural gasoline. The production of mercury ceased before the end of 1946, and the 1947 outputs of most of the nonmetallic minerals have been reported only as estimates. Comparison of production and exports during the past 2 years is presented in the accompanying table.

METALS

Antimony.—All of the increase in antimony production in 1947 was in the form of metal in ores and concentrates. Recovery in metallic forms by the Oroya smelter of the Cerro de Pasco Copper Corp. received much less attention than in 1946, with only 199 tons in crude antimony bars, less than one-half ton in refined bars, 50 tons in lead-antimony bars, and 33 tons in lead-tin-antimony bullion. Production by small, scattered mines was expected to increase further in 1948, in response to favorable prices.

Byproduct Metals.—In the recovery of byproducts from base-metal ores and concentrates, activity at the Oroya plant of the Cerro de Pasco Copper Corp. apparently was concentrated on indium and tin. The recovery of white arsenic, bismuth, and cadmium was considerably less than in 1946 although the base-metal ores from which they are customarily derived were produced in greater quantity. Tellurium recovery, initiated in 1943, has not been reported since that year.

Copper.—The decrease in copper output resulted in part from a congressional enactment in February 1947 that greatly increased the

Mineral production and exports of Peru, 1946–47, in metric tons (unless otherwise indicated)

Mineral	Production			Exports		
	1946	1947	Change, percent	1946	1947	Change, percent
ORES AND METALS						
Antimony	1,213	1,283	+6	1,096	1,046	−5
Arsenic oxide (white arsenic)	753	608	−19	2,891	448	−85
Bismuth ... kilograms	311,443	236,837	−24	321,697	219,034	−32
Cadmium, in refined bars ... do	1,388	1,255	−10	2,462	1,407	−43
Copper	24,700	22,418	−9	26,119	25,833	−1
Gold ... troy ounces	158,378	116,016	−27	140,480	199,228	+42
Indium ... grams	155,692	304,955	+96	155,692	304,955	+96
Lead	44,518	45,814	+3	44,018	39,018	−11
Mercury ... 76-pound flasks	5	----------	−100	5	----------	−100
Molybdenum	4	3	−25	3	4	+33
Silver ... troy ounces	12,334,086	10,782,909	−13	[1] 10,211,750	9,413,178	−8
Tin, in dross	31	51	+65	2	51	(2)
Tungsten concentrates, 60 percent WO_3 equivalent	510	579	+14	748	346	−54
Vanadium	324	434	+34	333	391	+17
Zinc	59,736	55,418	−7	59,242	59,750	+1
NONMETALLIC MINERALS						
Aluminum sulfate	99	59	−40	99	59	−40
Barite	(3)	[4] 7,000	(3)	----------	----------	----------
Cement	260,617	255,644	−2	(3)	(3)	(3)
Clay	57,264	(3)	(3)	300	(3)	(3)
Gypsum:						
Crude	49,582	[4] 50,000	(3)	----------	----------	----------
Calcined	26,035	[4] 27,000	(3)	(3)	(3)	(3)
Lime	15,450	(3)	(3)	(3)	(3)	(3)
Limestone	471,083	[4] 450,000	−4	----------	----------	----------
Magnesium sulfate	428	405	−5	434	425	−2
Manganese sulfate	12	----------	−100	44	----------	−100
Marble, architectural	(3)	[4] 10,000	(3)	1,174	185	−84
Mica:						
Trimmed	20	----------	−100	14	2	−86
Scrap	187	----------	−100	156	----------	−100
Total mica	207	----------	−100	170	2	−99
Mineral water ... gallons	1,667,588	2,382,636	+43	----------	----------	----------
Onyx, ornamental	(3)	[4] 850	(3)	212	63	−70
Salt	56,615	60,108	+6	----------	----------	----------
Sand, gravel, and crushed stone	(3)	[4] 200,000	(3)	----------	----------	----------
Silica, glass-grade	(3)	[4] 4,000	(3)	----------	----------	----------
Sulfur	369	791	+114	375	295	−21
HYDROCARBONS						
Coal:						
Anthracite	82,089	[4] 80,000	−3	60,245	49,431	−18
Bituminous	147,561	[4] 140,000	−5	----------	----------	----------
Total coal	229,650	[4] 220,000	−4	60,245	49,431	−18
Natural gasoline ... barrels (42-gal.)	1,037,284	999,011	−4	(3)	(3)	(3)
Petroleum, crude ... do	12,468,126	12,763,808	+2	1,648,066	1,968,279	+19
Petroleum refinery products ... do	10,962,948	10,652,072	−3	6,595,754	5,061,125	−23

[1] Exclusive of 273,281 ounces of silver art objects.
[2] Over 500 percent.
[3] Not reported.
[4] Approximate.

export tax on copper. The new tax largely canceled any benefits which copper producers hoped to receive from higher prices and tended further to discourage development of new ore bodies. Less copper ore was mined than in 1946 at Cerro de Pasco, Morococha, Huaron, and Puquiococha, while similar operations were maintained at a fairly even level at Casapalca and Quiruvilca. A break-down of production shows 17,430 tons in blister bars, 320 tons in electrolytic bars, 378 tons in matte, 1 ton in gold bullion, and 4,289 tons unextracted from ores and concentrates.

Some exploratory work was undertaken by the American Smelting & Refining Co. at its extensive low-grade deposit at Quellaveco in southern Peru, near the undeveloped Cuajone and Toquepala deposits. The production position of the country is expected to be improved considerably when the new copper-gold-silver mine of the Cerro de Pasco Copper Corp. at Yuaricocha begins production in 1948. Construction of a 50-mile railway and 9-mile aerial tramway for transporting ore from this mine to Oroya has been in progress for more than 5 years. The electrolytic-copper refining plant which the corporation has been constructing at Oroya for the last 2 years was expected to be in operation near the end of 1948.

Gold.—In March 1947 a decree was issued that granted virtually complete freedom of foreign sales and exportation of gold bullion. This decree had the effect of relieving producers of gold bars from their previous obligations of converting foreign money received from the sale of exports into Peruvian currency at the official rate of exchange; it also permitted exchange at the free rate. This enabled sellers of gold bullion (but not gold contained in other bullion or in ores or concentrates) to get about 16.00 soles instead of the former 6.50 soles per dollar for their gold. The decree considerably encouraged new development work for mining straight-gold ores and placer gold, but a notable improvement in actual production probably will not become apparent before 1949. Currently, about 65 percent of the country's gold production comes from quartz-gold mines, about 7 percent from placer operation, and about 28 percent as byproduct from base-metal mines.

Iron and Steel.—The Corporación Peruana del Santa continued studies of steel-smelting methods and is going ahead actively to establish at Chimbote a number of electric smelting furnaces and steel-making units, the capacity of which is planned to exceed 100,000 tons of steel products per year. Meanwhile, the corporación engaged in the development of the San Juan Bay area some 330 miles south of Lima, where port works and a system of highways are being constructed to permit exploiting iron-ore deposits at Marcona, about 15 miles inland. The deposit is to be the source of iron ore for the proposed steel furnaces at Chimbote.

Lead.—The high price of lead upheld 1947 production slightly above the 1946 level. An effective result of the lead price, combined with diminishing grade of copper ores, has been the mid-1946 shift in emphasis of operations at the Cerro de Pasco mine from low-grade copper to lead-zinc mining and milling; Cerro de Pasco was the only major mine that showed an actual increase in lead ore output. Of the total country production, 12,323 tons remained in ore and concentrates, 32,809 tons were refined as lead bars, and 682 tons were in bars with other metals. The United States received less than 25 percent of the lead exported from Peru.

Molybdenum.—There was no change in the inconsequential molybdenum output from the Caujul deposit, about 50 miles north of Lima.

Silver.—Distribution of the 1947 production of silver, compared parenthetically with 1946, shows 3,227,388 (3,850,598) ounces in untreated base-metal ores and concentrates and base bullion, none

(27,232 ounces) in gold-silver bars from the gold lode mines and—from the Oroya plant of the Cerro de Pasco Copper Corp.—302,217 (687,319) ounces in 0.999 fine refined bars, 2,114,426 (1,850,211) ounces in 0.925 fine sterling bars, and 5,138,878 (5,918,726) ounces in copper bars. The decrease reflects the declining silver content, at greater depth, of the copper, lead, and zinc ores from which most of the silver is derived.

Tungsten.—Tungsten production did not recover from the effects of a severe earthquake in November 1946, until nearly mid-1947, when operations resumed a normal rate. Malaga Santolalla i Hijos, the largest operator in the country, began construction of a new concentrating mill of 150-ton-per-day capacity in August 1947 at its mine in north-central Peru and expected to increase Peru's production of tungsten substantially in 1948. Operations of other small mines throughout the country were renewed or expanded.

Vanadium.—The Vanadium Corp. of America made a number of changes in the large lixiviation plant purchased from the Defense Plant Corporation in 1946, and the plant is now functioning more satisfactorily; but the relatively small percentage of vanadium recovered from low-grade Minasragra ores leaves much improvement to be desired. However, the 34-percent increase brought Peruvian production to a level that the corporation hopes to maintain for at least a few years.

Zinc.—Although lead and zinc occur together in Peru, the production of zinc showed a much better increase than that of lead owing largely to increased output at the Volcan and Atacocha mines, where zinc predominates over lead in the ores. A large part of the zinc concentrates are exported, except for enough to feed the Cerro de Pasco Copper Corp.'s plant at Oroya, which produced 1,331 tons of refined electrolytic bars in 1946 and 1,114 tons in 1947. The concentrates produced at the Cerro de Pasco flotation plant were stock-piled because they were subgrade for profitable export and because there is no plant in Peru for refining zinc on a regular commercial scale. The corporation plans for establishing an electrolytic zinc plant must await the development of more hydroelectric power to insure year-round operation.

The Corporación Peruana del Santa continued to visualize construction of a 100-ton-per-day electrolytic plant at the port of Chimbote. Preliminary technical studies and negotiations have been made during the past 3 years, but definite financial and organizational plans have not yet taken shape.

NONMETALLIC MINERALS

For the most part Peru's 1947 production of nonmetallic minerals has been estimated at virtually the same level of operation as in 1946. The decline in cement output resulted from a 22-day strike in June at the Lima plant of Cía. Peruana de Cemento Portland El Sol, Peru's only producer. Information relative to activities in other nonmetallic industries is limited to figures presented in the production-export table.

HYDROCARBONS

Coal.—Production of bituminous coal is believed to have proceeded normally during 1947, with the Cerro de Pasco Copper Corp. the outstanding producer from its Goyllarisquisga mine for consumption by the Cerro de Pasco railroad and the Oroya smelter. Production of anthracite from mines in the Ancos district was handicapped by the small capacity of the railway that transports the coal to the port of Chimbote until late in the year, when arrival of new locomotives and cars purchased in the United States raised the daily haulage capacity to more than 1,200 tons of coal. By the end of the year the Banco Minera was ready to submit to the Export-Import Bank a plan involving foreign financial backing for increasing production of the Chimbote-Ancos region from its present 100,000 tons to 600,000 tons of anthracite per year. The cost of the development was estimated at about US$6,000,000. Coal output in 1948 should considerably exceed that of 1947.

Petroleum.—Improved availability of machinery and materials permitted a 17-percent increase in drilling volume in 1947 and helped to arrest a 4-year decline in production. The production rate at the end of the year indicated a substantial increase for 1948. Efforts to open new areas on the Ucayali River about 125 miles north of Aguacaliente and the Pirin area northwest of Lake Titicaca were unsuccessful in 1947. Exploration in 1948 was expected to be concentrated in areas east of the Andes and the coastal area, including the Sechura Desert, just south of the fields currently producing. The producing companies, in the order of relative importance, are the International Petroleum Co., Cía. Petrolera Lobitos, Establicimientos Petroleros Fiscales, and Cía. de Petroleo Ganso Azul. About half of the crude produced is refined in Peru, chiefly at Tallara by the International Petroleum Co.

In 1947, 13,553 barrels of petroleum products were exported to Brazilian Amazon ports and 5,047,572 barrels to South and Central American west-coast ports.

SURINAM [20]

Bauxite.—Bauxite output in 1947 was the highest in the history of Surinam mining. The Surinam Bauxite Co. produced 764,601 metric tons from its Paranam mine and 656,270 from its Moengo mine, while the Billiton Co. (N. V. Billiton Maatschappij) mined 377,717 tons, giving a total production for the Colony of 1,798,588 tons (570,639 tons in 1946). Some tonnage was shipped from stocks; and total exports for the year amounted to 1,809,837 metric tons, compared with 857,843 tons in 1946—an increase of 111 percent. The new calcining kiln at the Paranam plant of the Surinam Bauxite Co. was put into operation early in 1947, and the company announced its intention to increase its 1948 shipments by 15 percent. The Billiton Co. intended to increase its shipments to 500,000 tons; and if both plans are realized, 1948 exports should exceed 2,250,000 metric tons. Progress in exploration by the Permanente Metals Corp. and the Reynolds Metals Co. has not been reported.

Gold.—Gold production dropped from 4,648 troy ounces in 1946 to 4,134 ounces in 1947, continuing the decline that started in 1941. At the reopened Savannah mine 544 ounces were ground from gold-quartz ore in the new ball mill; the remainder came from placer workings of Sara Creek Gold Fields, Ltd., Whitewater Mines, Ltd., and

[20] Netherlands Guiana.

private individuals. Mechanized operations by Sara Creek Gold Fields, Ltd., on the Lawa River, were replaced by leasers working entirely by hand.

Granite.—The Department of Public Works produced 13,328 metric tons of granite from its quarry at Fedra for construction and repair of streets at Paramaribo, 45 miles to the north.

URUGUAY

METALS

Discovery of a purported deposit of mercury at the village of Veragara, Treinta y Tres, had not been confirmed by announcement of results of sampling by the end of the year. A new company announced that it would start operation, in the near future, of a copper mine near Pan de Azucar in Maldonado. Metalurgica y Diques Flotantes, S. A., mined 200 tons of iron ore to mix with scrap in its local iron and steel plant. Uruguay has supported no other mining enterprises since 1941, when gold was last produced on a commercial scale.

NONMETALLIC MINERALS

Production of industrial stone responded to the slowdown in the construction industry caused partly by labor difficulties and partly by a shortage of portland cement, which, though increased in output,

Mineral production of Uruguay, 1946–47, in metric tons (unless otherwise indicated)

Mineral	1946	1947	Change, percent
ORE			
Iron ore	(1)	200	(1)
NONMETALLIC MINERALS			
Agate, rough (exports)	[2] 40		−100
Abrasives, aluminous	623	1,671	+168
Cement	[2] 220,000	279,353	+27
Clay:			
Common	[2] 600,000	(1)	(1)
Refractory	2,298	12,000	+422
Feldspar	513	843	+64
Gravel	407,241	593,767	+46
Mica, ground	6	14	+133
Quartz, ground	2,015	2,728	+35
Sand [3]	2,007,558	2,767,009	+38
Semiprecious stones [4] (exports) kilograms	[2] 5	(1)	(1)
Stone, industrial:			
Ballast	278,286	133,398	−52
Flagstone square meters	302		−100
Granite:			
Rough	83,817	53,704	−36
Cut	22,620	3,994	−82
Curbstones linear meters	5,092	4,496	−12
Paving blocks units	30,240	3,000	−90
Limestone	449,063	528,920	+18
Marble	1,833	1,117	−39
Marl	500	80	−84
Talc, crude	1,818	2,675	+47
HYDROCARBONS			
Petroleum refinery products barrels (42 gal.)	2,385,475	2,959,873	+24

[1] Not reported.
[2] Estimate.
[3] Includes granite sand: 1946—31,150 tons; 1947—21,441 tons.
[4] Cut agate, amethyst, aquamarine, and topaz.

continued to be exported to Paraguay and Brazil. A proposal to build a new 5-million-peso cement plant at Paysandu was under study by Uruguay's Ministry of the Interior. Output of other industrial minerals increased in response to ready market demands both locally and in Argentina. Salmar, a million-peso corporation, announced satisfactory progress in developing its project to process marine waters for extracting sodium chloride, sodium bromide, magnesium chloride, magnesium sulfate, and potassium chloride at its plant in Rocha.

HYDROCARBONS

The Administracion Nacional de Combustibles, Alcohol y Portland (ANCAP) operates at Montevideo, Uruguay's only oil refinery, treating imported crude petroleum. Uruguay produces no crude petroleum or coal.

VENEZUELA

METALS

Gold.—Operations of Guayana Mines, Ltd., were confined largely to development work in the mines of the Guasipati district, Bolivar, which were optioned from New Goldfields of Venezeula, Ltd., in 1946. With only the Vuela Caras mine and Caroni River district placers actively producing during most of the year, the output of gold in 1947 was less than half that of 1946. The outlook for 1948 was much brighter, with production for the first 3 months more than twice the amount mined in the equivalent period of 1947.

Iron.—The Iron Mines Co. of Venezuela (Bethlehem Steel Co.) continued work in the El Pao-San Felix area in preparation for the exploitation of its iron-ore deposits. In April 1948 the company predicted that exportation of ore would begin in late 1949.

In 1947 the Oliver Mining Co. (United States Steel Corp.) acquired five additional concessions totaling 25,000 hectares in the Imataca region. Extensive exploration of these and previously acquired concessions occupied a party of technicians during 1947 and throughout the first half of 1948.

Mineral production of Venezuela, 1946–47, in metric tons (unless otherwise indicated)

Mineral	1946	1947	Change, percent
METAL			
Gold ... troy ounces	36,904	16,659	−55
NONMETALLIC MINERALS			
Asbestos	65	240	+269
Cement	128,329	145,881	+14
Diamonds ... carats	20,912	61,634	+195
Magnesite, crude	2,750	2,980	+8
Salt, marine	90,555	35,794	−60
HYDROCARBONS			
Coal	[1] 3,621	[2] 15,069	[3]
Petroleum, crude ... barrels (42 gal.)	388,486,224	434,885,182	+12
Petroleum refinery products ... do	34,998,158	36,657,163	+5

[1] Incomplete.
[2] Estimate.
[3] Not reported.

The Corporacion Venezolana de Fomento began studies aimed toward establishing a national iron-ore reducing plant and is investigating the possibility of utilizing natural gas for fuel.

NONMETALLIC MINERALS

Asbestos.—Cía. Anónima Minas de Amiante de Tinaquillo overcame the initial difficulties experienced in starting its asbestos mill west of Tinaquillo and reached a fairly uniform production rate of slightly more than 20 tons a month by the end of 1947.

Cement.—The 1947 increase in cement production took place during the latter half of the year, when two new plants were opened—one at La Blanca, near San Cristobal, by Cía. Anónima Cementos del Táchira, an affiliate of C. A. Fabrica Nacional de Cementos of Caracas, on September 4, and one at Maracaibo by C. A. Venezolana de Cementos of Caracas, also in September. Plans for additional plants and enlargement of existing facilities are gaged to bring Venezuela's cement production by the end of 1949 to 461,000 tons annually, enough to satisfy estimated local requirements. To ease the chronic shortage of the past several years, importation of cement into Venezuela duty-free has been in effect since December 7, 1942, with periodic extensions.

Diamonds.—Of the 1947 diamond output of the State of Bolivar, 52,153 carats were washed from the Gran Sabana area of the Upper Caroni Basin and 9,481 from the Lower Caroni Basin and other areas. The major part of the production came from the Rio Ikabaro, a tributary of Upper Caroni. A clew to the enormous percentage increase over 1946 to all-time peak production in 1947 lies in a report from Brazil to the effect that many miners were believed to have deserted certain Brazilian diamond placers to go into Venezuela, where the fields are more easily productive and the diamonds bring a better price. This may conceivably mark the beginning of a gradual shift in relative importance of the two countries as diamond producers, particularly if the Venezuelan industry becomes organized. The Venezuelan fields were described in 1948.[21]

Magnesite.—La Industria Nueva Esparta, C. A., held its production of magnesite on Margarita Island at slightly above the 1946 level but considerably less than the 1945 output of 5,600 tons. The Margarita deposits completed their fifth year of production, following 23 years of inactivity. The rock is calcined and enters manufacture within Venezuela.

Other Nonmetallic Minerals.—The 60-percent drop in salt recovery has not been explained but may have resulted from overproduction in 1946, the all-time peak year. Assurance of increased production of clay and clay products is seen in the scheduled construction of three new plants at Baruta, Barquisimeto, and Tiquireflores, with combined annual capacity for making about 4,500,000 brick, 1,500,000 block tiles, and 780,000 roofing tiles. Quantitative production of clay, limestone, lime, gypsum, sand, and gravel has not been reported. On May 21, 1948, the Government closed the State of Falcon to exploration and exploitation of phosphate, to assure national control of any possible development activities in connection with several million

[21] Davey, John C., the Diamond Fields of Venezuela: Eng. and Min. Jour., Vol. 149, No. 4, April 1948, pp. 74-78.

tons of commercial-grade phosphate rock discovered a few years ago at Cerro Riecito, District of Acosta.

HYDROCARBONS

Coal.—The Government-owned Naricual mine in the State of Anzoátegui and privately owned mines in the Coro district, State of Falcon, were closed throughout 1947. Total coal production was from private mines in the vicinity of Lobatera, State of Táchira. Output from that area does not appear in official Venezuelan statistics; consequently, estimated total production in 1947 is not comparable with officially reported but incomplete totals for previous years.

Petroleum.—Crude-petroleum production soared to a new peak in 1947, establishing for the fourth consecutive year an all-time record. The Western district produced 304,551,185 barrels from the States of Zulia and Falcon (Maracaibo Basin), the Central district 63,390 barrels from the State of Guarico, and the Eastern district 130,270,607 barrels from the States of Anzoátegui and Monagas and the Territory of Delta Amacuro. As usual, the bulk of the output was supplied by the three largest producers: Creole Petroleum Corp. (Standard Oil of New Jersey), Mene Grand Oil Co. (Gulf Oil Corp.), and the Shell Oil Co. (through its subsidiaries Caribbean Oil Co., Venezuela Oil Concessions Ltd., and Colon Development Co., Ltd.). About 5 percent of the total was the product of nine other companies. Of 787 holes drilled during the year, 689 produced oil and 9 natural gas. It became evident that production in 1948 will increase substantially over that of 1947; some of the wells of the newly expanded Mara and La Paz fields west of Lake Maracaibo are comparing favorably with Middle East wells in productivity.

The Shell group completed another 12-inch pipe line from the Mara field to Palmarejo, and Socony-Vacuum Oil Co. completed a 103-mile, 12-inch line from the Oficina field to Guanta. Under construction were a 144-mile, 24- to 26-inch line by Creole Petroleum Corp. from the Lagunillas field to the Amuay Bay refinery area on the Paraguaná Peninsula, and a 157-mile, 16-inch line by S. A. Petrolera Las Mercedes from Las Mercedes field to Guanta.

In 1947, 10 refineries treated 36,804,595 barrels of crude, compared with 35,160,905 barrels treated by 8 plants in 1946. At the end of the year three new refineries were under construction and one in the planning stage, exclusive of reported plans by the Venezuelan Government for a 20,000-barrel refinery to supply deliveries of refined products to Argentina.

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By MABEL E. WINSLOW

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