Minerals yearbook: Area reports 1958. Year 1958, Volume III 1959

Bureau of Mines
Washington, D. C.: Bureau of Mines : United States Government Printing Office, 1959

MINERALS YEARBOOK

1958

Volume III of Three Volumes

AREA REPORTS

Prepared by the field staff of the
BUREAU OF MINES
REGIONAL DIVISIONS OF MINERAL INDUSTRIES

UNITED STATES DEPARTMENT OF THE INTERIOR

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UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1959

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington 25, D.C. - Price $3.75 (Buckram).

FOREWORD

MINERALS YEARBOOK, 1958, published in three volumes provides a record of performance of the Nation's minerals industry during the year, with enough background information to interpret the year's developments.

Volume I includes chapters on metal and nonmetal mineral commodities, with the exception of the mineral fuels. Included also are a chapter reviewing these mineral industries, a statistical summary, and chapters on mining technology, metallurgical technology, and employment and injuries.

Volume II includes chapters on each mineral fuel, an employment and injuries presentation, and a mineral-fuels review chapter that summarizes developments in the fuel industries and incorporates all data previously published in the Statistical Summary chapter. Also now included in this review chapter are data on energy production and uses that have previously been included in the Bituminous Coal chapter.

Volume III is comprised of chapters covering the 50 States plus chapters on island possessions in the Pacific Ocean, and the Commonwealth of Puerto Rico and island possessions in the Caribbean Sea, including the Canal Zone. Volume III also has a Statistical Summary chapter, identical with that in Volume I, and another presenting employment and injury data.

The data in the Minerals Yearbook are based largely upon information supplied by mineral producers, processors, and users, and acknowledgment is made of this indispensable cooperation given by industry. Information obtained from individuals by means of confidential surveys has been grouped to provide statistical aggregates. Data on individual producers are presented only if available from published or other nonconfidential sources, or when permission of the individuals concerned has been granted.

MARLING J. ARKENY, *Director.*

ACKNOWLEDGMENTS

In preparing this volume of the MINERALS YEARBOOK, the Bureau of Mines was assisted in collecting statistical data and mineral-industry information by State agencies, through cooperative agreements. Many State chapters were reviewed by staff members of these agencies, and in some instances the staff members collaborated in preparing the chapters and are shown as coauthors. For this assistance acknowledgment is made to the following cooperating organizations:

Alabama: Geological Survey of Alabama.
Alaska: Alaska Department of Mines.
Arkansas: Geological and Conservation Commission.
California: Division of Mines.
Delaware: Delaware Geological Survey.
Florida: Florida Geological Survey.
Georgia: Geological Survey of Georgia.
Idaho: Bureau of Mines and Geology.
Illinois: State Geological Survey.
Indiana: Indiana Department of Conservation.
Iowa: Iowa Geological Survey.
Kansas: State Geological Survey of Kansas.
Kentucky: Kentucky Geological Survey.
Louisiana: Louisiana Geological Survey.
Maine: Geological Survey of Maine.
Maryland: Department of Geology, Mines, and Water Resources.
Michigan: Michigan Department of Conservation.
Mississippi: Mississippi Geological Survey.
Missouri: Division of Geological Survey and Water Resources.
Montana: Montana Bureau of Mines and Geology.
Nevada: Nevada Bureau of Mines.
New Hampshire: New Hampshire State Planning and Development Commission.
New Jersey: Bureau of Geology and Topography.
New York: New York State Science Service.
North Carolina: Geological Survey of North Carolina.
North Dakota: North Dakota Geological Survey.
Oklahoma: Oklahoma Geological Survey.
Oregon: State Department of Geology and Mineral Industries.
Pennsylvania: Bureau of Topographic and Geological Survey.
Puerto Rico: Mineralogy and Geology Section, Economic Development Administration.
South Carolina: Geological Survey of South Carolina.
South Dakota: State Geological Survey.
Tennessee: Tennessee Division of Geology.
Texas: Bureau of Economic Geology, The University of Texas.
Utah: Utah Geological and Mineralogical Survey.
Virginia: Division of Mineral Resources.
Washington: Division of Mines and Geology.
West Virginia: West Virginia Geological and Economic Survey.
Wisconsin: Wisconsin Geological Survey.
Wyoming: Geological Survey of Wyoming.

Except for the two review chapters, this volume was prepared by the field staffs of the five Divisions of Mineral Industries. The following supervised preparation of the chapters: Albert J. Kauffman,

Jr., chief, Division of Mineral Industries, Region I, Albany, Oreg.; Alvin Kaufman, chief, Field Office, Region I, Juneau, Alaska; W. F. Dietrich, chief, Division of Mineral Resources, Region II, San Francisco, Calif.; Alfred L. Ransome, chief, Division of Mineral Industries, Region III, Denver, Colo.; Robert S. Sanford, chief, Division of Mineral Industries, Region IV, Bartlesville, Okla.; Robert D. Thomson, acting chief, Division of Mineral Industries, Region V, Pittsburgh, Pa.; Samuel A. Gustavson, chief, Field Office, Region V, Minneapolis, Minn.; and Avery H. Reed, Jr., chief, Field Office, Region V, Knoxville, Tenn. Preparation of this volume was supervised and the chapters coordinated with those in volumes I and II by Paul Yopes, assistant to the chief, Division of Minerals.

Statisticians and researchers in the Division of Mineral Industries who gave substantial assistance to the authors of the chapters were: In Region I, Clara M. Hutcheson; in Region III, Stella K. Drake and Mary Jelliffe; in Region IV, Geraldine M. Wright, and Darwina V. Goodchief; in Region V, Dorothy O. Stearns, Roy H. Davis, Eunice M. Garner, Ruth C. Melby, Richard J. Bishop, and Wanda J. Peterson.

The manuscripts upon which this volume is based have been reviewed to insure statistical consistency among the tables, figures, and text, between this volume and volumes I and II and between this volume and those for former years, by a staff under the direct supervision of Kathleen J. D'Amico, assisted by Julia Muscal, Hope R. Anderson, Helen L. Gealy, Helen E. Tice, Dorothy C. Allen, Anita C. Going, and Joseph Spann.

Minerals Yearbook compilations are based largely on data provided by the mineral industries. Acknowledgment is made of the willing contribution both by companies and individuals of these essential data.

CHARLES W. MERRILL,
Chief, Division of Minerals.

CONTENTS

Statistical Summary of Mineral Production

By Kathleen J. D'Amico [1]

THIS SUMMARY is identical to that in volume I of this series on mineral production in the United States (including Alaska and Hawaii), its island possessions, the Canal Zone, and the Commonwealth of Puerto Rico and on the principal minerals imported into and exported from the United States. For further details on production see the several commodity and area chapters. A summary table comparing world and U.S. mineral production also is included.

Mineral production may be measured at any of several stages of extraction and processing. The stage of measurement used in the chapter is normally what is termed "mine output." It usually refers to minerals in the form in which they are first extracted from the ground but customarily includes, for some minerals, the product of auxiliary processing operations at or near mines.

Because of inadequacies in the statistics available, some series deviate from the foregoing definition. The quantities of gold, silver, copper, lead, zinc, and tin are recorded on a mine basis—that is, as the recoverable content of ore sold or treated; the values assigned to these quantities, however, are based on the average selling price of refined metal, not the mine value. Mercury is measured in the form of recovered metal and valued at the average New York price for metal.

Data for clays and limestone, 1955–58, include output used in making cement and lime. Mineral-production totals have been adjusted to eliminate duplicating these values.

The weight or volume units shown are those customary in the particular industries producing the respective commodities. No adjustment has been made in the dollar values for changes in the purchasing power of the dollar.

[1] Publications editor.

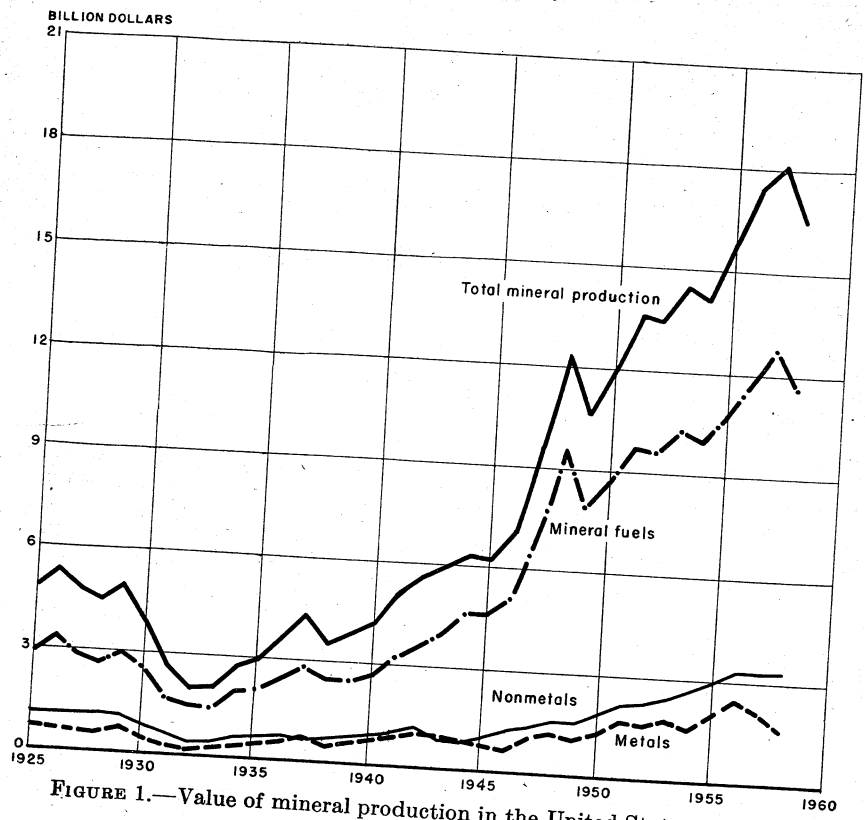

FIGURE 1.—Value of mineral production in the United States, 1925–58.

TABLE 1.—Value of mineral production in continental United States, 1925–58, by mineral groups [1]

(Millions)

Year	Mineral fuels	Nonmetals (except fuels)	Metals	Total
1925	$2,910	$1,187	$715	$4,812
1926	3,371	1,219	721	5,311
1927	2,875	1,201	622	4,698
1928	2,666	1,163	655	4,484
1929	2,940	1,166	802	4,908
1930	2,500	973	507	3,980
1931	1,620	671	287	2,578
1932	1,460	412	128	2,000
1933	1,413	432	205	2,050
1934	1,947	520	277	2,744
1935	2,013	564	365	2,942
1936	2,405	685	516	3,606
1937	2,798	711	756	4,265
1938	2,436	622	460	3,518
1939	2,423	754	631	3,808
1940	2,662	784	752	4,198
1941	3,228	989	890	5,107
1942	$3,568	$1,056	$999	$5,623
1943	4,028	916	987	5,931
1944	4,574	836	900	6,310
1945	4,569	888	774	6,231
1946	5,090	1,243	729	7,062
1947	7,188	1,338	1,084	9,610
1948	9,502	1,552	1,219	12,273
1949	7,920	1,559	1,101	10,580
1950	8,689	1,822	1,351	11,862
1951	9,779	2,079	1,671	13,529
1952	9,616	2,163	1,617	13,396
1953 [2]	10,257	2,350	1,811	14,418
1954 [2]	9,919	[3] 2,630	1,518	14,067
1955 [2]	10,780	[3 4] 2,957	2,055	[4] 15,792
1956 [2]	11,741	[3 4] 3,266	[4] 2,137	[4] 17,365
1957 [2]	[4] 12,709	[3 4] 3,267	[3] 3,341	[4] 18,113
1958 [2]	11,588	[3] 3,341	1,597	16,526

[1] Data for 1925–46 are not strictly comparable with those for subsequent years, since for the earlier years the value of heavy clay products has not been replaced by the value of raw clays used for such products.
[2] Includes Alaska and Hawaii.
[3] The total has been adjusted to eliminate duplicating the value of clays and stone.
[4] Revised figure.

TABLE 2.—Mineral production [1] in the United States [2]

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
MINERAL FUELS								
Asphalt and related bitumens (native):								
Bituminous limestone and sandstone	1,427,207	$4,111	1,458,533	$4,114	1,168,507	$3,221	1,326,493	$3,343
Gilsonite	82,822	3,117	89,003	3,822	[3] 207,704	4,259	317,280	4,864
Carbon dioxide, natural (estimated)—thousand cubic feet	702,417	234	713,930	235	794,276	139	722,615	102
Coal:								
Bituminous and lignite [4]—thousand short tons	464,633	2,092,383	500,874	2,412,004	492,704	2,504,406	410,446	1,996,281
Pennsylvania anthracite—do	26,205	206,097	28,900	236,785	25,338	227,754	21,171	187,898
Helium—thousand cubic feet	235,868	3,881	266,937	4,413	310,365	5,112	352,134	5,741
Natural gas—million cubic feet	9,405,351	978,357	10,081,923	1,083,812	10,680,258	1,201,759	[5] 11,030,298	[5] 1,317,492
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	5,844,904	423,775	5,807,100	431,958	5,734,307	415,791	5,596,458	393,139
LP-gases—do	5,972,698	195,231	6,487,413	265,185	6,655,282	263,665	6,783,000	296,571
Peat	273,669	2,283	272,972	2,320	316,217	3,458	327,813	3,446
Petroleum (crude)—thousand 42-gallon barrels	2,484,428	6,870,380	2,617,283	7,296,760	2,616,901	8,079,259	[5] 2,448,886	[5] 7,379,071
Total mineral fuels		10,780,000		11,741,000		[3] 12,709,000		11,588,000
NONMETALS (EXCEPT FUELS)								
Abrasive stone [6]	(6)	330	(6)	363	(6)	331	(6)	[7] 182
Asbestos	44,568	4,487	41,312	4,742	43,653	4,917	43,979	5,127
Barite	1,108,103	10,809	1,299,888	13,498	[3] 1,145,791	[3] 12,897	605,402	7,510
Boron minerals	[3] 522,466	[3] 30,739	[3] 546,815	[3] 32,848	[3] 541,124	[3] 38,041	528,209	38,310
Bromine—thousand pounds	184,454	39,856	196,730	47,434	191,971	48,038	176,397	46,689
Cement—thousand 376-pound barrels	306,128	884,381	321,395	989,233	229,189	961,499	317,263	1,038,672
Clays—thousand short tons	48,106	139,540	50,775	163,048	[3] 45,620	[3] 155,805	43,750	143,487
Emery	10,735	151	12,153	174	11,893	184	7,687	126
Epsom salts from epsomite	100	5	(8)	(8)	(8)	(8)		
Feldspar—long tons	[3] 550,861	[3] 4,528	[3] 560,074	[3] 5,829	[3] 498,057	[3] 4,935	469,738	4,278
Fluorspar	279,540	12,590	329,719	14,257	328,872	15,777	319,513	15,071
Garnet (abrasive)	11,835	1,191	9,812	1,073	9,776	1,080	10,035	860
Gem stones (estimated)	(9)	818	(9)	925	(9)	882	(9)	1,006
Gypsum—thousand short tons	10,684	33,938	10,316	34,099	9,195	29,871	9,600	32,495
Lime—do	10,470	126,890	10,567	135,532	10,266	135,143	9,203	118,026
Magnesite	486,088	2,713	686,569	2,502	678,489	3,258	492,982	2,409
Magnesium compounds from sea water and brines (except for metals)—MgO equivalent	155,779	12,704	169,019	13,668	[3] 184,236	[3] 15,997	207,053	16,419
Marl:								
Calcareous (except for cement)	183,044	128	285,653	215	(10)	(10)	(10)	(10)
Greensand	5,704	218	(8)	(8)	(8)	(8)	(8)	(8)

See footnotes at end of table.

TABLE 2.—Mineral production [1] in the United States [2]—Continued

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
NONMETALS (EXCEPT FUELS)—continued								
Mica:								
Scrap	95,432	$2,058	86,309	$1,850	92,438	$2,109	93,347	$2,065
Sheet—pounds	642,113	3,370	887,871	2,757	690,052	2,492	655,045	2,802
Perlite	286,157	2,282	310,800	2,550	301,605	2,562	291,994	2,463
Phosphate rock—thousand long tons	12,265	75,379	15,747	97,922	13,976	87,689	14,879	93,693
Potassium salts—thousand short tons, K_2O equivalent	2,067	78,602	2,172	82,107	2,266	84,612	2,147	75,000
Pumice—thousand short tons	1,804	3,369	1,482	4,749	1,827	4,628	1,973	5,287
Pyrites—thousand long tons	1,007	8,391	1,070	9,743	1,067	9,087	974	7,987
Salt (common)—thousand short tons	22,693	123,276	24,206	136,139	23,844	[3] 148,887	[11] 21,911	[11] 141,486
Sand and gravel—do	591,683	535,510	631,495	602,412	[3] 632,256	[3] 599,751	[11] 683,684	[11] 651,635
Slate	760	12,914	645	11,666	632	11,029	(12)	(12)
Sodium carbonate (natural)	613,594	15,001	652,891	17,400	652,717	17,792	628,619	17,032
Sodium sulfate (natural)	284,549	5,381	332,990	6,437	331,382	6,542	347,445	6,716
Stone [13]—thousand short tons	467,272	702,142	504,031	763,313	[3] 532,791	[3] 814,373	535,340	826,209
Strontium minerals (crude)	177	4	4,040	77	(8)	(8)	(8)	(8)
Sulfur:								
Frasch-process mines—thousand long tons	5,839	163,156	5,676	150,356	5,035	122,915	4,644	109,272
Other mines—long tons	199,899	(8)	185,532	(8)	(8)	(8)	153,574	1,505
Talc, pyrophyllite, and soapstone	725,708	4,517	739,039	4,859	684,453	4,796	737,333	4,818
Tripoli	49,662	213	45,009	203	50,717	195	47,044	183
Vermiculite	204,040	2,702	192,628	2,543	183,987	2,603	181,716	2,610
Value of items that cannot be disclosed: Aplite, brucite, calcium-magnesium chloride, diatomite, graphite, iodine, kyanite, lithium minerals, nitrogen compounds (1957–58), olivine, staurolite (1957–58), sharpening stones, wollastonite, and values indicated by footnote 8		[3] 30,903		[3] 35,033		[3] 37,086		39,910
Total nonmetals [14]		[3] 2,957,000		[3] 3,266,000		[3] 3,266,000		3,341,000
METALS								
Antimony ore and concentrate—antimony content	633	(15)	590	(15)	710	(15)	716	(15)
Bauxite—long tons, dried equivalent	1,788,341	14,543	1,743,344	13,973	1,416,172	[3] 12,868	1,310,685	11,898
Beryllium concentrate—gross weight	500	268	[3] 445	[3] 231	521	276	463	238
Chromite—do	153,253	6,644	[16] 207,662	[16] 8,715	166,157	7,816	143,795	6,187
Cobalt (contents of concentrate)—thousand pounds	2,439	(15)	3,657	(15)	4,123	(15)	4,832	(15)
Columbium-tantalum concentrate [17]—pounds	12,954	22	216,606	(15)	370,483	(15)	428,347	981
Copper (recoverable content of ores, etc.)	998,570	744,933	1,104,156	938,532	1,086,859	654,289	979,329	515,127
Gold (recoverable content of ores, etc.)—troy ounces	1,880,142	65,805	1,827,159	63,950	1,793,597	62,776	1,739,249	60,874

Iron ore, usable (excluding byproduct iron sinter)	105,237	748,602	96,944	750,354	104,157	865,703	66,525	572,735
thousand long tons, gross weight	338,025	100,731	352,826	110,787	338,216	96,730	267,377	62,566
	297,254	21,651	344,735	26,990	366,334	29,363	323,108	23,300
	911,636	5,128	680,651	3,984	865,127	[15]	520,601	3,532
Lead (recoverable content of ores, etc.)	213,370	[15]	130,129	[15]	[15]	[15]	[15]	[15] 8,720
Manganese ore (35 percent or more Mn)	18,955	5,504	24,177	6,284	34,625	8,552	42,328	50,371
Manganiferous ore (5 to 35 percent Mn)	64,709	66,919	57,126	63,901	57,143	67,605	13,439	[15] 286
Manganiferous residuum	4,411	[15]	7,392	[15]	12,901	[3] 653	2,021	30,872
Mercury	[15]	[15]	[15]	[15]	[3] 3,079	34,541	34,111	
Molybdenum (content of concentrate)	37,198	33,666	38,722	35,044	38,165			11,152
Nickel (content of ore and concentrate)						[3] 21,802	565,164	210
Rare-earth and thorium concentrates				14,199	782,975	1,544	1,863	3,991
Silver (recoverable content of ores, etc.)	573,192	10,268	735,388	1,749	10,644	8,186	3,788	116,397
Titanium concentrate:	9,152	1,122	12,065	51,201	5,520	[3] 81,181	5,178,315	10,817
Ilmenite	16,412	60,841	14,737	70,601	3,682,543	7,383	[15] 6,061	84,113
Rutile	[18]	[15]	3,003,590	[15]	[15]	123,235	412,005	[15]
Tungsten ore and concentrate	6,572	[15]	7,735	148,503	531,735	[15]	[15]	
Uranium ore	514,671	126,609	542,340	[15]	[15]			
Vanadium (recoverable in ore and concentrate)	28,913	1,426	[15]					22,262
Zinc (recoverable content of ores, etc.)						59,558		
Zirconium concentrate		40,596		48,704				1,597,000
Value of items that cannot be disclosed: Magnesium chloride for magnesium metal, platinum-group metals (crude), tin (1955), and values indicated by footnote 16				2,388,000		[3] 2,137,000		
		2,055,000						16,626,000
Total metals		[3] 15,792,000		[3] 17,365,000		[3] 18,113,000		
Grand total mineral production								

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Includes Alaska and Hawaii.
[3] Revised figure.
[4] Includes small quantity of anthracite mined in States other than Pennsylvania.
[5] Preliminary figure.
[6] Grindstones, pulpstones, millstones, grinding pebbles, and tube-mill liners weight not recorded; excludes value of sharpening stones, value for which is included with "Nonmetal items that cannot be disclosed."
[7] Excludes tube-mill liners, value for which is included with "Nonmetal items that cannot be disclosed."
[8] Figure withheld to avoid disclosing individual company confidential data; value included with "Nonmetal items that cannot be disclosed."
[9] Weight not recorded.
[10] Beginning with 1947 calcareous marl included with stone.
[11] Final figure. Supersedes preliminary figure given in commodity chapter.
[12] Beginning with 1953 slate included with stone.
[13] Beginning with 1958 slate included with stone, bituminous limestone, bituminous sandstone, and ground soapstone, all included elsewhere in table.
[14] Excludes abrasive stone, bituminous limestone, and bituminous sandstone, all included elsewhere in table.
[15] The total has been adjusted to eliminate duplicating value of clays and stone.
[16] Figure withheld to avoid disclosing individual company confidential data; value included with "Metal items that cannot be disclosed."
[17] Includes 45,710 short tons of concentrate produced in 1955 and 1956 from low-grade ore and concentrate stockpiled near Coquille, Oreg., during World War II.
[18] Total weight of columbite-tantalite plus $(Cb\text{-}Ta)_2O_5$ content of euxenite.
[19] Data not available.

TABLE 3.—Minerals produced in the United States and principal producing States in 1958

Mineral	Principal producing States, in order of quantity	Other producing States
Antimony	Idaho, Nev	
Aplite	Va	
Asbestos	Vt., Ariz., Calif., N.C	
Asphalt	Tex., Utah, Ala., Okla	
Barite	Mo., Ark., Ga., Nev	Mo.
Bauxite	Ark., Ala., Ga	Calif., Idaho, Mont., N. Mex., S.C., Tenn., Wash.
Beryllium	S. Dak., Colo., N. Mex., Ariz	
Boron	Calif	Conn., Maine, N.H., N.C., Wyo.
Bromine	Mich., Tex., Ark., Calif	
Brucite	Nev	W. Va.
Calcium magnesium chloride.	Mich., Calif., W. Va	
Carbon dioxide	N. Mex., Colo., Utah, Wash	
Cement	Pa., Calif., Tex., Mich	Oreg.
Chromite		All others except: Alaska, Conn., Del., Hawaii, Mass., Nev., N.H., N.J., N. Mex., N.C., N. Dak., R.I., Vt.
Clays	Mont., Calif., Oreg., Wash	
Coal	Ohio, Tex., Pa., Ga	
	W. Va., Pa., Ky., Ill	All others except Alaska, R.I.
Cobalt	Idaho, Mo., Pa	Ala., Alaska, Ariz., Ark., Colo., Ga., Ind., Iowa, Kans., Md., Mo., Mont., N. Mex., N. Dak., Ohio, Okla., S. Dak., Tenn., Utah, Va., Wash., Wyo.
Columbium-tantalum	Idaho, S. Dak., Colo	
Copper	Ariz., Utah, Mont., Nev	
Diatomite		Alaska, Calif., Colo., Idaho, Mich., Mo., N. Mex., N.C., Oreg., Pa., Tenn., Vt., Wash., Wyo.
Emery	Calif., Nev., Oreg., Wash	
Feldspar	N.Y	
	N.C., Calif., N.H., Colo	
Fluorspar		Ariz., Conn., Ga., Maine, S. Dak., Tex., Va., Wyo.
Garnet	Ill., Colo., Mont., Ky	
Gold	N.Y., Idaho	Ariz., Calif., Nev., Utah.
	S. Dak., Utah, Alaska, Calif	
Graphite		Ariz., Colo., Idaho, Mont., Nev., N. Mex., N.C., Oreg., Pa., Tenn., Wash., Wyo.
Gypsum	Tex., R.I	
	Calif., Mich., Tex., Iowa	
Helium		Ariz., Ark., Colo., Idaho, Ind., Kans., La., Mont., Nev., N.Y., Ohio, Okla., S. Dak., Utah, Va., Wash., Wyo.
Iodine	Tex., N. Mex., Kans	
Iron ore	Calif	
	Min., Mich., Ala., Utah	
Kyanite		Ark., Calif., Colo., Ga., Idaho, Miss., Mo., Mont., Nev., N.J., N. Mex., N.Y., Pa. Tex., Wash., Wis., Wyo.
Lead	Va., S.C	
	Mo., Idaho, Utah, Colo	
Lime	Ohio, Mo., Pa., Tex	Alaska, Ariz., Calif., Ill., Kans., Ky., Mont., Nev., N. Mex., N.Y., Okla., Oreg., Va., Wash., Wis.
Magnesite		Ala., Ariz., Ark., Calif., Colo., Conn., Fla., Hawaii, Ill., Iowa, La., Maine, Md., Mass., Mich., Minn., Mont., Nev., N.J., N. Mex., N.Y., Okla., Oreg., S. Dak., Tenn. Vt., Va., W. Va., Wis.
Magnesium chloride	Wash., Nev., Calif	
Magnesium compounds	Texas	
Manganese	Mich., Calif., N.J., Tex	
Mercury	Nev., Ariz., Mont., N. Mex	N. Mex.
	Calif., Nev., Alaska, Oreg	Ark., Calif., Colo., Ga., Tenn., Utah, Va. Ariz., Idaho, Tex., Wash.

TABLE 3.—Minerals produced in the United States and principal producing States in 1958—Continued

Mineral	Principal producing States, in order of quantity	Other producing States
Mica	N.C., Ga., Ala., S.C.	Ariz., Calif., Colo., Conn., Idaho, Maine, Mont., N.H., N. Mex., Pa., S. Dak., Tenn., Utah, Va.
Molybdenum	Colo., Utah, Ariz., Calif.	Nev., N. Mex.
Natural gas	Tex., La., N. Mex., Okla.	Ala., Alaska, Ark., Calif., Colo., Fla., Ill. Ind., Kans., Ky., Md., Mich., Miss., Mont., Neb., N.Y., N. Dak., Ohio, Pa., Tenn., Utah, Va., W. Va., Wyo.
Natural-gas liquids	Tex., Calif., La., Okla.	Ark., Colo., Ill., Kans., Ky., Mich., Miss., Mont., Neb., N. Mex., N. Dak., Ohio, Pa., Utah, W. Va., Wyo.
Nickel	Oreg., Mo., Idaho	
Olivine	N.C., Wash.	
Peat	Mich., Wash., Fla., Calif.	Colo., Conn., Ga., Idaho, Ill., Ind., Iowa, Maine., Mass., Minn., N.H., N.J., N.Y., Ohio, Pa., S.C., Wis.
Perlite	N. Mex., Nev., Calif., Ariz.	Colo., Utah.
Petroleum	Tex., Calif., La., Okla.	Ala., Alaska, Ariz., Ark., Colo., Fla., Ill., Ind., Kans., Ky., Mich., Miss., Mo., Mont., Neb., Nev., N. Mex., N.Y., N. Dak., Ohio, Pa., S. Dak., Tenn., Utah, Va., Wash., W. Va., Wyo.
Phosphate rock	Fla., Tenn., Idaho, Mont.	Utah.
Platinum-group metals	Alaska, Calif.	
Potassium salts	N. Mex., Calif., Utah, Mich.	Md.
Pumice	N. Mex., Ariz., Calif., Hawaii	Colo., Idaho, Kans., Neb., Nev., N. Dak., Okla., Oreg., Tex., Utah, Wash., Wyo.
Pyrites	Tenn., Va., Calif., Colo.	Ariz., Mont., Pa.
Rare-earth metals	Idaho, Colo., S.C., Calif.	Fla.
Salt	Mich., N.Y., Tex., La.	Ala., Calif., Colo., Hawaii, Kans., Nev., N. Mex., Ohio, Okla., Utah, Va., W. Va.
Sand and gravel	Calif., Mich., Wis., Tex.	All other States.
Silver	Idaho, Utah, Ariz., Mont.	Alaska, Calif., Colo., Ky., Mo., Nev., N. Mex., N.Y., N.C., Oreg., Pa., S. Dak., Tenn., Vt., Va., Wash., Wyo.
Sodium carbonate	Wyo., Calif.	
Sodium sulfate	Calif., Tex., Wyo.	
Stone	Pa., Tex., Ill., Calif.	All other States.
Strontium	Wash.	
Sulfur (Frasch)	Tex., La.	
Sulfur ore	Calif., Nev.	
Talc, pyrophyllite, and soapstone.	N.Y., Calif., N.C., Vt.	Ala., Ark., Ga., Md., Mont., Nev., Pa., Tex., Va., Wash.
Titanium	N.Y., Fla., Va., Idaho	S.C.
Tripoli	Ill., Okla., Pa.	
Tungsten	N.C., Colo., Calif., Idaho.	Nev.
Uranium	N. Mex., Utah, Colo., Wyo.	Alaska, Ariz., Calif., Idaho, Mont., Nev., S. Dak., Tex., Wash.
Vanadium	Colo., Utah, Ariz.	N. Mex., Wyo.
Vermiculite	Mont., S.C.	
Wollastonite	N.Y., Calif.	
Zinc	Tenn., N.Y., Idaho, Utah.	Ariz., Calif., Colo., Ill., Kans., Ky., Mo., Mont., Nev., N.J., N. Mex., Okla., Pa., Va., Wash., Wis.
Zirconium	Fla., S.C., Idaho.	

TABLE 4.—Value of mineral production in the United States,[1] in thousand dollars, and principal minerals produced in 1958

State	1955	1956	1957	1958			
				Value	Rank	Percent of U.S. total	Principal minerals in order of value
Alabama	$186,453	$189,186	$209,549	$187,747	21	1.14	Coal, cement, iron ore, petroleum.
Alaska	25,412	23,408	28,792	21,450	43	.13	Coal, gold, sand and gravel, stone.
Arizona	378,277	484,959	372,641	314,520	16	1.90	Copper, sand and gravel, cement, uranium ore.
Arkansas	131,759	134,049	142,685	131,603	26	.80	Petroleum, bauxite, stone, sand and gravel.
California	1,450,501	1,543,978	1,650,035	1,502,660	3	9.09	Petroleum, cement, natural gas, sand and gravel.
Colorado	286,219	321,908	338,504	305,284	17	1.85	Petroleum. molybdenum, uranium ore, coal.
Connecticut	10,428	11,737	16,055	13,128	45	.08	Stone, sand and gravel, lime, clays.
Delaware	1,658	1,232	1,042	1,142	50	.01	Sand and gravel, stone, clays.
Dist. of Columbia			72	72	51	(1)	Clays.
Florida	108,957	140,490	140,467	142,111	25	.86	Phosphate rock, stone, cement, clays.
Georgia	60,417	67,912	69,799	75,106	30	.45	Clays, stone, cement, sand and gravel.
Hawaii	3,592	6,972	5,930	6,298	47	.04	Stone, sand and gravel, pumice, lime.
Idaho	68,513	75,150	73,502	64,456	33	.39	Silver, lead, zinc, sand and gravel.
Illinois	532,984	572,247	576,324	582,412	7	3.52	Petroleum, coal, stone, sand and gravel.
Indiana	183,209	196,439	198,034	197,677	20	1.20	Coal, cement, petroleum, stone.
Iowa	63,555	66,529	68,985	85,356	29	.52	Cement, stone, sand and gravel, gypsum.
Kansas	470,830	493,770	511,513	498,526	9	3.02	Petroleum, natural gas, cement, stone.
Kentucky	391,068	443,168	449,390	402,121	10	2.43	Coal, petroleum, natural gas, stone.
Louisiana	1,156,424	1,288,116	1,517,522	1,517,415	2	9.18	Petroleum, natural gas, natural-gas liquids, sulfur.
Maine	12,991	12,728	12,711	12,574	46	.08	Cement, sand and gravel, stone, mica.
Maryland	35,488	40,534	39,625	44,679	38	.27	Cement, stone, sand and gravel, coal.
Massachusetts	22,109	25,085	24,789	23,887	41	.14	Stone, sand and gravel, lime, clays.
Michigan	363,778	394,556	404,673	343,483	15	2.08	Cement, iron ore, sand and gravel, salt.
Minnesota	501,151	501,027	584,037	395,880	11	2.40	Iron ore, sand and gravel, stone, cement.
Mississippi	122,620	133,098	144,950	148,663	23	.90	Petroleum, natural gas, sand and gravel, cement.
Missouri	151,626	163,693	152,913	144,009	24	.87	Cement, stone, lead, zinc.
Montana	166,993	213,704	191,750	177,240	22	1.07	Petroleum, copper, sand and gravel, zinc.
Nebraska	54,237	71,311	82,928	90,032	28	.54	Petroleum, cement, sand and gravel, stone.
Nevada	113,220	126,681	86,023	68,293	32	.41	Copper, manganese ore, sand and gravel, gold.
New Hampshire	2,605	3,436	3,331	3,877	48	.02	Sand and gravel, mica, stone, feldspar.
New Jersey	57,251	63,988	64,642	50,380	36	.30	Stone, sand and gravel, iron ore, clays.
New Mexico	438,549	514,903	551,155	558,866	8	3.38	Petroleum, natural gas, potassium salts, uranium ore.
New York	216,907	237,016	244,114	204,920	18	1.24	Cement, stone, salt, sand and gravel.
North Carolina	41,210	40,873	37,570	39,891	40	.24	Stone, sand and gravel, lithium minerals, mica.
North Dakota	44,123	53,509	56,702	59,093	35	.36	Petroleum, sand and gravel, coal, natural-gas liquids.
Ohio	340,456	375,488	383,000	344,856	14	2.09	Coal, cement, stone, sand and gravel.
Oklahoma	711,044	757,080	809,004	767,856	5	4.65	Petroleum, natural gas, natural-gas liquids, cement.
Oregon	31,736	34,021	42,820	45,053	37	.27	Stone, cement, sand and gravel, nickel.
Pennsylvania	969,647	1,088,481	1,077,157	881,181	4	5.33	Coal, cement, stone, petroleum.
Rhode Island	1,834	1,627	1,369	2,249	49	.01	Sand and gravel, stone, graphite.
South Carolina	20,197	21,342	22,168	22,412	42	.14	Cement, stone, clays, sand and gravel.
South Dakota	40,526	42,281	39,997	41,534	39	.25	Gold, sand and gravel, cement, stone.

Tennessee	119,316	137,846	128,739	124,928	27	.76	Stone, cement, coal, phosphate rock.
Texas	3,990,166	4,241,258	4,484,538	4,038,656	1	24.44	Petroleum, natural gas, natural-gas liquids, cement.
Utah	332,002	399,759	359,335	365,960	13	2.21	Copper, petroleum, uranium ore, coal.
Vermont	23,884	23,131	21,893	21,443	44	.13	Stone, asbestos, sand and gravel, talc.
Virginia	172,541	208,806	227,108	203,226	19	1.23	Coal, stone, cement, sand and gravel.
Washington	67,334	61,723	60,471	60,897	34	.37	Sand and gravel, cement, stone, gold.
West Virginia	755,426	934,999	981,654	749,784	6	4.54	Coal, natural gas, natural-gas liquids, sand and gravel.
Wisconsin	65,813	65,860	68,644	71,334	31	.43	Sand and gravel, stone, cement, iron ore.
Wyoming	294,546	314,380	352,532	369,938	12	2.24	Petroleum, uranium ore, natural gas, clays.
Total	15,792,000	17,365,000	18,113,000	16,526,000	--------	100.00	

[1] Less than 1 percent.

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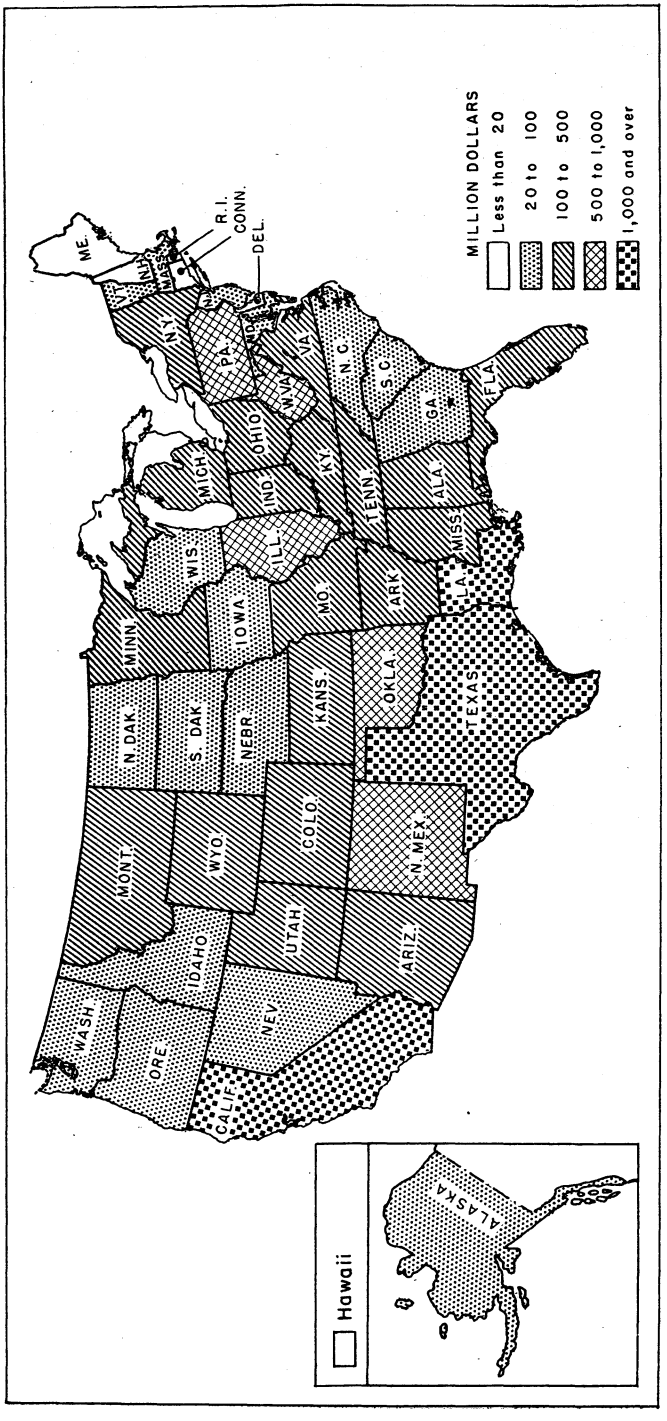

FIGURE 2.—Value of mineral production in the United States (including Alaska and Hawaii), 1958, by States.

TABLE 5.—Mineral production [1] in the United States,[2] by States

ALABAMA

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement [3]—thousand 376-pound barrels	13,721	$38,350	14,065	$41,840	13,000	$40,279	13,588	$42,930
Clays—thousand short tons	(4)	(4)	[5] 1,594	[5] 2,147	[5] 1,316	[5] 1,504	[5] 1,548	[5] 1,787
Coal—do	13,088	79,337	12,663	79,322	13,260	86,114	11,182	72,360
Iron ore (usable)—thousand long tons, gross weight	6,814	44,657	5,633	34,824	6,223	40,518	3,659	23,393
Lime—thousand short tons	462	5,186	466	5,089	554	6,271	520	4,660
Mica (sheet)	(4)	(4)	1,122	7	(4)	(4)	(4)	(4)
Natural gas—million cubic feet	282	20	42	3	190	12	[6] 323	[6] 30
Petroleum (crude)—thousand 42-gallon barrels	1,411	2,910	3,069	7,335	5,406	(4)	[6] 5,887	(4)
Sand and gravel—thousand short tons	3,680	3,524	4,999	4,621	5,065	4,883	4,128	4,210
Stone—do	8,269	11,867	[7] 12,343	[7] 14,702	[7] 9,519	[7] 11,972	[7] 11,080	[7] 17,068
Talc	1,500	8	2,200	5	1,600	3	(4)	(4)
Value of items that cannot be disclosed: Native asphalt, bauxite, slag cement, clays (kaolin, 1956–58), scrap mica, salt, stone (dimension limestone and marble 1957–58, shell, 1957), and values indicated by footnote 4		4,325		4,083		[8] 23,344		26,508
Total Alabama [9]		186,453		189,186		[8] 209,549		187,747

ALASKA

Antimony ore and concentrate—antimony content			28	(4)	17	(4)		
Chromite—gross weight	7,082	$625	7,193	$711	4,207	$431		
Clays—thousand short tons	1	4						
Coal—do	640	5,759	727	6,374	842	7,296	759	$6,931
Copper (recoverable content of ores, etc.)	1	1	(10)	(11)	(10)	(11)	5	3
Gold (recoverable content of ores, etc.)—troy ounces	249,294	8,725	209,296	7,325	215,467	7,541	186,435	6,525
Lead (recoverable content of ores, etc.)	1	(11)	1	(11)	9	3	2	(11)
Mercury—76-pound flasks	(4)	(4)	3,280	853	5,461	1,349	3,380	774
Natural gas—million cubic feet							[6] 50	[6] 6
Sand and gravel—thousand short tons	9,793	8,242	5,955	5,880	6,096	8,799	4,255	3,871
Silver (recoverable content of ores, etc.)—thousand troy ounces	34	31	28	26	29	26	24	22
Stone—thousand short tons	266	290	195	595	528	1,953	615	2,065
Tin (content of concentrate)—long tons	86	183						
Value of items that cannot be disclosed: Gem stones (1956–58), petroleum (1958), platinum-group metals, uranium ore (1957–58), and values indicated by footnote 4		1,552		1,644		1,394		1,253
Total Alaska		25,412		23,408		28,792		21,450

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

ARIZONA

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate—gross weight	(4)	(4)	6	$3	5	$2	18	$10
Clays—thousand short tons	254	$869	[5] 112	[5] 168	[5] 118	[5] 177	[5] 119	[5] 179
Columbium-tantalum concentrate—pounds	(4)	(4)			2, 435	7		
Coal—thousand short tons	9	59	10	66	9	62	8	54
Copper (recoverable content of ores, etc.)	454, 105	338, 762	505, 908	430, 022	515, 854	310, 544	485, 839	255, 551
Gem stones	(12)	97	(12)	104	(12)	75	(12)	86
Gold (recoverable content of ores, etc.)—troy ounces	127, 616	4, 467	146, 110	5 114	152, 449	5, 336	142, 979	5, 004
Gypsum—thousand short tons	(4)	(4)	96	366	(4)	(4)	(4)	(4)
Lead (recoverable content of ores, etc.)	9, 817	2, 925	11, 999	3, 768	12, 441	3, 558	11, 890	2, 782
Lime—thousand short tons	112	1, 438	127	1, 756	138	2, 127	126	1, 817
Manganese ore (35 percent or more Mn)—gross weight	1, 444	(4)	42, 088	3, 468	79, 505	6, 626	62, 279	5, 220
Manganiferous ore (5 to 35 percent Mn)—do							1, 455	32
Mercury—76-pound flasks	477	138	(4)	(4)	28	7	53	12
Mica (scrap)	1, 353	9			1, 650	17	1, 717	25
Molybdenum (content of concentrate)—thousand pounds	1, 497	1, 511	2, 392	2, 670	2, 385	3, 071	2, 320	2, 827
Natural gas—million cubic feet	(4)	(4)	21	3	22	3		
Perlite	10, 568	84	15, 928	108	15, 646	114	(4)	(4)
Pumice—thousand short tons	92	373	115	366	397	640	401	1, 025
Sand and gravel—do	7, 755	6, 519	7, 932	6, 167	10, 287	9, 222	12, 208	9, 526
Silver (recoverable content of ores, etc.)—thousand troy ounces	4, 634	4, 194	5, 179	4, 687	5, 279	4, 778	4, 685	4, 240
Stone—thousand short tons	1, 601	2, 329	1, 623	2, 474	2, 101	2, 982	1, 528	2, 731
Tungsten concentrate—60-percent WO_3 basis	181	676	186	637	5	9		
Uranium ore			274, 505	5, 408	286, 037	6, 277	257, 756	7, 049
Zinc (recoverable content of ores, etc.)	22, 684	5, 580	25, 580	7, 009	33, 905	7, 866	28, 532	5, 821
Value of item that cannot be disclosed: Asbestos, barite (1955), cement, clays (bentonite, 1955–56 and 1958), diatomite (1955), feldspar, fluorspar, nitrogen compounds (1957–58), petroleum (1958), pyrites (1957–58), rare-earth metals concentrates (1955), vanadium, and values indicated by footnote 4		9, 201		11, 701		10, 441		11, 734
Total Arizona [9]		378, 277		484, 959		[8] 372, 641		314, 520

ARKANSAS

Abrasive stones (whetstones)	(4)	(4)	35	$11				
Barite	462, 986	$3, 755	486, 254	4, 256	477, 327	[8] $4, 537	182, 779	$1, 668
Bauxite—long tons, dried equivalent	1, 721, 243	14, 026	1, 668, 432	13, 307	1, 356, 898	[8] 12, 314	1, 257, 916	11, 394
Clays—thousand short tons	739	2, 376	719	1, 636	617	1, 586	578	1, 578
Coal—do	578	4, 319	590	4, 601	508	3, 976	364	2, 744
Gem stones	(12)	4	(12)	25	(12)	(4)	(12)	23
Iron ore (usable)—thousand long tons, gross weight			(4)	(4)	7	35	(4)	(4)
Manganese ore (35 percent or more Mn)—gross weight	23, 744	1, 727	29, 485	2, 066	23. 261	1, 726	22, 221	1, 737
Natural gas—million cubic feet	32, 123	1, 799	30, 162	1, 810	31, 327	2, 256	[6] 32, 890	[6] 2, 664
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	47, 483	3, 239	41. 529	2, 541	39, 869	2, 313	37, 197	2, 574
LP-gases—do	57, 088	2, 169	56, 146	2, 293	54, 034	2, 097	53, 518	2, 743
Petroleum (crude)—thousand 42-gallon barrels	28, 369	76, 880	29, 355	78, 965	31, 047	90, 657	[6] 28, 700	[6] 80, 934
Sand and gravel—thousand short tons	9, 003	7, 663	10, 200	8, 730	8, 599	6, 949	8, 644	7, 039
Slate—do	(4)	(4)	(4)	(4)	(4)	(4)	(13)	(13)
Stone—do	6, 176	8, 026	6, 325	8, 113	7, 278	8, 378	8, 461	10, 178
Value of items that cannot be disclosed: Abrasive stones, bromine (1957–58), cement, gypsum, lime, soapstone, and values indicated by footnote 4		[8] 6, 553		8, 182		[8] 6, 933		7, 241
Total Arkansas [9]		[8] 131, 759		[8] 134, 049		[8] 142, 685		131, 603

CALIFORNIA

Barite	(4)	(4)	(4)	(4)	(4)	(4)	24, 812	$272
Boron minerals	[8] 522, 466	[8] $30, 739	[8] 546, 815	[8] $32, 848	[8] 541, 124	[8] $38, 041	528, 209	38, 310
Cement—thousand 376-pound barrels	35, 087	103, 804	39, 290	120, 511	[14] 37, 731	[14] 117, 852	[14] 39, 583	[14] 124, 367
Chromite—gross weight	22, 105	1, 834	27, 082	2, 192	34, 901	2, 789	20, 588	1, 646
Clays—thousand short tons	2, 860	5, 027	2, 982	6, 137	2, 729	[8] 5, 740	2, 394	5, 012
Coal (lignite)—do	8	77	12	120	(4)	(4)	(4)	(4)
Copper (recoverable content of ores, etc.)	613	457	859	730	945	569	749	394
Feldspar—long tons	(4)	(4)	[8] 107, 958	[8] 1, 080	[8] 67, 869	[8] 581	71, 193	624
Gem stones	(12)	(4)	(12)	90	(12)	100	(12)	150
Gold (recoverable content of ores, etc.)—troy ounces	251, 737	8, 811	193, 816	6, 784	170, 885	5, 981	185, 385	6, 489
Gypsum—thousand short tons	1, 308	3. 274	1, 399	3, 402	1, 268	2, 995	1, 423	3, 184
Iron ore (usable)—thousand long tons, gross weight	1, 777	(4)	2, 414	(4)	(4)	(4)	(4)	(4)
Lead (recoverable content of ores, etc.)	8, 265	2, 463	9, 296	2, 919	3, 458	989	140	33
Lime—thousand short tons	268	4, 373	302	5, 078	325	5, 408	262	4, 470
Magnesium compounds from sea water and bitterns (partly estimated) MgO equivalent	58, 042	3, 833	66, 007	4, 532	[8] 74, 295	[8] 5, 077	74, 132	4, 854
Manganese ore (35 percent or more Mn)—gross weight	3, 136	271	6, 595	595	9, 009	802	17, 644	1, 516
Mercury—76-pound flasks	9, 875	2, 867	9, 017	2, 344	16, 511	4, 078	22, 365	5, 123
Natural gas—million cubic feet	538, 178	119, 476	504, 458	113, 503	492, 338	116, 684	[6] 465, 582	[6] 108, 481
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	929, 649	89, 003	876, 902	84, 615	843, 378	81, 355	853, 045	68, 485
LP-gases—do	360, 902	19, 379	410, 232	21, 332	390, 743	20, 421	342, 992	18, 678
Peat	(4)	(4)	18, 918	215	35, 916	424	28, 617	374

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

CALIFORNIA—Continued

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Perlite	15,653	$125	15,119	$135	15,109	$113	14,883	$114
Petroleum (crude)—thousand 42-gallon barrels	354,812	887,030	350,754	918,975	339,646	1,035,920	[6] 314,429	[6] 911,844
Pumice—thousand short tons	797	1,099	634	2,334	459	1,510	377	1,670
Salt (common)—do	1,315	6,751	1,444	7,606	1,330	8,721	1,297	(4)
Sand and gravel—do	64,879	66,820	86,447	96,526	[8] 78,983	87,030	84,137	95,340
Silver (recoverable content of ores, etc.)—thousand troy ounces	954	864	938	849	522	473	188	170
Stone—thousand short tons	24,708	37,164	32,583	46,109	41,351	53,591	32,423	48,345
Strontium minerals	177	4	(4)	(4)	(4)	(11)		
Sulfur ore—long tons	199,599	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Talc, pyrophyllite and soapstone	166,551	1,553	153,710	1,419	133,915	1,526	148,806	1,439
Tungsten concentrate—60-percent WO_3 basis	4,383	16,201	3,719	13,449	1,750	2,735	(4)	(4)
Wollastonite							1,652	17
Zinc (recoverable content of ores, etc.)	6,836	1,682	8,049	2,205	2,969	689	51	10
Value of items that cannot be disclosed: Asbestos, bromine, calcium-magnesium chloride, carbon dioxide (1955–57), masonry cement (1956–58), clay, (kaolin 1957), diatomite, fluorspar (1957–58), abrasive garnet (1955–56), iodine, lithium minerals (1958), magnesite (1955–56 and 1958), mica, molybdenum, platinum-group metals (crude), potassium salts, pyrites, rare-earth metals concentrates, slate (1955–57), sodium carbonate and sulfate, uranium ore (1956–58), and values indicated by footnote 4		[8] 52,755		[8] 63,654		[8] 65,352		68,562
Total California [9]		[8] 1,450,501		[8] 1,543,978		[8] 1,650,035		1,502,660

COLORADO

Beryllium concentrate—gross weight	46	$23	[8] 163	[8] $88	182	$91	134	$58
Clays—thousand short tons	464	1,118	523	1,215	403	978	448	1,111
Coal—do	3,568	20,100	3,502	19,832	3,594	21,831	2,974	19,305
Columbium-tantalum concentrate [10]—pounds	4,325	7	52	(11)	103	(11)	2,280	7
Copper (recoverable content of ores, etc.)	4,323	3,225	4,228	3,594	5,115	3,079	4,193	2,206
Feldspar—long tons	46,114	314	47,014	327	43,818	307	34,648	237
Gem stones	(12)	48	(12)	30	(12)	35	(12)	38
Gold (recoverable content of ores, etc.)—troy ounces	88,577	3,100	97,668	3,418	87,928	3,078	79,539	2,784
Gypsum—thousand short tons	77	329	88	353	(4)	(4)	103	341
Iron ore (usable)—thousand long tons, gross weight	4	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Lead (recoverable content of ores, etc.)	15,805	4,710	19,856	6,235	21,003	6,007	14,112	3,302
Lime—thousand short tons					2	45	(4)	(4)

Manganese ore (35 percent or more Mn)—gross weight					175	14	210	17
Mica: Scrap	699	13	517	7	312	6	387	6
Sheet—pounds			8	(11)	14	(11)		
Molybdenum—thousand pounds	45,837	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas—million cubic feet	49,152	4,866	54,205	5,312	95,259	9,526	[6] 82,464	[6] 8,659
Natural-gas liquids:								
Natural gasoline—thousand gallons	(4)	(4)	(4)	(4)	(4)	(4)	49,505	3,410
LP-gases—do	(4)	(4)	(4)	(4)	(4)	(4)	68,027	3,343
Peat					3,559	(4)	7,143	41
Petroleum (crude)—thousand 42-gallon barrels	52,653	144,800	58,516	162,674	54,982	166,046	[6] 48,309	[6] 144,444
Pumice—thousand short tons	71	163	50	109	25	53	34	65
Pyrites—thousand long tons	(4)	(4)	(4)	(4)	62	(4)	67	359
Rare-earth metals concentrates	(4)	(4)	16	23	[8] 749	[8] 24	650	35
Salt—thousand short tons	4	17	4	18	(4)	(4)	(4)	(4)
Sand and gravel—do	12,912	8,915	15,152	11,082	16,400	13,994	20,626	17,842
Silver (recoverable content of ores, etc.)—thousand troy ounces	2,772	2,509	2,285	2,068	2,788	2,523	2,056	1,860
Stone—thousand short tons	2,149	3,508	2,250	5,217	2,438	4,168	2,930	4,943
Tungsten concentrate—60-percent WO_3 basis	1,152	4,079	873	3,010	45	55	(4)	(4)
Uranium ore			496,517	12,410	740,055	15,605	[16] 939,706	[16] 22,486
Vanadium—thousand pounds	4,595	(4)	5,582	(4)	6,264	(4)	4,791	(4)
Zinc (recoverable content of ores, etc.)	35,350	8,696	40,246	11,027	47,000	10,904	37,132	7,575
Value of items that cannot be disclosed: Carbon dioxide, cement, fluorspar, perlite, tin (1955), and values indicated by footnote 4		76,969		75,632		[8] 81,907		62,855
Total Colorado [9]		286,219		[8] 321,908		[8] 338,504		305,284
CONNECTICUT								
Beryllium concentrate—gross weight	5	$3	(4)	(4)	(4)	(4)	(4)	(4)
Clays—thousand short tons	325	315	338	$390	308	$409	199	$299
Gem stones					(12)	(4)	(12)	3
Lime—thousand short tons	35	503	40	609	30	503	29	464
Mica (sheet and scrap)	3	13	[17] 310	[17] 2	(4)	(4)	(4)	(11)
Peat	(4)	(4)	3,190	13	2,004	11	1,764	11
Sand and gravel—thousand short tons	4,345	4,080	4,369	4,101	4,777	5,042	5,019	5,479
Stone—do	3,642	5,451	[7] 4,428	[7] 6,590	6,199	10,040	4,223	6,863
Value of items that cannot be disclosed: Columbium-tantalum concentrate (1955), feldspar, stone (crushed granite and dimension limestone 1955, dimension limestone, 1956) and values indicated by footnote 4		123		124		119		89
Total Connecticut [9]		10,428		11,737		16,055		13,128
DELAWARE								
Sand and gravel—thousand short tons	2,297	$1,407	1,160	$967	974	$860	1,090	$962
Stone—do	79	228	83	232	(4)	(4)	(4)	(4)
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 4		23		33		182		180
Total Delaware		1,658		1,232		1,042		1,142

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

FLORIDA

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays—thousand short tons	413	$4,816	432	$5,826	422	$6,067	450	$5,808
Lime—do	(4)	(4)	40	490	(4)	(4)	(4)	(4)
Natural gas—million cubic feet	36	4	35	3	34	4	[6] 35	[6] 5
Peat	61,098	232	58,496	203	37,844	195	36,438	165
Petroleum (crude)—thousand 42-gallon barrels	495	(4)	479	(4)	461	(4)	[6] 448	(4)
Phosphate rock—thousand long tons	8,747	53,640	11,822	74,290	10,191	64,789	10,851	68,951
Sand and gravel—thousand short tons	5,066	4,349	5,815	5,034	6,753	6,148	5,490	4,389
Stone—do	[7] 17,028	[7] 22,966	18,779	25,183	21,786	30,467	[7] 23,549	[7] 30,983
Titanium concentrate:								
Rutile—gross weight	9,182	1,122	(4)	(4)	(4)	(4)	(4)	(4)
Zirconium concentrate	28,913	1,425	43,794	2,160	56,802	1,976	30,302	1,018
Value of items that cannot be disclosed: Cement, abrasive garnet (1956), gem stones (1956), rare-earth metals concentrates (1956–58), staurolite (1957–58), stone (dimension limestone, 1955 and 1958), titanium concentrate (ilmenite), and values indicated by footnote 4		22,787		28,452		[8] 33,157		34,003
Total Florida [9]		108,957		140,490		[8] 140,467		142,111

GEORGIA

Clays—thousand short tons	2,953	$26,145	3,047	$29,501	2,707	$30,120	2,942	$31,253
Coal—do	12	62	8	42	13	63	9	44
Iron ore (usable)—thousand long tons, gross weight	257	994	357	1,609	443	2,109	209	1,008
Iron oxide pigments	6,139	36	(4)	(4)	(4)	(4)	(4)	(4)
Manganiferous ore (5 to 35 percent Mn)—gross weight	(4)	(4)	(4)	(4)	2,203	(4)	(4)	(4)
Mica (sheet)—pounds	(4)	(4)	20,149	150	16,933	158	15,102	82
Peat	(4)	(4)	6,225	48	4,690	45	4,491	(4)
Sand and gravel—thousand short tons	2,988	2,199	2,426	2,183	2,127	2,096	[10] 2,631	[10] 2,693
Stone—do	[7] 7,488	[7] 14,250	[7] 9,196	[7] 20,714	[7] 9,065	[7] 15,833	12,129	31,108
Talc and soapstone	53,828	118	57,916	122	49,372	106	(4)	(4)
Value of items that cannot be disclosed: Barite, bauxite, beryllium concentrate (1955–57), cement, feldspar, gem stones, manganese ore, scrap mica, slate (1955–57), stone (dimension and crushed marble and crushed sandstone, 1955: crushed marble and crushed sandstone, 1956; dimension and crushed marble and crushed sandstone, 1957), and minerals indicated by footnote 4		17,495		14,558		20,081		10,145
Total Georgia [9]		60,417		67,912		69,799		75,106

HAWAII

Clays	thousand short tons	(4)	(4)	2	$2	2	$3	(4)	(4)
Lime	do	6	$202	10	306	8	271	8	$260
Pumice	do	130	76	59	92	266	493	260	481
Salt	do	(4)	(4)	(18)	18	(18)	15	(18)	(4)
Sand and gravel	do	165	426	193	503	286	538	438	1,112
Stone	do	1,414	2,884	3,494	6,076	2,585	4,632	2,377	4,446
Value of items that cannot be disclosed: Other nonmetals and values indicated by footnote 4			22						13
Total Hawaii [19]			3,592		6,972		5,930		6,298

IDAHO

Antimony ore and concentrate	antimony content	633	(4)	549	(4)	664	(4)	677	(4)
Beryllium concentrate	gross weight					1	(11)		
Clays	thousand short tons	35	$30	[5] 23	[5] $13	[5] 23	[5] $16	[5] 27	[5] $20
Cobalt (content of concentrate)	thousand pounds	1,691	(4)	2,385	(4)	2,618	(4)	3,078	(4)
Columbium-tantalum concentrate	pounds	(4)	(4)	215,900	(4)	364,768	(4)	422,612	(4)
Copper (recoverable content of ores, etc.)		5,618	4,191	6,656	5,658	7,912	4,763	9,846	5,179
Gold (recoverable content of ores, etc.)	troy ounces	10,572	370	9,210	322	12,301	431	15,896	556
Iron ore (usable)	thousand long tons			1	(4)	(4)	(4)	1	14
Lead (recoverable content of ores, etc.)		64,163	19,121	64,321	20,197	71,637	20,488	53,603	12,543
Mercury	76-pound flasks	1,107	321	3,394	882	2,260	558	2,625	601
Mica:									
Scrap								1	(11)
Sheet	pounds	(4)	(4)			1,240	9	1,968	14
Nickel (content of ore and concentrate)		33	(4)	49	(4)	37	55	29	(4)
Phosphate rock	thousand long tons	1,330	6,038	1,438	6,539	1,307	5,684	1,291	5,652
Pumice	thousand short tons	(4)	(4)	102	206	100	168	108	172
Rare-earth metals concentrates		(4)	(4)	303	(4)	366	(4)	692	(4)
Sand and gravel	thousand short tons	8,652	3,934	7,874	5,661	[8] 6,665	[5] 5,274	6,714	6,305
Silver (recoverable content of ores, etc.)	thousand troy ounces	13,831	12,518	13,472	12,193	15,067	13,637	15,953	14,438
Stone	thousand short tons	1,525	1,866	1,791	2,752	1,542	2,759	1,122	1,710
Titanium concentrate	gross weight	1,330	7	48,619	261	28,397	(4)	2,223	(4)
Tungsten concentrate	60-percent WO_3 basis	642	(4)	582	(4)	35	(4)	(4)	(4)
Zinc (recoverable content of ores, etc.)		53,314	13,115	49,561	13,580	57,831	13,417	49,725	10,144
Value of items that cannot be disclosed: Barite, cement, fire clay (1956–1958), bentonite (1958), fluorspar (1955), abrasive garnet, gem stones, gypsum (1958), peat (1955, 1957–58), stone (crushed limestone 1955), uranium ore (1957–58), zirconium concentrate (1958), and values indicated by footnote 4			[19] 7,002		[19] 6,885		[8 19] 6,243		[19] 7,108
Total Idaho			68,513		75,150		[8] 73,502		64,456

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

ILLINOIS

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement—thousand 376-pound barrels	9,397	$25,032	9,301	$27,264	8,575	$26,356	9,618	$30,858
Clays—thousand short tons	2,339	3,979	2,258	4,005	1,917	5,155	2,335	5,910
Coal—do	45,932	167,938	48,102	184,678	46,993	187,908	43,912	176,614
Fluorspar	166,337	7,838	178,254	8,470	169,939	8,827	152,087	7,931
Gem stones					[12]	2	[12]	1
Lead (recoverable content of ores, etc.)	4,544	1,354	3,832	1,203	2,970	849	1,610	377
Lime—thousand short tons	644	9,416	[4]	[4]	[4]	[4]	[4]	[4]
Natural gas—million cubic feet	8,033	1,036	6,177	933	9,647	1,495	[6] 12,983	[6] 1,921
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	[4]	[4]	[4]	[4]	[4]	[4]	22,380	1,645
LP-gases—do	[4]	[4]	[4]	[4]	[4]	[4]	353,129	20,866
Peat	[4]	[4]	14,451	158	11,480	106	11,588	72
Petroleum (crude)—thousand 42-gallon barrels	81,423	236,940	82,346	241,274	77,083	240,499	[6] 82,125	[6] 246,375
Sand and gravel—thousand short tons	26,362	28,139	31,239	33,254	30,151	32,572	29,866	33,453
Silver (recoverable content of ores, etc.)—thousand troy ounces	3	3	2	1				
Stone—thousand short tons	28,866	35,621	31,855	40,859	31,861	41,835	35,016	44,245
Zinc (recoverable content of ores, etc.)	21,700	5,338	24,039	6,587	22,185	5,147	24,940	5,088
Value of items that cannot be disclosed: Tripoli, and values indicated by footnote 4		12,666		26,048		[8] 27,898		9,573
Total Illinois [9]		[8] 532,984		[8] 572,247		[8] 576,324		582,412

INDIANA

Abrasive stones	[4]	[4]	3	$5	4	$8	10	$10
Clays—thousand short tons	1,729	$2,938	2,051	3,457	1,475	2,569	1,371	2,477
Coal—do	16,149	58,000	17,089	64,061	15,841	62,055	15,022	58,506
Lime—do	[4]	[4]	[18]	1				
Marl, calcareous (except for cement)	17,080	10	99,561	66	[20]	[20]	[20]	[20]
Natural gas—million cubic feet	1,226	152	791	96	671	88	[6] 378	[6] 59
Peat	[4]	[4]	11,383	79	13,805	130	12,106	145
Petroleum (crude)—thousand 42-gallon barrels	10,988	31,980	11,513	33,733	12,662	39,632	[6] 11,864	[6] 35,711
Sand and gravel—thousand short tons	17,082	14,306	18,302	15,432	16,750	14,206	16,862	15,045

Stone ..... do	14,124	34,680	14,700	31,575	14,460	33,094	15,394	31,974
Value of items that cannot be disclosed: Cement, gypsum, and values indicated by footnote 4		[8] 43,618		[8] 50,284		[8] 48,417		56,397
Total Indiana [9]		[8] 183,209		[8] 196,439		[8] 198,034		197,677
IOWA								
Cement ..... thousand 376-pound barrels ..	10,430	$29,539	10,760	$32,823	10,823	$34,881	12,675	$41,741
Clays ..... thousand short tons ..	(4)	(4)	[5] 852	[5] 1,078	[5] 752	[5] 944	[5] 837	[5] 1,054
Coal ..... do	1,258	4,402	1,358	4,732	1,312	4,543	1,179	4,147
Gypsum ..... do	1,337	4,177	1,177	3,919	1,123	3,773	1,230	4,491
Peat	(4)	(4)	27,375	(4)	(4)	(4)	(4)	(4)
Sand and gravel ..... thousand short tons ..	11,771	8,345	12,895	9,525	12,042	8,927	12,411	10,965
Stone ..... do	15,705	18,555	14,035	17,256	15,214	18,768	21,045	26,138
Value of items that cannot be disclosed: Fire clay (1956–58), lime, and values indicated by footnote 4		1,252		467		614		633
Total Iowa [9]		63,555		66,529		68,985		85,356
KANSAS								
Cement [21] ..... thousand 376-pound barrels ..	9,454	$25,854	10,598	$30,696	8,178	$24,814	9,600	$30,047
Clays ..... thousand short tons ..	[5] 768	[5] 873	977	1,169	909	1,240	875	1,145
Coal ..... do	742	3,166	884	3,856	749	3,331	823	3,711
Helium ..... thousand cubic feet ..	42,750	663	45,035	698	36,743	570	27,888	432
Lead (recoverable content of ores, etc.)	5,498	1,638	7,635	2,398	4,257	1,217	1,299	304
Natural gas ..... million cubic feet ..	471,041	52,286	526,091	59,448	586,690	66,883	[6] 561,816	[6] 64,047
Natural-gas liquids:								
Natural gasoline ..... thousand gallons ..	118,599	6,318	105,482	5,928	119,247	6,569	110,293	6,229
LP-gases ..... do	92,596	2,643	90,287	3,843	103,494	4,042	115,175	5,193
Petroleum (crude) ..... thousand 42-gallon barrels ..	121,669	340,670	124,204	346,529	123,614	372,078	[6] 118,188	[6] 354,564
Pumice ..... thousand short tons ..	2	60	(4)	(4)	(4)	(4)	(4)	(4)
Salt (common) ..... do	911	8,432	1,004	9,167	1,018	10,353	1,073	11,348
Sand and gravel ..... do	10,665	6,910	12,515	8,022	9,345	6,175	10,317	6,769
Stone ..... do	12,483	15,946	13,434	15,703	[7] 10,412	[7] 11,926	[7] 12,424	[7] 15,036
Zinc (recoverable content of ores, etc.)	27,611	6,792	28,665	7,854	15,859	3,679	4,421	902
Value of items that cannot be disclosed: Natural cement, fire clay (1955), gypsum, stone (dimension and crushed sandstone, 1957–58), and values indicated by footnote 4		1,616		1,465		1,191		1,627
Total Kansas [9]		470,830		493,770		[8] 511,513		498,526

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

KENTUCKY

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays thousand short tons	876	$4,416	905	$4,079	894	$3,915	737	$2,957
Coal do	69,020	288,665	74,555	331,358	74,667	338,109	66,312	289,385
Fluorspar	8,899	308	14,865	608	20,626	979	25,861	1,201
Lead (recoverable content of ores, etc.)			228	72	411	118	516	121
Natural gas million cubic feet	73,214	17,352	73,687	17,022	70,024	16,666	[6] 72,248	[6] 17,412
Natural-gas liquids:								
Natural gasoline thousand gallons	34,991	2,492	35,275	2,414	34,956	1,935	37,926	2,165
LP-gases do	189,247	6,451	248,992	8,709	176,033	7,403	150,655	8,491
Petroleum (crude) thousand 42-gallon barrels	15,518	44,850	17,628	51,297	17,029	53,301	[6] 17,509	[6] 51,652
Sand and gravel thousand short tons	4,899	5,298	5,684	5,974	4,482	4,556	4,685	4,835
Stone do	11,934	15,579	11,553	15,324	12,718	16,714	12,597	17,360
Zinc (recoverable content of ores, etc.)			417	114	837	194	1,258	257
Value of items that cannot be disclosed: Native asphalt (1955–57), cement, iron ore (1956), and silver (1956–58)		6,446		7,079		6,211		7,059
Total Kentucky [9]		391,068		443,168		[8] 449,390		402,121

LOUISIANA

Clays [5] thousand short tons	651	$659	785	$785	642	$642	755	$755
Gypsum do	335	587	276	598	(4)	(4)	(4)	(4)
Natural gas million cubic feet	1,680,032	189,844	1,886,302	215,038	2,078,901	232,837	[6] 2,451,587	[6] 316,255
Natural-gas liquids:								
Natural gasoline and cycle products thousand gallons	782,328	59,158	773,949	62,394	775,009	63,956	783,099	50,371
LP-gases do	291,138	10,323	305,222	14,727	335,142	14,888	410,869	21,435
Petroleum (crude) thousand 42-gallon barrels	271,010	793,280	299,421	877,951	329,896	1,094,402	[6] 312,070	[6] 1,017,562
Salt (common) thousand short tons	3,563	15,407	3,704	17,695	3,461	18,944	3,442	18,960
Sand and gravel do	8,574	10,942	15,074	18,640	12,579	14,730	15,061	17,119
Stone do	3,253	4,961	4,405	6,674	4,383	7,152	5,453	9,532
Sulfur (Frasch-process) thousand long tons	2,072	58,028	2,239	59,330	2,156	52,690	2,028	47,651
Value of items that cannot be disclosed: Cement, bentonite, lime, and values indicated by footnote 4		[8] 15,096		[8] 16,348		[8] 18,966		20,475
Total Louisiana [10]		[8] 1,156,424		[8] 1,288,116		[8] 1,517,522		1,517,415

MAINE

Beryllium concentrate—gross weight	22	$13	12	$7	4	$2	[10]	[11]
Cement—thousand 376-pound barrels	2,349	6,875	[4]	[4]	[4]	[4]	[4]	[4]
Clays—thousand short tons	33	33	26	23	30	28	23	$26
Feldspar—long tons	26,282	189	22,219	144	14,330	92	13,034	83
Gem stones	[12]	5	[12]	1	[12]	1	[12]	5
Lime—thousand short tons	[4]	[4]	12	179	[4]	[4]	[4]	[4]
Mica: Scrap	71	2	114	3	6	[11]	104	3
Sheet—pounds	21,121	129	19,913	146	25,453	202	20,097	278
Peat	[4]	[4]	[4]	[4]	3,770	175	[4]	[4]
Sand and gravel—thousand short tons	7,529	2,855	7,196	3,085	8,037	3,099	8,941	3,746
Stone—do	1,192	2,542	947	2,787	889	3,076	880	2,760
Value of items that cannot be disclosed: Columbium-tantalum concentrate (1955–56), slate (1955–57), and values indicated by footnote 4		857		6,912		6,617		6,363
Total Maine [10]		12,991		12,728		12,711		12,574

MARYLAND

Clays—thousand short tons	698	$1,265	[5] 636	[5] $1,046	[5] 631	[5] $963	[5] 605	$815
Coal—do	512	2,002	669	2,685	748	3,082	838	3,161
Gem stones	[12]	[4]	[12]	[4]	[12]	[4]	[12]	2
Lime—do	74	669	53	581	[4]	[4]	[4]	[4]
Natural gas—million cubic feet	3,116	626	4,619	1,169	4,649	1,218	[6] 4,266	[6] 1,148
Sand and gravel—thousand short tons	9,695	12,211	10,147	12,395	8,679	11,594	7,864	10,312
Stone—do	[7] 5,343	[7] 8,800	6,229	13,305	6,140	13,392	6,721	14,387
Value of items that cannot be disclosed: Beryllium concentrate (1955–57), cement, ball clay (1956–58), gem stones (1956–58), greensand marl, mica (1957), potassium salts, slate (1955), stone (oystershell 1955), talc and soapstone, and values indicated by footnote 4		11,025		10,729		10,664		16,224
Total Maryland [9]		35,488		40,534		[8] 39,625		44,679

MASSACHUSETTS

Clays—thousand short tons	125	$142	128	$213	78	$98	85	$111
Lime—do	135	1,957	134	2,093	137	2,233	139	2,121
Peat	[4]	[4]	300	[4]	600	[4]	1,014	[4]
Sand and gravel—thousand short tons	9,581	8,926	10,189	9,520	9,900	9,691	10,620	10,035
Stone—do	4,128	11,381	5,442	13,753	4,877	13,165	4,649	12,354
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 4		6		3		6		9
Total Massachusetts [10]		22,109		25,085		24,789		23,887

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

MICHIGAN

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement—thousand 376-pound barrels	19,738	$58,048	21,880	$67,798	22,045	$71,606	20,912	$70,432
Clays—thousand short tons	1,938	2,019	2,110	2,401	1,842	1,982	1,663	1,813
Copper (recoverable content of ores, etc.)	50,066	37,349	61,526	52,297	58,400	35,157	58,005	30,511
Gypsum—thousand short tons	1,762	5,661	1,716	5,861	1,386	4,823	1,331	4,824
Iron ore (usable)—thousand long tons, gross weight	14,144	104,258	12,536	98,111	13,123	111,484	8,111	69,845
Magnesium compounds from well brines (partly estimated) MgO equivalent	46,336	5,064	(4)	(4)	(4)	(4)	(4)	(4)
Manganiferous ore (5 to 35 percent Mn)—gross weight	119,313	57	157,246	95	123,547	(4)	112,536	(4)
Marl, calcareous (except for cement)	8,300	955	10,911	1,451	(20)	(20)	(20)	(20)
Natural gas—million cubic feet					9,122	1,715	[6] 14,243	[6] 2,649
Natural-gas liquids:								
Natural gasoline—thousand gallons	(4)	(4)	(4)	(4)	(4)	(4)	382	28
LP-gases—do	(4)	(4)	(4)	(4)	(4)	(4)	2,754	112
Peat	(4)	(4)	31,111	475	80,271	1,406	107,342	1,684
Petroleum (crude)—thousand 42-gallon barrels	11,266	32,900	10,740	30,824	10,169	31,117	[6] 9,307	[6] 27,363
Salt (common)—thousand short tons	4,975	31,668	5,548	35,644	5,225	41,073	4,267	33,018
Sand and gravel—do	37,214	29,491	42,150	35,146	41,838	35,144	39,871	34,616
Silver (recoverable content of ores, etc.)—thousand troy ounces	478	433	380	344	430	389		
Stone—thousand short tons	33,636	28,909	33,999	31,010	34,495	34,176	27,188	26,846
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, gem stones (1955–57), lime, magnesium chloride for metal (1955), potassium salts, and values indicated by footnote 4		31,841		38,737		[8] 40,324		45,418
Total Michigan [9]		363,778		394,556		[8] 404,673		343,483

MINNESOTA

Clays—thousand short tons	(4)	(4)	[5] 80	[5] $91	[5] 97	[5] $113	93	$150
Iron ore (usable)—thousand long tons, gross weight	69,419	$465,170	62,637	461,904	67,656	541,474	42,503	354,528
Manganiferous ore (5 to 35 percent Mn)—gross weight	864,628	(4)	633,919	(4)	692,295	(4)	370,603	(4)
Marl, calcareous (except for cement)	(4)	(4)	875	(4)	(20)	(20)	(20)	(20)
Peat	(4)	(4)	(4)	(4)	1,300	(4)	(4)	(4)
Sand and gravel—thousand short tons	25,896	17,429	28,197	18,254	28,493	19,385	29,634	21,680
Stone—do	[7] 3,005	[7] 7,043	[7] 3,084	[7] 7,552	[7] 2,968	[7] 8,175	3,519	9,560

Value of items that cannot be disclosed: Abrasive stones, cement, fire clay (1956–57), gem stones, lime, manganese ore (1955–57), stone (crushed sandstone, 1955–57, calcareous marl 1957), and values indicated by footnote 4		11,739		13,443		[8] 15,107		10,154
Total Minnesota [19]		501,151		501,027		[8] 584,037		395,880
MISSISSIPPI								
Clays	thousand short tons	701	$3,913	613	$3,590	616	$3,635	576	$3,338
Iron ore	thousand long tons			(22)	(11)	(22)	1	(22)	(11)
Natural gas	million cubic feet	163,167	15,664	185,137	18,143	169,967	17,507	[6] 160,143	[6] 22,260
Natural-gas liquids:									
Natural gasoline and cycle products	thousand gallons	22,382	1,573	24,829	1,751	25,152	1,469	25,738	1,658
LP-gases	do	12,242	396	10,698	580	10,044	472	9,208	503
Petroleum (crude)	thousand 42-gallon barrels	37,741	92,840	40,824	100,019	38,922	113,263	[6] 38,551	[6] 110,256
Sand and gravel	thousand short tons	5,625	4,603	5,315	4,701	5,172	4,344	6,545	6,240
Stone	do	573	573	656	656	[7] 60	[7] 54	[7] 102	[7] 92
Value of items that cannot be disclosed: Certain metals and nonmetals			3,590		4,174		4,694		4,820
Total Mississippi [19]			122,620		133,098		[8] 144,950		148,663
MISSOURI									
Barite		363,692	$4,004	381,642	$4,462	317,350	$3,938	199,268	$2,666
Cement	thousand 376-pound barrels	[14] 12,255	[14] 34,912	[14] 12,012	[14] 36,888	[14] 10,794	[14] 34,307	12,116	40,657
Clays	thousand short tons	2,402	6,902	2,658	8,016	2,648	7,648	2,060	5,986
Coal	do	3,232	12,772	3,283	13,223	2,976	12,691	2,592	11,111
Copper (recoverable content of ores, etc.)		1,722	1,285	1,890	1,606	1,604	966	1,429	752
Iron ore (usable)	thousand long tons, gross weight	261	(4)	365	(4)	530	4,625	387	3,820
Lead (recoverable content of ores, etc.)		125,412	37,373	123,783	38,868	126,345	36,135	113,123	26,471
Lime	thousand short tons	1,465	14,408	1,482	15,814	1,393	16,475	1,173	14,136
Natural gas	million cubic feet	15	3	12	2	12	2		
Nickel (content of ore and concentrate)		(4)	(4)	(4)	(4)	(4)	(4)	763	(4)
Petroleum (crude)	thousand 42-gallon barrels	72	190	65	176	(4)	(4)	(4)	(4)
Sand and gravel	thousand short tons	9,984	9,981	9,585	10,117	8,480	8,942	8,972	9,728
Silver (recoverable content of ores, etc.)	thousand troy ounces	269	243	295	267	184	166	251	227
Stone	thousand short tons	[7] 22,369	[7] 29,580	24,578	33,577	22,098	29,836	24,276	32,878
Zinc (recoverable content of ores, etc.)		4,476	1,101	4,380	1,200	2,951	685	362	74
Value of items that cannot be disclosed: Native asphalt, masonry cement (1955–57), cobalt, gem stones (1957), iron oxide pigment materials (1955–56), manganese ore (1957–58), stone (dimension marble 1955), and values indicated by footnote 4			4,833		5,897		[8] 2,793		1,926
Total Missouri [9]			151,626		163,693		[8] 152,913		144,009

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

MONTANA

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Chromite—gross weight	118,703	$3,719	118,780	$3,807	119,149	$3,921	119,057	(4)
Clays—thousand short tons	(4)	(4)	[5] 33	[5] 31	[5] 32	[5] 24	[5] 23	[5] $19
Coal: Bituminous and lignite—do	1,247	3,782	846	3,468	413	2,161	305	1,475
Copper (recoverable content of ores, etc.)	81,542	60,830	98,426	81,962	91,512	55,090	90,683	47,699
Fluorspar	25,223	(4)	59,775	(4)	64,339	(4)	53,654	(4)
Gem stones	(12)	(4)	(12)	35	(12)	(4)	(12)	(4)
Gold (recoverable content of ores, etc.)—troy ounces	28,123	984	38,121	1,334	32,766	1,147	26,003	910
Iron ore (usable)—thousand long tons, gross weight	7	(4)	12	(4)	36	(4)	14	(4)
Lead (recoverable content of ores, etc.)	17,028	5,075	18,642	5,853	13,300	3,804	8,434	1,974
Manganese ore (35 percent or more Mn)—gross weight	106,026	(4)	80,552	(4)	68,298	(4)	53,123	4,036
Manganiferous ore (5 to 35 percent Mn)—do	6,341	(4)	4,752	(4)	4,547	(4)	(4)	(4)
Mica, sheet—pounds			56	1	13	(11)	(4)	(4)
Natural gas—million cubic feet	28,255	1,724	25,847	1,758	28,638	2,062	[6] 27,989	[6] 1,903
Petroleum (crude)—thousand 42-gallon barrels	15,654	35,380	21,760	56,141	27,172	73,364	[6] 28,291	[6] 74,971
Phosphate rock—thousand long tons	(4)	(4)	558	3,957	534	3,825	(4)	(4)
Sand and gravel—thousand short tons	13,772	6,615	10,024	7,174	[8] 11,403	[8] 8,732	13,432	12,593
Silver (recoverable content of ores, etc.)—thousand troy ounces	6,080	5,503	7,386	6,685	5,558	5,030	3,630	3,286
Stone—thousand short tons	1,274	1,200	1,247	1,816	2,567	3,654	1,545	2,214
Talc	(4)	(4)	22,197	210	(4)	(4)	(4)	(4)
Tungsten ore and concentrate—60-percent WO_3 basis	1,211	(4)	1,230	(4)	661	(4)		
Uranium ore			(4)	(4)	(4)	(4)	689	20
Zinc (recoverable content of ores, etc.)	68,588	16,873	70,520	19,322	50,520	11,721	33,238	6,780
Value of items that cannot be disclosed: Barite, cement, clay (bentonite, 1956; bentonite and fire clay, 1957–58), gypsum, lime, natural-gas liquids, pumice (1955–56), pyrites, vanadium (1957), vermiculite, and values indicated by footnote 4		25,637		[8] 21,056		[8] 17,951		20,200
Total Montana [10]		166,993		[8] 213,704		[8] 191,750		177,240

NEBRASKA

Clays—thousand short tons	151	$151	153	$154	134	$135	108	$110
Gem stones	(12)	2	(12)	3	(12)	2	(12)	2
Natural gas—million cubic feet	12,515	2,553	13,541	2,844	14,249	2,280	[6] 11,405	[6] 1,711
Natural-gas liquids:								
Natural gasoline—thousand gallons	(4)	(4)	(4)	(4)	(4)	(4)	10,870	727
LP-gases—do	(4)	(4)	(4)	(4)	(4)	(4)	31,178	1,565
Petroleum (crude)—thousand 42-gallon barrels	11,203	30,810	16,204	45,209	19,586	58,366	[6] 20,368	[6] 59,882

Sand and gravel	thousand short tons	8,405	6,193	10,350	7,404	7,944	5,889	10,441	7,945
Stone	do	3,081	4,177	3,063	4,142	3,065	3,749	3,555	4,747
Value of items that cannot be disclosed: Cement and pumice			11,144		12,771		13,670		14,603
Total Nebraska [9]			54,237		71,311		[8] 82,928		90,032

NEVADA

Antimony ore and concentrate	antimony content			13	(4)	29	$9	39	$8
Barite		113,694	$709	178,440	$1,067	109,663	721	59,407	405
Clays	thousand short tons	6	13	14	32	12	20	(4)	(4)
Copper (recoverable content or ores, etc.)		78,925	58,878	80,824	68,700	77,750	46,806	66,137	34,788
Fluorspar		(4)	(4)	(4)	(4)	(4)	(4)	12,338	340
Gem stones		(12)	(4)	(12)	50	(12)	100	(12)	100
Gold (recoverable content of ores, etc.)	troy ounces	72,913	2,552	68,040	2,381	76,752	2,680	105,087	3,678
Gypsum	thousand short tons	837	2,836	790	2,701	674	(4)	686	2,306
Iron ore (usable)	thousand long tons, gross weight	325	1,667	917	5,021	904	5,341	594	3,149
Lead (recoverable content of ores, etc.)		3,291	981	6,384	2,004	5,979	1,710	4,150	971
Manganese ore (35 percent or more Mn)	gross weight	101,469	(4)	121,482	(4)	129,046	(4)	127,322	7,566
Mercury	76-pound flasks	5,750	1,669	5,859	1,523	6,313	1,559	7,336	1,681
Petroleum	thousand 42-gallon barrels	64	110	64	111	44	76	[6] 40	[6] 69
Pumice	thousand short tons	(4)	(4)	12	34	(4)	(4)	(4)	(4)
Sand and gravel	do	3,580	3,762	4,087	4,569	5,233	5,190	5,503	5,311
Silver (recoverable content of ores, etc.)	thousand troy ounces	845	765	994	899	959	868	933	844
Stone	thousand short tons	1,612	2,609	1,401	2,281	925	1,585	813	1,335
Talc and soapstone		10,732	79	10,540	98	7,467	57	5,391	41
Tungsten concentrate	60-percent WO_3 basis	6,155	22,751	5,400	19,263	1,196	1,676	(4)	(4)
Zinc (recoverable content of ores, etc.)		2,670	657	7,488	2,052	5,292	1,228	91	19
Value of items that cannot be disclosed: Brucite (1956–58), diatomite, lime, magnesite, calcareous marl (1955–56), molybdenum, perlite, salt, sulfur ore, uranium (1956–58), and values indicated by footnote 4			13,752		14,446		16,756		6,020
Total Nevada [10]			113,220		126,681		86,023		68,293

NEW HAMPSHIRE

Beryllium concentrate	gross weight	20	$12	(4)	(4)	4	$2	14	$8
Clays	thousand short tons	35	35	36	$47	37	51	26	26
Gem stones		(12)	5	(12)	1	(12)	(11)	(12)	5
Mica:									
Sheet	pounds	(4)	(4)	50,873	178	53,554	460	75,173	604
Scrap		(4)	(4)	305	10	522	17	314	12
Peat		(4)	(4)	320	(4)	85	(4)	100	(4)
Sand and gravel	thousand short tons	2,432	1,593	3,862	1,822	4,505	1,970	4,940	2,620
Value of items that cannot be disclosed: Abrasive stones (1955–57), columbium-tantalum concentrate (1955), feldspar, stone, and values indicated by footnote 4			960		1,378		831		602
Total New Hampshire			2,605		3,436		3,331		3,877

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TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

NEW JERSEY

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays—thousand short tons	644	$1,562	[5] 651	[5] $2,214	[5] 593	[5] $1,872	684	$2,181
Gem stones	(12)	(4)	(12)	(4)	(12)	(4)	(12)	4
Iron ore (usable)—thousand long tons, gross weight	760	13,633	912	16,842	877	16,668	(4)	(4)
Manganiferous residuum—gross weight	213,370	(4)	130,129	(4)	(4)	(4)	(4)	(4)
Peat	(4)	(4)	(4)	(4)	(4)	(4)	18,397	185
Sand and gravel—thousand short tons	11,153	16,425	11,194	18,239	10,323	17,619	9,877	16,145
Stone—do	[7] 8,358	[7] 17,528	9,012	20,825	8,792	21,222	8,229	19,193
Zinc (recoverable content of ores, etc.)[23]	11,643	2,864	4,667	1,260	12,530	2,857	607	125
Value of items that cannot be disclosed: Ball clay (1956–57), lime, magnesium compounds, greensand marl, stone (crushed marble, 1955), and values indicated by footnote 4. Excludes limestone used in manufacturing lime		5,239		4,608		[8] 4,404		12,547
Total New Jersey		[8] 57,251		[8] 63,988		[8] 64,642		50,380

NEW MEXICO

Barite	(4)	(4)	4,059	$81	4,441	$98	(4)	(4)
Beryllium concentrate—gross weight	106	$56	31	(4)	29	15	27	$16
Clays—thousand short tons	45	109	40	95	33	83	[5] 40	[5] 73
Coal—do	202	1,236	158	923	137	829	117	719
Columbium-tantalum concentrate—pounds	76	(11)	95	(11)	866	1		
Copper (recoverable content of ores, etc.)	66,417	49,547	74,345	63,193	67,472	40,618	55,540	29,214
Gem stones	(12)	25	(12)	30	(12)	30	(12)	28
Gold (recoverable content of ores, etc.)—troy ounces	1,917	67	3,275	115	3,212	112	3,378	118
Helium—thousand cubic feet	53,721	946	76,072	1,350	69,336	1,189	29,793	502
Iron ore (usable)—thousand long tons, gross weight	9	(4)	(4)	(4)	(22)	1	(22)	(4)
Lead (recoverable content of ores, etc.)	3,296	982	6,042	1,897	5,294	1,514	1,117	261
Lime—thousand short tons			31	373	24	290	21	260
Manganese ore (35 percent or more Mn)—gross weight	1,390	(4)	22,011	1,834	25,459	2,114	24,665	1,996
Manganiferous ore (5 to 35 percent Mn)—do	40,320	(4)	38,782	(4)	42,535	152	(4)	(4)
Mica:								
Scrap	84	3	767	22	1,347	47	787	24
Sheet—pounds	9,431	65	6,247	53	2,134	16	1,791	18
Natural gas—million cubic feet	540,664	48,119	626,340	55,118	723,004	67,962	[6] 761,446	[6] 79,190

Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	261,023	15,425	306,595	16,560	309,010	19,941	258,312	15,131
LP-gases—do	278,403	6,767	308,218	11,065	375,930	13,046	458,178	17,331
Perlite	147,805	1,091	167,705	1,271	187,259	1,568	202,046	1,790
Petroleum (crude)—thousand 42-gallon barrels	82,958	227,310	87,893	241,706	94,759	283,128	[6] 98,323	[6] 293,400
Potassium salts—thousand short tons, K_2O equivalent	1,899	71,839	1,997	75,122	2,080	77,197	1,978	69,106
Pumice—thousand short tons	394	780	292	667	321	756	507	959
Salt (common)—do	50	597	58	501	53	429	31	275
Sand and gravel—do	4,556	6,005	6,054	5,776	7,991	7,803	13,205	11,413
Silver (recoverable content of ores, etc.)—thousand troy ounces	251	227	393	356	309	280	159	144
Stone—thousand short tons	1,573	1,547	1,268	1,272	1,348	1,618	1,730	1,507
Tungsten ore and concentrate—60-percent WO_3 basis	1	3	[10]	2				
Uranium ore			1,105,183	24,086	1,175,742	20,538	1,888,499	32,264
Zinc (recoverable content of ores, etc.)	15,277	3,758	35,010	9,593	32,680	7,582	9,034	1,843
Value of items that cannot be disclosed: Carbon dioxide, fire clay (1957), diatomite (1955), fluorspar (1955), molybdenum, magnesium compounds (1956–58), rare-earth metals concentrates (1956), vanadium, and values indicated by footnote 4		[8] 2,045		[8] 1,933		[8] 2,276		1,345
Total New Mexico [10]		[8] 438,549		[8] 514,903		[8] 551,155		558,866
NEW YORK								
Cement—thousand 376-pound barrels	[21] 17,942	[21] $52,150	[4]	[4]	[4]	[4]	[4]	[4]
Clays—thousand short tons	1,394	1,676	1,235	$1,508	1,002	$1,270	1,085	$1,419
Emery	10,735	151	12,153	174	11,893	184	7,687	126
Gem stones	[12]	[4]	[12]	2	[12]	5	[12]	8
Gypsum—thousand short tons	1,249	4,404	1,140	4,817	864	3,749	834	3,869
Iron ore (usable)—thousand long tons, gross weight	3,202	38,019	3,188	41,094	3,329	44,567	1,944	25,683
Lead (recoverable content of ores, etc.)	1,037	309	1,608	505	1,667	477	579	135
Lime—thousand short tons	83	1,366	87	1,030	[4]	[4]	[4]	[4]
Natural gas—million cubic feet	3,637	1,073	4,098	1,160	2,869	815	[6] 2,808	[6] 859
Peat	[4]	[4]	2,900	23	[4]	[4]	13,606	117
Petroleum (crude)—thousand 42-gallon barrels	2,904	10,310	2,748	12,091	2,677	12,662	[6] 1,664	[6] 7,039
Salt (common)—thousand short tons	3,780	25,214	3,873	27,545	3,691	28,002	3,896	30,609
Sand and gravel—do	25,562	25,542	27,815	28,722	25,640	26,480	24,730	27,541
Silver (recoverable content of ores, etc.)—thousand troy ounces	66	60	84	76	64	58	67	60
Slate—thousand short tons	91	1,345	64	944	59	961	[13]	[13]
Stone—do	22,812	37,919	22,805	36,135	24,265	43,276	22,598	38,219
Zinc (recoverable content of ores, etc.)	53,016	13,042	59,111	16,196	64,659	15,001	53,014	10,815
Value of items that cannot be disclosed: Natural cement (1955 and 1958), abrasive garnet, iron oxide pigments, talc, titanium concentrate, wollastonite, and values indicated by footnote 4		8,773		68,969		70,699		61,859
Total New York [9]		216,907		237,016		[8] 244,114		204,920

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

NORTH CAROLINA

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stones	[24] 227	$12	[24] 454	$16	(12)	[25] $5	(12)	[25] $2
Beryllium concentrate—gross weight	(4)	(4)	3	2	1	1	(10)	(11)
Clays—thousand short tons	2,375	1,792	2,663	2,027	[5] 2,392	[5] 1,407	[5] 2,046	[5] 1,187
Feldspar—long tons	242,724	2,185	255,637	3,192	233,439	2,728	(4)	(4)
Gem stones	(12)	(11)	(12)	1	(12)	(11)	(12)	1
Gold (recoverable content of ores, etc.)—troy ounces	190	7	882	31	1,373	48	876	31
Lead (recoverable content of ores, etc.)	2	1	10	3	9	3		
Mica:								
Scrap	60,887	1,377	47,125	1,065	53,452	1,173	50,897	1,041
Sheet—pounds	553,444	2,745	770,903	2,135	577,607	1,575	521,701	1,722
Sand and gravel—thousand short tons	7,786	5,911	7,581	6,264	6,829	5,724	7,044	5,880
Silver (recoverable content of ores, etc.)—thousand troy ounces	(26)	(11)	1	1	12	11	15	14
Stone—thousand short tons	10,903	16,533	[7] 8,352	[7] 11,472	[7] 9,455	[7] 12,839	12,385	19,132
Talc and pyrophyllite	125,206	572	125,487	529	120,905	558	126,158	614
Tungsten concentrate—60-percent WO_3 basis	2,609	(4)	2,732	(4)	1,828	(4)	(4)	(4)
Zinc					2	(11)		
Value of items that cannot be disclosed: Abrasive stone (grinding pebbles and tube-mill liners, 1957–58), asbestos (1955, 1957–58), clay (bentonite 1957, kaolin 1958), copper, lithium minerals, olivine, slate (1957), stone (crushed and dimension granite, crushed limestone, crushed miscellaneous, and dimension sandstone, 1956; dimension granite, crushed basalt, dimension and crushed marble, crushed limestone, and crushed sandstone 1957), vermiculite (1955), and values indicated by footnote 4		10,075		14,135		11,498		10,267
Total North Carolina		41,210		40,873		37,570		39,891

NORTH DAKOTA

Clays—thousand short tons	(4)	(4)	[5] 52	[5] $71	[5] 54	[5] $67	[5] 54	[5] $66
Coal (lignite)—do	3,102	$7,261	2,815	6,578	2,561	5,947	2,314	5,409
Gem stones					(12)	(11)	(12)	1
Natural gas—million cubic feet	5,256	405	11,725	950	15,450	1,468	[6] 17,325	[6] 1,672
Petroleum (crude)—thousand 42-gallon barrels	11,143	32,200	13,495	39,136	13,259	41,501	[6] 14,141	[6] 42,282
Pumice—thousand short tons	4	10	5	5	2	2	11	11
Sand and gravel—do	11,169	2,638	5,946	4,259	7,048	4,967	11,464	6,605
Stone—do	77	80	83	87	29	52	23	35

Value of items that cannot be disclosed: Clays (bentonite), natural gas liquids, and values indicated by footnote 4		1,529		2,423		2,698		3,012
Total North Dakota		44,123		[8] 53,509		[8] 56,702		59,093
OHIO								
Abrasive stones, grindstones and pulpstones	(4)	(4)	(4)	(4)	1,505	$132	852	$83
Cement thousand 376-pound barrels	14,914	$42,966	16,065	$49,794	16,238	52,184	15,700	53,043
Clays thousand short tons	6,297	15,677	6,703	17,675	6,136	16,073	5,220	13,082
Coal do	37,870	133,814	38,934	148,650	36,862	146,134	32,028	126,241
Lime do	3,039	39,394	2,995	40,805	2,763	38,383	2,411	32,471
Natural gas million cubic feet	33,756	7,595	25,368	6,088	30,384	7,201	31,786	6,802
Peat	22,484	249	15,509	174	5,478	102	5,660	104
Petroleum (crude) thousand 42-gallon barrels	4,353	12,580	4,785	15,025	5,478	17,694	[6] 6,260	[6] 18,091
Salt (common) thousand short tons	2,905	14,769	2,972	15,923	2,825	16,936	2,443	17,443
Sand and gravel do	27,906	31,995	30,200	36,146	30,596	37,503	29,624	36,619
Stone do	33,273	49,841	[7] 33,418	[7] 50,947	[7] 37,451	[7] 61,847	29,122	49,782
Value of items that cannot be disclosed: Calcium-magnesium chloride (1955–56), gypsum, natural gasoline, stone (crushed sandstone, 1956; dimension limestone and calcareous marl, 1957), and values indicated by footnote 4		[8] 2,864		5,394		[8] 2,453		1,905
Total Ohio [9]		[8] 340,456		375,488		[8] 383,000		344,856
OKLAHOMA								
Clays thousand short tons	[5] 724	[5] $727	[5] 705	[5] $701	[5] 641	[5] $642	[5] 576	[5] $579
Coal do	2,164	12,668	2,007	12,341	2,195	14,165	1,629	10,858
Lead (recoverable content of ores, etc.)	14,126	4,209	12,350	3,878	7,183	2,054	3,692	864
Natural gas million cubic feet	614,976	45,508	678,603	54,288	719,794	59,743	[6] 696,504	[6] 70,347
Natural-gas liquids:								
Natural gasoline and cycle products thousand gallons	504,692	28,770	489,963	26,543	460,644	25,329	440,798	26,029
LP-gases do	512,320	14,297	579,101	23,427	587,140	21,824	657,114	25,822
Petroleum (crude) thousand 42-gallon barrels	202,817	563,830	215,862	600,096	214,661	650,423	[6] 202,699	[6] 599,989
Pumice thousand short tons			[18]	3	(4)	(4)	(4)	(4)
Salt (common) do	(4)	(4)	10	90	7	63	4	41
Sand and gravel do	6,294	4,786	5,947	4,842	4,960	4,507	7,232	5,859
Stone do	10,933	12,295	10,547	12,417	12,016	14,064	10,794	12,232
Tripoli	(4)	(4)	(4)	(4)	22,236	67	(4)	(4)
Zinc (recoverable content of ores, etc.)	41,543	10,220	27,515	7,539	14,951	3,469	5,267	1,074
Value of items that cannot be disclosed: Native asphalt, clay (bentonite), cement, gypsum, lime, manganese ore (1957), uranium ore (1956), and values indicated by footnote 4		[8] 15,480		[8] 12,929		[8] 14,573		16,022
Total Oklahoma [9]		[8] 711,044		[8] 757,080		[8] 809,004		767,856

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

OREGON

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Chromite—gross weight	5,341	$463	[27] 54,577	[27] $2,001	7,900	$675	4,133	[4]
Clays—thousand short tons	251	276	257	278	240	266	252	$293
Copper (recoverable content or ores, etc.)	4	3	7	6	23	14	10	5
Gem stones	[12]	[4]	[12]	250	[12]	200	[12]	[4]
Gold (recoverable content of ores, etc.)—troy ounces	1,708	60	2,738	96	3,381	118	1,423	50
Iron ore (usable)—thousand long tons	2	[4]	1	[4]	[22]	[4]		
Lead (recoverable content of ores, etc.)	3	1	5	2	5	1	1	[11]
Mercury—76-pound flasks	1,056	307	1,893	492	3,993	986	2,276	521
Nickel (content of ore and concentrate)	4,181	[4]	6,866	[4]	12,276	[4]	12,697	[4]
Pumice—thousand short tons	[4]	[4]	[4]	[4]	123	294	138	331
Sand and gravel—do	11,954	11,832	11,637	11,647	12,843	13,481	10,464	10,265
Silver (recoverable content of ores, etc.)—thousand troy ounces	9	8	14	12	16	14	3	2
Stone—thousand short tons	7,742	9,418	6,098	7,890	[8] 10,583	[8] 11,745	15,004	15,483
Value of items that cannot be disclosed: Carbon dioxide, cement, diatomite, iron oxide pigments (1956–57), lime (1957–58), sodium carbonate (1956), tungsten concentrate (1955–57), uranium ore (1956–57), and values indicated by footnote 4		10,500		12,689		15,954		19,311
Total Oregon [9]		31,736		34,021		[8] 42,820		45,053

PENNSYLVANIA

Cement—thousand 376-pound barrels	48,090	$141,969	51,964	$162,387	44,680	$148,130	42,115	$142,399
Clays—thousand short tons	4,020	12,413	[5] 4,413	[5] 23,782	4,074	22,012	[5] 3,318	[5] 17,051
Coal:								
Anthracite—do	26,205	206,097	28,900	236,785	25,338	227,754	21,171	187,898
Bituminous—do	85,713	440,452	90,287	479,437	85,365	492,539	67,771	373,812
Cobalt (content of concentrate)—thousand pounds	479	[4]	533	[4]	599	[4]	564	[4]
Gem stones	[12]	[4]	[12]	[4]	[12]	[4]	[12]	2
Gold (recoverable content of ores, etc.)—troy ounces	1,610	56	[4]	[4]	[4]	[4]	[4]	[4]
Iron ore (usable)—thousand long tons, gross weight	838	[4]	[4]	[4]	[4]	[4]	[4]	[4]
Iron oxide pigments (crude)	519	7	600	7	998	9	[4]	[4]
Lime—thousand short tons	1,424	17,632	1,443	18,282	1,298	18,406	1,003	12,457
Natural gas—million cubic feet	99,172	29,652	104,508	33,652	101,801	31,660	95,869	27,131

Natural-gas liquids:								
Natural-gasoline thousand gallons	4,305	281	4,081	251	3,106	192	1,608	107
LP-gases do	995	90	1,127	99	1,211	106	1,363	123
Peat	23,277	220	20,498	213	26,086	236	23,623	203
Petroleum (crude) thousand 42-gallon barrels	8,531	30,200	8,230	35,718	[6] 8,179	[6] 38,687	[6] 6,678	[6] 27,380
Sand and gravel thousand short tons	13,313	20,512	14,047	21,321	12,406	19,570	11,825	19,180
Silver (recoverable content of ores, etc.) thousand troy ounces	10	9	(4)	(4)	(4)	(4)	(4)	(4)
Slate thousand short tons	186	4,421	154	4,194	139	4,005	(13)	(13)
Stone do	44,438	[7] 68,918	[7] 44,913	[7] 73,831	43,258	73,090	40,049	69,694
Tripoli	1,090	6	1,030	7	(4)	(4)	(4)	(4)
Zinc (recoverable content of ores, etc.) [23]							10,812	2,229
Value of items that cannot be disclosed: Clays (kaolin 1956–58), copper, mica, pyrites, pyrophyllite and soapstone, stone (dimension basalt 1956, shell 1956), and values indicated by footnote 4		15,819		16,202		[8] 16,604		15,960
Total Pennsylvania [9]		[8] 969,647		[8] 1,088,481		[8] 1,077,157		881,181
RHODE ISLAND								
Sand and gravel thousand short tons	1,941	$1,498	1,308	$1,263	1,058	$1,060	2,038	$1,883
Stone do	(4)	(4)	42	221	[7] 4	[7] 14	[7] 3	[7] 8
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 4		336		143		295		358
Total Rhode Island		1,834		1,627		1,369		2,249
SOUTH CAROLINA								
Clays thousand short tons	1,086	$5,463	1,087	$5,450	937	$5,161	929	$5,157
Mica (sheet) pounds	(4)	(4)	5,400	14	2,278	12	1,144	8
Peat							4,865	(4)
Sand and gravel thousand short tons	3,127	2,677	3,229	2,926	2,647	2,571	2,946	2,858
Stone do	3,455	4,921	3,304	4,285	[7] 3,413	[7] 4,581	[7] 3,637	[7] 5,229
Zirconium concentrate					(4)	(4)	141	5
Value of items that cannot be disclosed: Barite, cement, kyanite, scrap mica, rare-earth metal concentrates (1956–58), staurolite (1957–58), stone (dimension granite, 1956–57, crushed limestone 1956–58, calcareous marl 1957–58), titanium (1956–58), vermiculite (1955–57) and values indicated by footnote 4		7,400		9,277		10,491		9,586
Total South Carolina [19]		20,197		21,342		22,168		22,412

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States,[2] by States—Continued

SOUTH DAKOTA

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate—gross weight	294	$157	195	$95	268	$145	240	129
Clays—thousand short tons	(4)	(4)	[5] 201	[5] 201	[5] 176	[5] 176	[5] 155	[5] 155
Coal (lignite)—do	26	90	25	90	21	79	20	78
Columbium-tantalum concentrate—pounds	5,638	10	237	(11)	2,311	6	4,294	10
Feldspar—long tons	42,164	267	45,226	289	41,316	267	23,229	145
Gem stones	(12)	7	(12)	10	(12)	15	(12)	16
Gold (recoverable content of ores, etc.)—troy ounces	529,865	18,545	568,523	19,898	568,130	19,885	570,830	19,979
Gypsum—thousand short tons	13	16	16	63	13	53	12	49
Iron ore (usable)—thousand long tons, gross weight	2	(4)	22	100	(22)	(4)		
Mica:								
Scrap	1,322	27	1,268	31	1,626	43	1,003	24
Sheet—pounds	4,854	21	12,494	67	9,093	46	16,772	68
Sand and gravel—thousand short tons	13,538	10,097	12,539	8,423	14,758	8,001	14,705	9,179
Silver (recoverable content of ores, etc.)—thousand troy ounces	154	140	136	123	135	122	153	138
Stone—thousand short tons	2,262	5,680	2,200	5,725	1,718	5,068	1,395	4,095
Uranium ore			35,302	475	69,800	760	35,489	530
Value of items that cannot be disclosed: Cement, clays (bentonite, 1956–58), lime, lithium minerals (1958), petroleum, and values indicated by footnote 4		6,115		7,547		[8] 6,090		7,555
Total South Dakota [9]		40,526		42,281		[8] 39,997		41,534

TENNESSEE

Cement—thousand 376-pound barrels	8,812	$23,673	8,755	$25,435	7,415	$22,806	8,375	$26,408
Clays—thousand short tons	1,208	4,170	1,379	4,888	1,154	4,228	935	4,210
Coal—do	7,053	28,747	8,848	35,609	7,955	31,147	6,785	25,969
Copper (recoverable content of ores, etc.)	9,911	7,394	10,449	8,882	9,790	5,894	9,109	4,791
Gem stones							(12)	1
Gold (recoverable content of ores, etc.)—troy ounces	221	8	189	7	172	6	124	4
Lead (recoverable content of ores, etc.)			5	1				
Lime—thousand short tons	103	1,102	125	1,436	94	1,134	(4)	(4)
Manganese ore (35 percent or more Mn)—gross weight	15,895	1,280	17,821	1,417	12,938	1,007	5,935	452
Natural gas—million cubic feet	39	5	45	6	38	6	[6] 54	[6] 9
Phosphate rock—thousand long tons	1,466	10,526	1,685	11,643	1,812	12,514	1,903	13,041
Sand and gravel—thousand short tons	5,137	5,814	5,629	6,480	5,617	6,641	5,612	6,671
Silver (recoverable content of ores, etc.)—thousand troy ounces	67	60	65	59	54	49	44	40
Stone—thousand short tons	14,381	22,276	[7] 15,556	[7] 23,796	[7] 15,354	[7] 24,155	[7] 16,850	[7] 26,814

Zinc (recoverable content of ores, etc.)	40,216	9,893	46,023	12,610	58,063	13,470	59,130	12,062		
Value of items that cannot be disclosed: Barite, fluorspar (1956–57), iron ore (1955–57), petroleum, pyrites, stone (crushed sand-stone 1956–58, crushed granite 1957, dimension limestone 1958) and values indicated by footnote 4		6,994		8,772		8,029			6,878	
		119,316		137,846		[8] 128,739			124,928	
Total Tennessee [9]										
TEXAS										
Cement:										
thousand 376-pound barrels	24,856	$67,549	25,966	$75,695	22,144	$68,541	25,875		$79,756	
thousand short tons	3,097	5,100	3,146	4,765	2,992	4,934	3,720		5,424	
Clays [5]	1	1		115	(12)	100	(12)		100	
Copper (recoverable content of ores, etc.)	(12)	115	(12)	1,157	1,043	3,343	1,240		4,120	
Gem stones		4,220		3,623		3,353			4,807	
Gypsum:										
thousand short tons	1,349	2,272	145,830	2,364	204,286	(4)	294,462		(4)	
thousand cubic feet	139,397	(4)	(4)	6,938	(4)	7,489	(4)		7,146	
Helium:										
thousand long tons, gross weight	875	5,549	592	434,990	796	500,153	691		517,807	
thousand short tons	585	378,464	4,999,889		5,156,215		5,178,073			
Iron ore (usable)	4,730,798									
million cubic feet										
Lime		206,506	2,964,609	216,378	2,944,381	201,423	2,871,589		204,501	
Natural gas:	2,987,808	110,414	3,731,047	144,745	3,831,664	147,618	3,786,575		151,896	
thousand gallons	3,450,430	2,999,330	1,107,808	3,131,225	1,073,867	3,338,119	[6] 940,706		[6] 2,873,988	
do	1,063,297	12,867	3,963	14,370	4,612	17,104	3,843		15,115	
Natural-gas liquids:										
Natural gasoline and cycle products:										
thousand 42-gallon barrels	3,583	28,480	29,336	27,213	23,685	23,427	32,871		30,808	
LP-gases:										
thousand short tons	31,518	1,099	(4)	(4)	(4)	[8] 36,153	(4)		(4)	
do	46,718	33,544	32,773	36,350	[8] 31,248	70,226	36,076		40,912	
Petroleum (crude)	27,321	105,128	3,437	91,026	2,879	190	2,616		61,621	
Salt (common)	3,767	213	41,332	244	47,780		60,827		168	
Sand and gravel:	35,064									
thousand short tons										
Sodium sulfate:										
thousand long tons										
Stone		50,069		62,354		71,510			50,635	
Sulfur (Frasch-process)		[8] 3,990,166		[8] 4,241,258		[8] 4,484,598			4,038,656	
Talc and soapstone										
Value of items that cannot be disclosed: Abrasive stones (1955–57), native asphalt, bromine, clay, (fuller's earth), coal (lignite), feldspar (1957–58), graphite, magnesium chloride (for metal), magnesium compounds (except for metal), mercury, pumice, silver (1956), uranium ore (1956–58), and values indicated by footnote 4										
Total Texas [9]										
UTAH										
Asphalt and related bitumens, native: Gilsonite:										
thousand short tons	82,822	$3,117	(4)	(4)	[8] 207,704	$4,259	317,280		$4,864	
do	(4)	(4)	[5] 227	[5] $492	[5] 164	[5] 473	[5] 157		[5] 488	
Clays	6,296	40,005	6,522	34,436	6,858	40,263	5,328		30,340	
Coal	232,949	173,780	250,604	213,013	237,857	143,190	189,184		99,511	
Copper (recoverable content of ores, etc.)	7,328	151	10,581	265	11,087	387	16,109		564	
Fluorspar	(12)	6	(12)	10	(12)	12	(12)		40	
Gem stones	441,206	15,442	416,031	14,561	378,438	13,245	307,824		10,774	
Gold (recoverable content of ores, etc.):										
troy ounces	3,847	24,688	4,002	27,508	4,156	30,383	3,514		25,202	
thousand long tons, gross weight	50,452	15,035	49,555	15,560	44,471	12,719	40,355		9,443	
Iron ore (usable)	39	583	55	830	53	821	80		1,513	
Lead (recoverable content of ores, etc.):					142	12	1,043		84	
thousand short tons							12		(11)	
Lime:										
gross weight										
Manganese ore (35 percent or more Mn)										
pounds										
Mica (sheet)										

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States,[2] by States—Continued

UTAH—Continued

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Natural gas—million cubic feet	17,163	$2,386	17,268	$2,435	16,824	$2,473	19,247	[6] $2,829
Natural gasoline—thousand gallons	(4)	(4)	(4)	(4)	(4)	(4)	240	15
Perlite	(4)	(4)	2,271	9	(4)	(4)	(4)	(4)
Petroleum (crude)—thousand 42-gallon barrels	2,227	5,140	2,466	5,302	4,367	9,913	[6] 24,386	[6] 72,914
Phosphate rock	(4)	(4)	125	772	114	756	(4)	(4)
Pumice—thousand long tons	2	20	45	330	36	148	41	84
Salt (common)—thousand short tons	196	1,339	184	1,471	221	2,013	184	2,275
Sand and gravel—do	5,158	3,309	5,836	4,476	26,958	15,485	25,304	14,379
Silver (recoverable content of ores, etc.)—thousand troy ounces	6,251	5,657	6,572	5,948	6,199	5,610	5,278	4,777
Stone—thousand short tons	1,926	2,550	2,322	3,298	7,854	8,540	13,126	13,949
Tungsten ore and concentrate—60-percent WO_3 basis	65	225	11	41				
Uranium ore			926,273	25,214	1,075,759	[8] 32,501	1,239,767	[16] 38,583
Vanadium	996	(4)	1,099	(4)	1,017	(4)	752	(4)
Zinc (recoverable content of ores, etc.)—thousand pounds	43,556	10,715	42,374	11,610	40,846	9,476	44,982	9,176
Value of items that cannot be disclosed: Carbon dioxide, cement, clay (kaolin, 1956–58), gypsum, molybdenum, potassium salts, and values indicated by footnote 4		28,806		33,352		27,651		25,219
Total Utah [19]		332,002		399,759		[8] 359,335		365,960

VERMONT

Clays—thousand short tons	14	$14	(4)	(4)	(4)	(4)	(4)	(4)
Copper (recoverable content of ores, etc.)	4,305	3,212	3,403	$2,893	3,405	$2,050	475	$250
Gem stones	(12)	(4)					(12)	1
Gold (recoverable content of ores, etc.)—troy ounces	181	6	(4)	(4)	(4)	(4)		
Pyrites—thousand long tons	22	(4)	23	107	62	2		
Sand and gravel—thousand short tons	1,763	1,169	1,910	905	10	56		
Silver (recoverable content of ores, etc.)—thousand troy ounces	50	46	(4)	(4)	2,216	1,051	1,882	1,316
Slate—thousand short tons	(4)	(4)	162	3,772	37	33	5	5
Stone—do	582	11,061	621	11,622	(4)	3,269	(13)	(13)
Value of items that cannot be disclosed: Asbestos, lime, talc, and values indicated by footnote 4		8,400		3,915	557	11,404	808	15,789
Total Vermont [19]		23,884		23,131		4,058		4,106
						21,893		21,443

VIRGINIA

Beryllium concentrate	gross weight	(4)	(11)	1	(11)			
Clays	thousand short tons	936	$874	1,000	$1,033	893	$986	1,153	$1,143
Coal	do	23,508	108,174	28,063	138,127	29,506	153,959	26,826	130,319
Gem stones		(12)	(4)	(12)	(4)			(12)	3
Lead (recoverable content of ores, etc.)		2,997	893	3,035	953	3,143	899	2,934	687
Lime	thousand short tons	494	5,049	512	5,926	510	6,029	471	5,533
Manganese ore (35 percent or more Mn)	gross weight	32,654	2,779	20,231	1,902	12,655	1,058	8,128	647
Manganiferous ore (5 to 35 percent Mn)	do			(4)	(4)			56	1
Marl, calcareous (except for cement)		(4)	(4)	10,522	12	(20)	(20)	(20)	(20)
Mica, sheet	pounds	(4)	(4)	396	6	529	6	147	2
Natural gas	million cubic feet	968	259	2,926	810	2,465	661	[6] 2,521	[6] 681
Petroleum (crude)	thousand 42-gallon barrels	4	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Sand and gravel	thousand short tons	6,461	8,076	7,783	9,420	7,047	9,877	7,158	10,834
Silver (recoverable content of ores, etc.)	thousand troy ounces	2	2	2	2	(4)	(4)	2	2
Slate	thousand short tons	32	820	32	1,035	(4)	1,003	(13)	(13)
Stone	do	11,966	19,870	14,082	23,076	[7] 14,244	[7] 21,158	15,413	27,504
Zinc (recoverable content of ores, etc.) [23]		18,329	4,509	19,196	5,181	23,080	5,277	18,472	3,808
Value of items that cannot be disclosed: Aplite, cement, feldspar, gypsum, iron oxide pigments (1955–57), kyanite, mica (scrap 1955), pyrites, salt, stone (dimension miscellaneous dimension sandstone and calcareous marl (1957), talc and soapstone, titanium concentrate, and values indicated by footnote 4			24,046		24,931		[8] 29,746		25,420
Total Virginia [9]			172,541		208,806		[8] 227,108		203,226

WASHINGTON

Abrasive stone: Pebbles (grinding)	(4)	(4)	25	(11)	25	(11)	18	(11)
Barite	25	(11)			(4)	(4)	(4)	(4)
Chromite	gross weight	22	$2	30	$3			17	$2
Clays	thousand short tons	365	412	320	440	298	$488	[5] 196	[5] 183
Coal	do	610	4,263	473	3,432	360	2,761	252	1,968
Copper (recoverable content of ores, etc.)		3,958	2,953	2,926	2,487	1,700	1,023	52	27
Epsomite		100	5	(4)	(4)	(4)	(4)		
Gem stones		(12)	(4)	(12)	75	(12)	75	(12)	75
Gold (recoverable content of ores, etc.)	troy ounces	74,360	2,602	70,669	2,473	(4)	(4)	(4)	(4)
Gypsum	thousand short tons	4	14	(4)	(4)	6	(4)	(4)	(4)
Iron ore	thousand long tons	2	(4)	2	(4)	4	(4)	4	(4)
Lead (recoverable content of ores, etc.)		10,340	3,081	11,657	3,660	12,734	3,642	9,020	2,111
Peat		37,640	113	37,043	129	39,364	153	34,642	116
Pumice	thousand short tons	(4)	(4)	5	15	(4)	(4)	(4)	(4)
Sand and gravel	do	21,645	19,351	16,842	15,037	[8] 20,415	[8] 17,510	24,389	20,086
Silver (recoverable content of ores, etc.)	thousand troy ounces	436	395	448	406	(4)	(4)	(4)	(4)
Stone	thousand short tons	6,593	10,580	8,057	11,660	[8] 8,897	[8] 11,645	7,837	9,991
Talc and soapstone		(4)	(4)	(4)	(4)	4,065	25	4,000	21
Tungsten concentrate	60-percent WO_3 basis	12	46	2	(4)	(10)	(4)		

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States,[2] by States—Continued

WASHINGTON—Continued

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Zinc (recoverable content of ores, etc.)	29,536	$7,266	25,609	$7,017	24,000	$5,568	18,797	$3,835
Value of items that cannot be disclosed: Carbon dioxide, cement, fire clay (1958), diatomite, lime (1955–57), magnesite, mercury (1957–58), olivine, petroleum (1957–58), strontium minerals (1956–58), uranium ore (1956–58), and values indicated by footnote 4		19,765		17,736		18,950		24,128
Total Washington [9]		67,334		61,723		[8] 60,471		60,897

See footnotes at end of table.

WEST VIRGINIA

Clays—thousand short tons	707	$2,563	770	$2,449	708	$2,691	510	$1,960
Coal—do	139,168	653,388	155,890	824,043	156,842	875,587	119,468	635,201
Marl, calcareous	(4)	(4)	1,685	1	(20)	(20)	(20)	(20)
Natural gas—million cubic feet	212,403	49,915	204,717	48,518	202,440	48,181	[6] 204,581	[6] 50,734
Natural-gas liquids:								
Natural gasoline—thousand gallons	35,756	2,352	35,728	2,594	30,435	2,185	27,917	5,643
LP-gases—do	286,871	6,376	240,989	12,031	235,881	6,543	235,524	12,806
Petroleum (crude)—thousand 42-gallon barrels	2,320	7,080	2,179	8,411	2,215	9,436	[6] 2,186	[6] 7,629
Salt (common)—thousand short tons	638	3,477	681	3,453	648	2,642	627	2,784
Sand and gravel—do	5,171	9,779	5,110	10,711	5,354	9,893	5,253	11,729
Stone—do	5,899	9,714	6,579	10,765	6,989	11,934	[7] 5,599	[7] 9,990
Value of items that cannot be disclosed: Abrasive stone, (1955), bromine, calcium-magnesium chloride, cement, lime, manganese ore (1957), stone (crushed sandstone 1958), and values indicated by footnote 4		[8] 12,844		[8] 14,515		[8] 14,938		13,104
Total West Virginia [9]		[8] 755,426		[8] 934,999		[8] 981,654		749,784

WISCONSIN

Abrasive stones	(4)	(4)	1,093	$31	1,790	$43	858	$26
Clays—thousand short tons	165	$166	163	172	131	136	154	167
Iron ore (usable)—thousand long tons, gross weight	1,886	(4)	1,488	(4)	1,576	(4)	867	(4)
Lead (recoverable content of ores, etc.)	1,948	581	2,582	811	1,900	543	800	187
Lime—thousand short tons	135	1,768	(4)	(4)	(4)	(4)	141	2,193
Marl, calcareous (except for cement)	14,087	7	11,074	6	(20)	(20)	(20)	(20)
Peat					400	(4)	(4)	(4)

Sand and gravel	thousand short tons	27,978	19,958	27,715	19,097	29,394	18,694	39,383	25,845
Stone	do	12,180	18,843	11,126	20,402	12,434	22,455	13,722	23,334
Zinc (recoverable content of ores, etc.)		18,326	4,508	23,890	6,546	21,575	5,006	12,140	2,477
Value of items that cannot be disclosed: Cement, gem stones (1957), stone (crushed basalt, 1955), and values indicated by footnote 4			20,528		19,451		22,590		18,083
Total Wisconsin [9]			65,813		65,860		68,644		71,334

WYOMING

Beryllium concentrate	gross weight			(4)	(4)	5	$3	17	$9
Clays	thousand short tons	10,036	$10,924	1,086	$11,864	[5] 1,069	[5] 11,973	[5] 1,075	[5] 9,968
Coal	do	2,927	11,845	2,553	9,920	2,117	7,777	1,629	5,820
Copper (recoverable content of ores, etc.)				3	3	4	2	(10)	(11)
Feldspar	long tons			1,201	8	(4)	(4)	(4)	(4)
Gem stones		(12)	57	(12)	75	(12)	55	(12)	52
Gold (recoverable content of ores, etc.)	troy ounces	52	2	762	27	573	20	117	4
Gypsum	thousand short tons	22	89	11	46	(4)	(4)	6	19
Iron ore (usable)	thousand long tons, gross weight	749	(4)	650	(4)	736	(4)	557	(4)
Natural gas	million cubic feet	77,819	6,615	84,398	7,258	117,256	10,201	[6] 121,682	[6] 10,221
Natural-gas liquids:									
Natural gasoline	thousand gallons	40,290	2,775	48,859	3,160	47,709	2,866	49,451	3,052
	do	46,106	1,961	49,838	2,337	57,805	2,566	54,496	2,614
LP-gases		99,483	239,750	104,830	255,785	109,584	291,493	[6] 115,572	[6] 301,643
Petroleum (crude)	thousand 42-gallon barrels	55	345	119	721	18	121	124	937
Phosphate rock	thousand long tons	(4)	(4)	46	38	49	41	45	40
Pumice	thousand short tons					2	5		
Rare-earth metals concentrates						2,425	1,905	5,333	4,760
Sand and gravel	thousand short tons	3,952	3,978	3,904	2,935	(4)	(4)	(4)	(4)
Sodium carbonate (natural)		(4)	(4)	337,851	8,345	1,291	2,266	1,099	1,472
Stone	thousand short tons	1,303	2,034	1,333	2,076				
Tungsten ore and concentrate	60-percent WO_3 basis			2	7				
Uranium ore				156,509	2,765	274,699	4,669	651,790	13,286
Value of items that cannot be disclosed: Cement, fire clay (1957–58), silver, sodium sulfate, vanadium, and values indicated by footnote 4			14,983		7,824		17,527		16,760
Total Wyoming [9]			[8] 294,546		[8] 314,380		[8] 352,532		369,938

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Includes Alaska and Hawaii.
[3] Excludes slag cement, value for which is included with "Items that cannot be disclosed."
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Excludes certain clays, value for which is included with "Items that cannot be disclosed."
[6] Preliminary figure.
[7] Excludes certain stone, value included with "Items that cannot be disclosed."
[8] Revised figure.
[9] Total adjusted to eliminate duplicating the value of clays and stone.
[10] Less than 1 ton.
[11] Less than $1,000.
[12] Weight not recorded.
[13] Beginning with 1958 slate included with stone.
[14] Excludes masonry cement, value for which is included with "Items that cannot be disclosed."
[15] Total weight of columbite-tantalite plus (Cb-Ta) $_2O_5$ content of euxenite.
[16] Final figure. Supersedes preliminary figure given in commodity chapter.
[17] Sheet mica only.
[18] Less than 1,000 short tons.
[19] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and/or lime.
[20] Beginning with 1957 calcareous marl included with stone.
[21] Excludes natural cement, value for which is included with "Items that cannot be disclosed."
[22] Less than 1,000 long tons.
[23] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.
[24] Grinding pebbles and tube-mill liners, weight of millstones not recorded.
[25] Millstones only.
[26] Less than 1,000 troy ounces.
[27] Includes 45,710 short tons of concentrate produced in 1955 and 1956 from low-grade ore and concentrate stockpiled near Coquille, Oreg. during World War II.

TABLE 6.—Mineral production [1] in the Canal Zone and islands administered by the United States [2]

Mineral		1955		1956		1957		1958	
		Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
American Samoa:									
Sand and gravel	thousand short tons	1	$1						
Stone	do	9	4	2	$6	34	$37	30	$59
Total American Samoa			5		6		37		59
Canal Zone:									
Sand and gravel	thousand short tons	36	47	40	48			41	34
Stone (crushed)	do	169	240	177	230	59	99	140	237
Total Canal Zone			287		278		99		271
Canton: Stone (crushed)	thousand short tons	1	2	2	5				
Guam:									
Sand and gravel	do			19	24	1	1	9	23
Stone	do	1,241	3,352	341	311	1,034	1,132	684	751
Total Guam			3,352		335		1,133		774
Johnston: Stone	thousand short tons	12	33	203	304	3,875	6,700	175	476
Midway: Stone (crushed)	do	1	5	12	32	11	31	25	81
Virgin Islands: Stone (crushed)	do	1	3	22	22	5	6	10	37
Wake: Stone (crushed)	do								

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Production data for Canton and Wake furnished by the U.S. Department of Commerce, Civil Aeronautics Administration; Midway and Johnston, by the U.S. Department of the Navy; Guam by the Government of Guam; American Samoa, by the Government of American Samoa.

TABLE 7.—Mineral production [1] in the Commonwealth of Puerto Rico

Mineral	1955		1956		1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement.....thousand 376-pound barrels	4,117	$12,507	4,255	$14,065	5,552	$17,232	4,748	$15,175
Clays.....thousand short tons	137	122	143	129	159	140	165	83
Lime.....do	10	254	(2)	(2)	(2)	(2)	(2)	(2)
Salt (common).....do	10	112	10	101	10	104	1	14
Sand and gravel.....do	433	679	183	192	497	754	476	763
Stone.....do	1,784	2,516	2,076	2,556	2,452	3,505	1,986	2,768
Value of items that cannot be disclosed: Other nonmetals and values indicated by footnote 2	----------	----------	----------	195	----------	180	----------	272
Total Puerto Rico [3]	----------	14,917	----------	16,395	----------	20,265	----------	17,689

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Total has been adjusted to eliminate duplicating the value of stone.

TABLE 8.—Principal minerals imported for consumption in the United States

[Compiled by Mae B. Price and Elsie D. Jackson, Division of Foreign Activities, Bureau of Mines, from records of the U.S. Department of Commerce, Bureau of the Census]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS				
Aluminum:				
Metal	222,158	[1] $107,336	255,322	$117,297
Scrap	16,271	[1] 5,396	9,922	2,969
Plates, sheets, bars, etc	[2] 19,577	[1 2] 15,124	27,943	20,183
Antimony:				
Ore (antimony content)	8,198	1,973	3,427	643
Needle or liquated	38	17	136	58
Metal	5,412	2,587	4,282	1,871
Oxide	1,893	790	1,634	643
Arsenic: White	10,135	794	9,524	720
Bauxite:				
Crude thousand long tons	[2 3] 7,098	[2] 60,933	[3] 7,919	70,142
Calcined:				
Imports for manufacturing firebrick long tons	67,172	1,522	29,414	715
Other do	[1] 204	4	100	2
Beryllium ore	7,290	2,526	4,599	1,547
Boron carbide pounds	74,162	123	47,368	133
Cadmium:				
Metal thousand pounds	1,586	2,424	1,002	1,312
Flue dust (cadmium content) do	1,400	837	1,218	661
Calcium:				
Metal pounds	24,204	[1] 39	15,694	24
Chloride	1,989	77	475	17
Chromate:				
Ore and concentrates (Cr_2O_3 content)	[2] 983,492	[2] 55,675	544,447	28,206
Ferrochrome (chromium content)	30,910	14,460	15,965	7,818
Metal	1,354	[1] 2,748	2,353	4,768
Cobalt:				
Alloy (cobalt content) thousand pounds	817	(4)		
Ore (cobalt content) do	15	20		
Metal do	[2 5] 16,173	[2 5] 32,431	[3] 15,719	[3] 30,995
Oxide (gross weight) do	647	853	837	1,116
Salts and compounds (gross weight) do	364	179	234	145
Columbium ore pounds	3,348,706	3,038	2,555,942	2,346
Copper (copper content):				
Ore	[2] 20,951	[2] 12,217	5,926	2,357
Concentrates	[2] 62,361	[2] 34,258	84,871	37,968
Regulus, black, coarse	[2] 5,361	[2] 3,213	4,925	2,172
Unrefined, black, blister	[2] 301,186	179,440	138,633	66,320
Refined in ingots, etc	162,309	97,025	124,629	61,139
Old and scrap	5,843	[1 2] 3,049	5,849	2,676
Old brass and clippings	4,643	[1] 2,393	4,201	1,852
Ferroalloys: Ferrosilicon (silicon content)	3,813	1,679	2,398	905
Gold:				
Ore and base bullion troy ounces	1,185,917	41,474	1,099,484	38,457
Bullion do	6,515,253	231,167	7,020,242	251,298
Iron ore:				
Ore thousand long tons	[2] 33,651	[2] 285,051	27,530	231,553
Pyrites cinder long tons	567	[1 2]	2,721	9
Iron and steel:				
Pig iron	225,387	13,528	209,743	12,041
Iron and steel products (major):				
Semimanufactures	[2] 283,475	[2] 33,753	788,235	66,880
Manufactures	[2] 1,011,419	[2] 170,872	1,030,758	152,974
Scrap	203,407	9,078	295,859	10,069
Tin-plate scrap	35,203	1,072	36,763	1,000
Lead:				
Ore, flue dust, matte (lead content)	[2] 234,616	[2] 62,284	241,297	51,707
Base bullion (lead content)	25	8	416	136
Pigs and bars (lead content)	[2] 321,708	[2] 85,146	351,759	71,404
Reclaimed, scrap, etc (lead content)	[2 7] 576	[1 2] 1,641	8,619	1,441
Sheets, pipe, and shot	5,917	[1] 1,377	2,625	596
Babbitt metal and solder (lead content)	2,100	[1] 3,049	2,049	4,677
Type metal and antimonial lead (lead content)	4,858	1,527	4,525	1,190
Manufactures	659	[1] 360	1,272	446

See footnotes at end of table.

TABLE 8.—Principal minerals imported for consumption in the United States—Continued

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS—continued				
Magnesium:				
Metallic and scrap	982	[1] $480	537	$280
Alloys (magnesium content)	35	283	9	38
Sheets, tubing, ribbons, wire, and other forms (magnesium content)	8	17	16	97
Manganese:				
Ore (35 percent or more manganese) (manganese content)	[2] 1,167,232	[2] 96,670	837,100	76,256
Ferromanganese (manganese content)	257,821	[2] 60,236	49,521	11,046
Mercury:				
Compounds—pounds	19,221	[1] 68	9,125	29
Metal—76-pound flasks	42,005	9,333	20,158	3,914
Minor metals: Selenium and salts—pounds	[2] 172,178	[1 2] 1,909	204,311	1,380
Molybdenum: Ore and concentrates (molybdenum content)—pounds	27,461	55	1,344	6
Nickel:				
Ore and matte	13,177	5,202	4,574	1,765
Pigs, ingots, shot, cathodes	[2] 99,787	[2] 156,393	62,793	87,311
Scrap	410	573	271	254
Oxide	37,080	42,925	29,622	35,106
Platinum group:				
Unrefined materials:				
Ore and concentrates—troy ounces	1,572	119	----------	----------
Grains and nuggets, including crude, dust, and residues—troy ounces	[2] 26,328	[2] 1,936	21,635	1,341
Sponge and scrap—do	[2 3] 2,043	[3] 160	[3] 13,167	[3] 823
Osmiridium—do	2,851	168	1,450	85
Refined metal:				
Platinum—do	[2 3] 301,611	[2 3] 25,217	[3] 247,763	[3] 15,363
Palladium—do	327,558	6,303	360,077	5,211
Iridium—do	1,431	109	1,156	78
Osmium—do	126	9	145	8
Rhodium—do	16,629	[1] 1,688	17,280	1,803
Ruthenium—do	1,864	75	7,758	259
Radium:				
Radium salts—milligrams	76,206	1,061	38,419	538
Radioactive substitutes	(6)	[1] 844	(6)	908
Rare earths: Ferrocerium and other cerium alloys—pounds	7,948	[1] 26	11,544	46
Silver:				
Ore and base bullion—thousand troy ounces	99,926	78,260	134,650	102,286
Bullion—do	106,193	79,400	31,316	27,807
Tantalum: Ore—pounds	828,265	949	1,035,588	1,838
Tin:				
Ore (tin content)—long tons	94	118	5,440	11,244
Blocks, pigs, grains, etc—do	[2] 56,158	[2] 120,739	41,149	84,624
Dross, skimmings, scrap, residues, and tin alloys, n.s.p.f.—long tons	[2] 5,077	[2] 9,485	3,208	5,771
Tinfoil, powder, flitters, etc	(6)	[1] 561	(6)	610
Titanium:				
Ilmenite	460,353	[1] 10,317	348,144	6,766
Rutile	84,837	11,843	36,563	4,513
Metal—pounds	7,064,672	16,722	4,146,896	6,287
Ferrotitanium—do	256,000	100	201,333	73
Compounds and mixtures—do	135,116	[1] 79	1,417,522	285
Tungsten (tungsten content):				
Ore and concentrates—thousand pounds	14,018	[1] 34,525	6,542	11,960
Metal—pounds	82,617	[1] 239	101,363	230
Ferrotungsten—thousand pounds	415	674	159	154
Other—pounds	66,955	[1] 112	83	1
Zinc:				
Ores (zinc content)	[2] 679,416	[2] 88,516	538,566	51,361
Blocks, pigs, and slabs	[2] 268,824	[1 2] 64,129	185,693	35,612
Sheets	732	245	901	285
Old, dross, and skimmings	590	89	972	108
Dust	112	[1] 28	96	14
Manufactures	(6)	[1] 264	(6)	390
Zirconium: Ore, including zirconium sand	41,692	1,142	19,225	467

See footnotes at end of table.

TABLE 8.—Principal minerals imported for consumption in the United States—Continued

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
NONMETALS				
Abrasives: Diamonds (industrial)—carats	[2] 12,612,641	[1] [2] $51,524	10,070,816	$39,346
Asbestos	682,732	[1] 60,104	644,331	58,314
Barite:				
Crude and ground	833,049	[1] 5,875	527,571	3,754
Witherite	3,029	138	2,240	108
Chemicals	5,369	[1] 502	4,171	416
Bromine—pounds	1,512	38	11,925	38
Cement—376-pound barrels	[3] 4,427,047	[1] 14,819	3,390,086	9,682
Clays:				
Raw	159,866	[1] 2,859	158,980	2,835
Manufactured	2,967	79	35,030	65
Cryolite	32,712	[3] 4,001	24,186	2,332
Feldspar: Crude—long tons	72	7	73	5
Fluorspar	631,367	[1] 16,031	392,164	9,777
Gem stones:				
Diamonds—carats	[2] 1,606,937	[1] [2] 142,588	1,847,719	140,495
Emeralds—do	37,245	[1] 1,595	38,848	1,100
Other	([6])	[1] [2] 24,480	([6])	24,212
Graphite	41,530	2,107	27,067	1,203
Gypsum:				
Crude, ground, calcined	4,335,337	[1] 7,604	4,049,522	6,898
Manufactures	([6])	[1] 911	([6])	967
Iodine, crude—thousand pounds	2,685	2,769	1,561	1,329
Jewel bearings—number, thousands	70,127	[1] 2,780	40,969	1,418
Kyanite	5,999	263	1,965	95
Lime:				
Hydrated	245	5	1,000	21
Other	39,002	687	18,822	318
Dead-burned dolomite	10,419	640	5,686	322
Magnesium:				
Magnesite	80,638	4,298	77,630	4,912
Compounds	12,582	510	12,477	505
Mica:				
Uncut sheet and punch—pounds	1,841,840	[1] 3,359	2,181,056	5,092
Scrap	5,187	57	4,064	48
Manufactures	5,766	[1] 8,032	5,052	8,800
Mineral-earth pigments: Iron oxide pigments:				
Natural	3,079	[1] 125	2,485	123
Synthetic	7,033	[1] 1,046	5,933	889
Ocher, crude and refined	203	12	217	10
Siennas, crude and refined	676	56	555	49
Umber, crude and refined	1,944	[1] 65	2,278	73
Vandyke brown	139	10	204	15
Nitrogen compounds (major), including urea	[2] 1,453,678	[1] [2] 63,107	1,349,585	59,840
Phosphate, crude—long tons	109,546	3,090	108,182	2,944
Phosphatic fertilizers—do	29,175	[2] 2,246	24,562	1,711
Pigments and salts:				
Lead pigments and salts	8,565	1,912	8,557	1,770
Zinc pigments and salts	6,967	1,336	13,206	2,520
Potash	338,690	[1] 11,823	398,823	13,679
Pumice:				
Crude or unmanufactured	35,182	291	38,613	274
Wholly or partly manufactured	2,124	[1] 70	1,873	48
Manufactures, n.s.p.f.	([6])	[1] 14	([6])	15
Quartz crystal (Brazilian pebble)—pounds	1,546,236	729	473,000	356
Salt	[2] 650,845	[1] [2] 3,523	611,043	3,368
Sand and gravel:				
Glass sand	683	621	6,516	224
Other sand	290,280	[1] 437	317,860	486
Gravel	14,877	[1] 22	7,619	7
Sodium sulfate—thousand short tons	74	1,511	97	1,968
Stone, including slate	([6])	[1] 8,792	([6])	8,312
Strontium: Mineral	6,525	131	6,647	141
Sulfur and pyrites:				
Sulfur:				
Ore—long tons	14,454	350	18,906	445
Other forms, n.e.s.—do	[2] 484,947	[1] 11,882	571,781	13,106
Pyrites—do	[7] 70,632	[1] [7] 408	343,060	1,194
Talc: Unmanufactured	20,395	[1] 701	22,890	785

See footnotes at end of table.

TABLE 8.—Principal minerals imported for consumption in the United States—Continued

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
COAL, PETROLEUM, AND RELATED PRODUCTS				
Carbon black:				
Acetylene black.....pounds	7,571,116	$1,342	7,154,224	$1,287
Gas black and carbon black.....do	20	(3)	125,958	22
Coal:				
Anthracite	1,138	9	4,363	34
Bituminous, slack, culm, and lignite	366,506	[1] 3,146	306,940	2,547
Briquets	850	10	184	2
Coke	117,951	[1] 1,544	121,517	1,571
Peat:				
Fertilizer grade	236,370	[1] 10,700	258,824	11,433
Poultry and stable grade	10,389	[1] 587	10,272	602
Petroleum:				
Crude.....thousand barrels	[2] 385,802	[1 2] 980,142	383,981	940,343
Gasoline [9].....do	11,483	48,202	29,133	111,071
Kerosine.....do	125	537	34	148
Distillate oil [10].....do	9,148	[1] 31,277	14,878	47,103
Residual oil [11].....do	176,021	464,960	195,756	451,736
Unfinished oils.....do	[2] 1,959	[2] 5,292	20,510	56,316
Asphalt.....do	[2] 6,569	[2] 17,175	7,501	18,935
Miscellaneous.....do	(5)	[1] 44	14	222

[1] Data known to be not comparable with 1958.
[2] Revised figure.
[3] Adjusted by the Bureau of Mines.
[4] Data not available.
[5] Includes 4,903 pounds of scrap ($1,698).
[6] Weight not recorded.
[7] In addition to data shown an estimated 282,400 long tons ($889,100) were imported.
[8] Less than 1,000.
[9] Includes naphtha but excludes benzol, 1957—1,317,212 barrels ($14,516,000); 1958—1,060,597 barrels ($10,928,459).
[10] Includes quantities imported free of duty for supplies of vessels and aircraft.
[11] Includes quantities imported free for manufacture in bond and export and for supplies of vessels and aircraft.

TABLE 9.—Principal minerals and products exported from the United States[1]

[Compiled by Mae B. Price and Elsie D. Jackson, Division of Foreign Activities, Bureau of Mines, from records of the U.S. Department of Commerce, Bureau of the Census]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS				
Aluminum:				
Ingots, slabs, crude	[2] 29,105	[2] $14,613	52,711	$24,220
Scrap	18,166	6,435	18,906	5,595
Plates, sheets, bars, etc	13,767	13,179	9,183	10,240
Castings and forgings	1,333	3,064	1,633	3,022
Antimony: Metals and alloys, crude	4	3	39	23
Arsenic: Calcium arsenate—pounds	2,779,954	201	1,274,000	81
Bauxite, including bauxite concentrates—long tons	60,993	4,847	11,868	968
Aluminum sulfate	19,689	834	9,864	423
Other aluminum compounds	48,390	5,251	32,803	4,438
Beryllium—pounds	208,771	260	57,636	247
Cadmium—thousand pounds	693	1,060	580	771
Calcium chloride	47,965	1,628	37,632	1,325
Chrome:				
Ore and concentrates:				
Exports	837	53	717	49
Reexports	4,872	194	52,303	2,158
Chromic acid	674	388	486	281
Ferrochrome	4,535	2,419	1,920	1,012
Cobalt—pounds	[2] 1,061,275	[2] 946	1,757,600	1,102
Columbium metals, alloys, and other forms—do	59,241	47	54,711	42
Copper:				
Ores, concentrates, composition metal, and unrefined copper (copper content)	15,656	9,964	11,475	5,865
Refined copper and semimanufactures	430,446	288,936	428,015	231,102
Other copper manufactures	238	321	2,302	1,567
Copper sulfate or blue vitriol	33,644	6,534	7,248	1,176
Copper base alloys	[3]	[2] 56,319	[3]	26,906
Ferroalloys:				
Ferrosilicon—pounds	5,297,681	502	4,353,279	392
Ferrophosphorous—do	100,635,032	1,901	89,006,784	1,468
Gold:				
Ore and base bullion—troy ounces	23,953	834	26,929	945
Bullion, refined—do	4,781,780	167,498	859,042	30,077
Iron ore—thousand long tons	5,002	[2] 47,543	3,439	34,427
Iron and steel:				
Pig iron	882,342	[2] 57,184	103,348	6,725
Iron and steel products (major):				
Semimanufactures	3,395,118	574,548	[4] 1,676,749	[4] 298,943
Manufactured steel mill products	2,521,622	579,236	[4] 1,625,576	[4] 406,812
Advanced products	[3]	[2] 169,204	[3]	[4] 170,772
Iron and steel scrap: Ferrous scrap, including rolling materials	[2] 6,765,992	[2] 329,511	2,954,969	97,447
Lead:				
Ore, matte, base bullion (lead content)	906	257	1,012	252
Pigs, bars, anodes	4,339	1,345	1,359	467
Scrap	885	215	1,015	237
Magnesium:				
Metal and alloys and semifabricated forms, n.e.c	1,574	1,890	1,041	1,280
Powder	22	39	11	16
Manganese:				
Ore and concentrates	5,270	724	4,833	700
Ferromanganese	7,395	1,866	1,406	464
Mercury:				
Exports—76-pound flasks	1,919	484	320	95
Reexports—do	3,275	763	934	199
Molybdenum:				
Ores and concentrates—pounds	25,465,515	32,428	11,962,938	15,045
Metals and alloys, crude and scrap—do	98,513	182	14,151	5
Wire—do	13,750	231	11,346	215
Semifabricated forms, n.e.c—do	4,289	49	20,878	63
Powder—do	28,222	43	4,841	16
Ferromolybdenum—do	383,271	447	226,246	245
Nickel:				
Ore			10	1
Alloys and scrap (including Monel metal), ingots, bars, sheets, etc	12,756	14,089	13,305	17,066
Catalysts	[5]	[5]	485	1,023
Nickel-chrome electric resistance wire	151	632	154	678
Semifabricated forms, n.e.c	508	1,797	563	2,491

See footnotes at end of table.

TABLE 9.—Principal minerals and products exported from the United States[1]—Continued

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS—continued				
Platinum:				
Ore and concentrates—troy ounces			35,075	$1,233
Bars, ingots, sheets, wire, sponge, and other forms, including scrap—troy ounces	17,199	$1,329		
Palladium, rhodium, iridium, osmiridium, ruthenium and osmium metals and alloys, including scrap—troy ounces	23,155	374	12,293	379
Platinum group manufactures, except jewelry	(2)	1,960	(3)	2,103
Radium metal (radium content)—milligrams	750	7	80	3
Rare earths:				
Cerium ores, metals, and alloys—pounds	13,270	33	29,998	24
Lighter flints—do	3,372	24	7,720	47
Silver:				
Ore and base bullion—thousand troy ounces	1,373	1,246	1,640	1,456
Bullion, refined—do	8,927	8,238	1,093	1,000
Tantalum:				
Ore, metal, and other forms—pounds	4,877	252	20,076	302
Powder—do	5,997	228	5,773	212
Tin:				
Ingots, pigs, bars, etc:				
Exports—long tons	1,112	1,526	917	1,336
Reexports—do	419	919	424	899
Tin scrap and other tin bearing material except tinplate scrap—do	9,545	3,911	2,291	992
Tin cans finished or unfinished—do	30,166	14,309	35,849	18,322
Tin compounds—pounds	489,227	867	(6)	(6)
Titanium:				
Ores and concentrates	2,019	276	1,246	172
Sponge (including iodide titanium) and scrap	71	78	97	172
Intermediate mill shapes	698	7,174	192	1,772
Mill products n.e.c	81	2,230	144	3,456
Ferrotitanium	367	130	323	138
Dioxide and pigments	52,960	19,687	37,016	11,347
Tungsten: Ore and concentrates:				
Exports	163	227	22	17
Reexports	572	724	162	207
Vanadium ore and concentrates (vanadium content)—pounds	1,000,340	2,115	1,261,083	2,625
Zinc:				
Ores and concentrates (zinc content)	7	(7)		
Slabs, pigs, or blocks	10,785	2,553	1,736	627
Sheets, plates, strips, or other forms, n.e.c	4,056	2,950	[4] 3,818	[4] 2,637
Scrap (zinc content)	5,469	822	5,344	364
Dust	595	195	519	170
Semifabricated forms, n.e.c	485	247	1,168	542
Zirconium:				
Ores and concentrates	3,160	315	1,994	336
Metals and alloys and other forms—pounds	66,784	384	100,556	757
NONMETALS				
Abrasives:				
Grindstones—pounds	660,057	54	280	45
Diamond dust and powder—carats	199,252	622	123,194	378
Diamond grinding wheels—do	194,934	1,135	203,095	1,294
Other natural and artificial metallic abrasives and products	(3)	25,777	(3)	24,987
Asbestos: Unmanufactured:				
Exports	2,775	340	2,937	407
Reexports	118	10	89	17
Boron: Boric acid, borates, crude and refined—pounds	428,994,042	15,975	[4] 471,167,767	[4] 18,292
Bromine, bromides, and bromates—do	10,510,719	3,053	10,071,033	3,129
Cement—376-pound barrels	1,330,520	5,322	641,159	2,975
Clay:				
Kaolin or china clay	54,879	1,327	66,419	1,602
Fire clay	136,819	1,794	125,923	1,880
Other clays	292,921	10,407	257,436	8,646
Cryolite	165	55	164	46
Fluorspar	754	81	3,374	191

See footnotes at end of table.

TABLE 9.—Principal minerals and products exported from the United States [1]—Continued

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
NONMETALS—continued				
Graphite:				
Amorphous	902	$93	767	$97
Crystalline flake, lump or chip	167	57	164	52
Natural, n.e.c	280	75	235	43
Gypsum:				
Crude, calcined, crushed thousand short tons	24	763	29	921
Plasterboard, wallboard, and tile square feet	8,866,572	520	(6)	1,544
Manufactures, n.e.c	(3)	62		
Iodine, iodide, iodates thousand pounds	233	335	199	314
Kyanite and allied minerals	2,588	130	2,493	127
Lime	65,195	1,329	45,844	1,047,310
Mica:				
Unmanufactured pounds	911,006	46	1,030,540	90
Manufactured:				
Ground or pulverized do	9,256,170	521	8,198,367	431
Other do	541,432	983	254,198	696
Mineral-earth pigments: Iron oxide, natural and manufactured	3,675	1,038	3,914	1,065
Nitrogen compounds (major)	[2] 1,218,122	[2] 59,208	704,492	38,938
Phosphate rock long tons	3,126,215	28,189	2,818,073	25,234
Phosphatic fertilizers do	575,387	24,705	514,227	23,388
Pigments and salts (lead and zinc):				
Lead pigments	3,953	1,422	3,446	1,095
Zinc pigments	4,135	1,163	3,156	912
Lead salts	608	231	1,050	412
Potash:				
Fertilizer	459,699	16,096	496,805	16,478
Chemical	7,796	1,410	9,871	1,799
Quartz crystal (raw)	(3)	153	(3)	285
Radioactive isotopes, etc	(3)	1,367	(3)	1,534
Salt:				
Crude and refined	390,707	2,591	363,009	2,273
Shipments to noncontiguous Territories	10,975	857	12,790	1,026
Sodium and sodium compounds:				
Sodium sulfate	23,667	859	20,193	786
Sodium carbonate thousand short tons	174	6,282	104	4,279
Stone:				
Limestone, crushed, ground, broken	[2] 1,088,004	[2] 1,650	767,757	1,390
Marble and other building and monumental cubic feet	415,903	1,158	349,366	1,236
Stone, crushed, ground, broken	129,559	2,699	173,340	3,697
Manufactures of stone	(3)	506	(3)	432
Sulfur:				
Crude long tons	[2] 1,578,359	[2] 43,940	1,570,979	39,317
Crushed, ground, flowers of do	[2] 14,620	[2] 1,458	27,949	2,050
Talc:				
Crude and ground	39,985	1,127	58,647	1,358
Manufactures, n.e.c	291	138	212	93
Powders-talcum (face and compact)	(3)	1,322	(3)	1,341
COAL, PETROLEUM, AND RELATED PRODUCTS				
Carbon black thousand pounds	459,671	40,468	440,542	39,748
Coal:				
Anthracite	4,331,785	65,012	2,279,859	35,762
Bituminous	[2] 76,445,529	[2] 764,666	50,279,706	489,881
Briquets	86,464	1,383	54,961	899
Coke	822,244	14,356	392,817	7,127
Petroleum:				
Crude thousand barrels	[2] 50,243	[2] 173,366	4,345	14,748
Gasoline [9] do	30,792	206,914	20,370	142,554
Kerosine do	4,914	21,780	1,140	5,369
Distillate oil do	45,071	182,163	17,115	63,638
Residual oil do	32,875	95,951	22,772	54,078
Lubricating oil do	13,193	[2] 194,887	12,464	185,807

See footnotes at end of table.

TABLE 9.—Principal minerals and products exported from the United States [1]—Continued

Mineral		1957		1958	
		Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
NONMETALS—continued					
Petroleum—Continued					
Asphalt	thousand barrels	1,545	$9,992	1,083	$6,013
Liquefied petroleum gases	do	4,538	21,100	2,854	8,423
Wax	do	1,023	22,741	905	19,861
Coke	do	5,176	20,970	4,406	18,026
Petrolatum	do	270	5,962	256	6,084
Miscellaneous products	do	1,032	18,480	518	13,655

[1] Changes in Minerals Yearbook 1957, p. 115, should read as follows; 1956, titanium dioxide and pigment 64,806 short tons ($25,158).
[2] Revised figure.
[3] Weight not recorded.
[4] Due to changes in classifications by the Bureau of the Census data not strictly comparable with 1957.
[5] Not separately classified prior to 1958.
[6] Beginning Jan. 1, 1958, not separately classified.
[7] Less than $1,000.
[8] Curie: 156,191.
[9] Includes naphtha but excludes benzol: 1957—64,158 barrels ($1,154,633), 1958—273,428 barrels ($3,562,974).

TABLE 10.—Comparison of world and United States [1] production of principal metals and minerals

Mineral	1957			1958		
	World	United States		World	United States	
	Thousand short tons		Percent of world	Thousand short tons		Percent of world
Coal:						
Bituminous	1,761,225	490,097	27	1,846,370	408,019	22
Lignite	655,496	2,607	[2]	677,365	2,427	[2]
Pennsylvania anthracite	156,800	25,338	16	161,400	21,171	13
Coke (excluding breeze):						
Gashouse [3]	52,196	[4]	[4]	51,283	[4]	[4]
Oven and beehive	293,848	75,951	26	280,246	53,604	19
Fuel briquets and packaged fuel	120,830	1,152	[2]	116,760	1,072	[2]
Natural gas—million cubic feet	[5]	10,680,258	[5]	[5]	11,030,298	[5]
Peat	69,260	316	[2]	65,670	328	[2]
Petroleum (crude)—thousand barrels	6,450,666	2,616,901	41	6,617,656	2,448,866	37
Nonmetallic minerals:						
Asbestos	2,070	44	2	2,020	44	2
Barite	3,500	1,305	37	2,500	486	19
Cement—thousand barrels	1,447,912	313,756	21	1,541,996	326,352	21
Corundum	10			11		
Diamonds—thousand carats	20,800			22,000		
Diatomite	770	368	48	825	368	45
Feldspar [6]—thousand long tons	1,050	498	47	1,025	470	46
Fluorspar	1,920	329	17	1,760	320	18
Graphite	405	[4]	[4]	335	[4]	[4]
Gypsum	36,430	9,195	25	36,660	9,600	26
Magnesite	5,600	678	12	5,900	493	8
Mica (including scrap)—thousand pounds	320,000	185,566	58	320,000	187,348	59
Nitrogen, agricultural [6 7]	7,606	2,105	28	8,267	2,218	27
Phosphate rock—thousand long tons	32,560	13,976	43	34,870	14,879	43
Potash—K_2O equivalent	8,700	2,266	26	8,800	2,147	24
Pumice	9,000	1,827	20	9,100	1,973	22
Pyrites—thousand long tons	17,800	1,067	6	17,650	974	6
Salt	77,350	23,844	31	81,800	21,911	27
Strontium [6]	13	[4]	[4]	13	[4]	[4]
Sulfur, native—thousand long tons	7,300	5,579	76	6,500	4,646	71
Talc, pyrophyllite, and soapstone	2,030	684	34	2,000	737	37
Vermiculite [6]	249	184	74	238	182	76

See footnotes at end of table.

TABLE 10.—Comparison of world and United States [1] production of principal metals and minerals—Continued

Mineral	1957			1958		
	World	United States		World	United States	
	Thousand short tons		Percent of world	Thousand short tons		Percent of world
Metals, mine basis:						
Antimony (content of ore and concentrate) [6] short tons	50,000	709	1	44,000	705	2
Arsenic [6]	43	10	23	40	12	30
Bauxite thousand long tons	20,100	1,416	7	20,700	1,311	6
Beryllium concentrates short tons	11,900	521	4	7,000	463	7
Bismuth thousand pounds	5,500	(4)	(4)	4,900	(4)	(4)
Cadmium do	21,070	10,549	50	19,850	9,673	49
Chromite	5,125	166	3	4,050	144	4
Cobalt (contained) short tons	15,900	1,651	10	14,600	2,012	14
Columbium-tantalum concentrates thousand pounds	6,910	370	5	5,000	428	9
Copper (content of ore and concentrate)	3,900	1,087	28	3,740	979	26
Gold thousand fine ounces	39,600	1,800	5	40,400	1,739	4
Iron ore thousand long tons	422,633	106,148	25	397,036	67,947	17
Lead (content of ore and concentrate)	2,610	338	13	2,520	267	11
Manganese ore (35 percent ot more Mn)	14,126	366	3	13,049	323	2
Mercury thousand 76-pound flasks	245	35	14	248	38	15
Molybdenum (content of ore and concentrate) thousand pounds	76,200	60,753	80	56,500	41,069	73
Nickel (content of ore and concentrate)	314	10	3	245	12	5
Platinum groups (Pt, Pd, etc.) thousand troy ounces	1,310	19	1	880	14	2
Silver thousand fine ounces	230,100	38,720	17	236,800	36,800	16
Tin (content of ore and concentrate) thousand long tons	200			152		
Titanium concentrates:						
Ilmenite	1,972	757	38	1,711	563	33
Rutile	156	11	7	103	7	7
Tungsten concentrate-60 percent WO_3 short tons	75,000	5,520	7	63,500	3,788	6
Vanadium (content of ore and concentrate) [6] short tons	4,295	3,691	86	4,231	3,030	72
Zinc (content of ore and concentrate)	3,510	532	15	3,350	412	12
Metals, smelter basis:						
Aluminum	3,725	1,648	44	3,890	1,566	40
Copper	4,070	1,178	29	3,930	1,069	27
Iron, pig (incl. ferroalloys)	233,200	80,920	35	216,440	58,867	27
Lead	2,510	533	21	2,480	469	19
Magnesium	155	81	52	101	30	30
Selenium thousand pounds	1,940	1,077	56	1,630	727	45
Steel ingots and castings	322,000	112,715	35	298,400	85,255	29
Tellurium thousand pounds	287	255	89	214	170	80
Tin thousand long tons	195	2	1	160	(4)	(4)
Zinc	3,240	986	30	3,010	781	26

[1] Including Alaska and noncontiguous territories.
[2] Less than 1 percent.
[3] Includes low- and medium-temperature and gashouse coke.
[4] Bureau of Mines not at liberty to publish U.S. figure separately.
[5] Data not available.
[6] World total exclusive of U.S.S.R.
[7] Year ended June 30 of year stated (United Nations).

Employment and Injuries in the Mineral Industries

By John C. Machisak [1]

THIS CHAPTER contains the overall injury experience and related employment for bituminous-coal, lignite, and anthracite mines, metal mines, nonmetal mines, sand and gravel plants, stone quarries, coke plants, peat plants and metallurgical plants (ore-dressing and nonferrous reduction and refinery plants combined), and nonmetal mills for 1958. Volume I includes data on injuries and employment in the metal and nonmetal industries, and Volume II those in the fuel industries—coal, coke, peat, and oil and gas.

Injury and employment data were obtained from surveys conducted by the Bureau of Mines and were submitted voluntarily for all mineral industries with the exception of those for the coal-mining industry, which are required by Federal law. Every effort has been made to present complete coverage for the Nation's mineral industries, and the injury information is believed to be representative of the hazards to which workers in these industries are exposed.

Estimated employment in the mineral industries declined 12 percent from that in 1957. The number of days worked in 1958 averaged 16 less than in 1957; and man-hours of work decreased approximately 194.5 million or 17 percent. An 8-hour shift was worked each year, and the average employee worked 1,840 hours, a decline of 6 percent from the 1,960 hours worked the preceding year.

The overall injury experience in the mineral industries improved. The combined (fatal and nonfatal) injury-frequency rate per million man-hours of work revealed a decline of 8 percent. Both fatal and nonfatal injuries declined sharply, 22 and 24 percent respectively. A decline in the number of man-hours worked caused the fatal rate (0.58) to be comparable to the 1957 rate (0.62). The nonfatal injury-frequency rate dropped to 28.28 from the rate of 30.88 reported for 1957.

Three major disasters (a disaster in which 5 or more men are killed in a single accident) occurred in bituminous-coal mining, all in West Virginia. On February 12, 6 men were killed by a fall of roof; 22 men lost their lives on October 27, and 14 men were killed on October 28, from explosions.

[1] Chief, Branch of Accident Analysis, Division of Safety.

TABLE 1.—Salient statistics of employment and injury experience in the mineral industries in the United States, by industry groups

	1954	1955	1956	1957	1958 [1]
Average number of men working daily: [2]					
Coal mines	283,705	260,161	[3] 260,285	254,725	214,540
Metal mines	66,610	65,143	[3] 68,273	68,457	59,000
Nonmetal mines (except stone quarries) [4]	12,810	14,504	15,595	17,921	17,300
Sand and gravel operations [5]				31,531	31,000
Stone quarries	78,910	78,238	80,093	84,126	80,500
Coke plants	19,209	20,681	20,473	20,264	16,186
Peat [6]				139	464
Metallurgical plants	54,396	57,741	[3] 65,681	65,212	56,000
Nonmetal mills [7]		8,723	17,585	27,081	26,000
Total	515,640	505,191	[3] 527,985	569,456	500,990
Average number of active mine days:					
Coal mines	175	206	212	204	187
Metal mines	245	263	[3] 264	259	222
Nonmetal mines (except stone quarries) [4]	284	264	268	262	250
Sand and gravel operations [5]				221	217
Stone quarries	273	274	272	266	263
Coke plants	342	352	346	355	351
Peat [6]				209	[8]
Metallurgical plants	307	314	[3] 327	322	301
Nonmetal mills [7]		283	288	274	268
Total	222	245	[3] 252	245	229
Man-days worked, in thousands:					
Coal mines	49,598	53,612	[3] 55,286	52,077	40,095
Metal mines	16,294	17,113	[3] 18,017	17,751	13,108
Nonmetal mines (except stone quarries) [4]	3,637	3,836	4,178	4,691	4,318
Sand and gravel operations [5]				6,954	6,718
Stone quarries	21,506	21,470	21,777	22,410	21,189
Coke plants	6,567	7,279	7,082	[3] 7,187	5,683
Peat [6]				29	[8]
Metallurgical plants	16,713	18,150	[3] 21,470	21,003	16,842
Nonmetal mills [7]		2,467	5,056	7,415	6,956
Total	114,315	123,927	[3] 132,866	139,517	114,909
Man-hours worked, in thousands:					
Coal mines	387,950	419,627	[3] 433,662	408,207	314,251
Metal mines	130,489	136,950	[3] 144,407	142,181	104,966
Nonmetal mines (except stone quarries) [4]	29,564	31,093	33,963	37,877	34,927
Sand and gravel operations [5]				59,764	57,718
Stone quarries	175,817	175,775	178,281	183,394	173,348
Coke plants	52,482	58,164	56,557	[3] 57,337	45,486
Peat [6]				231	704
Metallurgical plants	133,675	145,841	[3] 171,578	167,489	134,221
Nonmetal mills [7]		19,843	40,675	59,765	56,098
Total	909,977	987,293	[3] 1,059,123	1,116,245	921,719
Number of injuries:					
Fatal:					
Coal mines	396	420	448	478	356
Metal mines	86	79	[3] 89	71	63
Nonmetal mines (except stone quarries) [4]	9	19	17	9	12
Sand and gravel operations [5]				35	37
Stone quarries	34	53	50	53	42
Coke plants	8	9	10	12	5
Peat [6]					
Metallurgical plants	16	11	[3] 20	21	12
Nonmetal mills [7]		3	7	10	9
Total	549	594	641	689	536

See footnotes at end of table.

TABLE 1.—Salient statistics of employment and injury experience in the mineral industries in the United States, by industry groups—Continued

	1954	1955	1956	1957	1958 [1]
Number of injuries—Continued					
Nonfatal:					
Coal mines	17,718	18,890	[3] 19,816	18,792	14,354
Metal mines	4,994	5,837	[3] 5,475	4,554	3,080
Nonmetal mines (except stone quarries) [4]	956	1,156	1,036	1,112	850
Sand and gravel operations [5]				1,763	1,035
Stone quarries	3,834	3,811	3,754	4,210	3,800
Coke plants	254	325	301	244	210
Peat [6]				5	12
Metallurgical plants	2,578	2,694	[3] 2,543	2,280	1,425
Nonmetal mills [7]		451	1,157	1,512	1,300
Total	30,334	33,164	[3] 34,082	34,472	26,066
Injury rates per million man-hours:					
Fatal:					
Coal mines	1.02	1.00	1.03	1.17	1.13
Metal mines	.66	.58	[3] .62	.50	.60
Nonmetal mines (except stone quarries) [4]	.30	.61	.50	.24	.34
Sand and gravel operations [5]				.59	.64
Stone quarries	.19	.30	.28	.29	.24
Coke plants	.15	.15	.18	.21	.11
Peat [6]					
Metallurgical plants	.12	.08	[3] .12	.13	.09
Nonmetal mills [7]		.15	.17	.17	.16
Total	.60	.60	.61	.62	.58
Nonfatal:					
Coal mines	45.67	45.02	[3] 45.69	46.04	45.68
Metal mines	38.27	42.62	[3] 37.91	32.03	29.34
Nonmetal mines (except stone quarries) [4]	32.34	37.18	30.50	29.36	24.34
Sand and gravel operations [5]				29.50	17.93
Stone quarries	21.81	21.68	21.06	22.96	21.92
Coke plants	4.84	5.59	5.32	4.26	4.62
Peat [6]				21.68	17.04
Metallurgical plants	19.29	18.47	[3] 14.82	13.61	10.62
Nonmetal mills [7]		22.73	28.44	25.30	23.17
Total	33.33	33.59	[3] 32.18	30.88	28.28

[1] Estimate—excepting coke.
[2] Men at work each day mine was active.
[3] Revised figure.
[4] Clay mines included beginning 1955.
[5] Sand and gravel included beginning 1957.
[6] Peat canvass included beginning 1957.
[7] Nonmetal mills shown beginning 1955—clay included 1956.
[8] Data not available.

Work Stoppages.—There were 190 work stoppages in the mineral industries, with a loss of 380,000 man-days of work, according to the Bureau of Labor Statistics. The bituminous-coal mining industry had most of these stoppages (136); however, the petroleum industry was charged with the largest number of man-days lost (141,000) and 16 stoppages during the year. The nonmetal mining and quarrying industry had 17 stoppages and 80,000 man-days idle during 1958. Anthracite mines had 8 stoppages and 2,000 man-days lost. The metal mining industry with 7 stoppages and the cement industry with 6 accounted for the remaining 13 work stoppages, and totaled 156,000 additional man-days of work lost.

Average Earnings.—Increases, or the same rates, were noted in hourly earnings in the mineral industries as reported by the U.S. Department of Labor, Bureau of Labor Statistics. Weekly earnings, how-

TABLE 2.—Work stoppages, average earnings, and labor turnover in certain mineral industries in the United States, 1954–58

[U.S. Department of Labor]

Industry and year	Work stoppages		Average earnings [1]		Labor-turnover rates [2]	
	Number	Man-days lost (thousands)	Weekly	Hourly	Accession	Separation
Coal mining:						
Anthracite:						
1954	19	76	[3] 73.68	[3] 2.40	1.3	5.2
1955	17	9	[3] 78.73	[3] 2.35	1.8	4.5
1956	18	56	[3] 78.96	[3] 2.40	[3] 1.4	[3] 1.5
1957	3	3	81.79	2.63	1.3	2.4
1958	8	2	76.01	2.63	1.6	4.3
Bituminous:						
1954	208	344	80.85	2.48	1.2	3.2
1955	292	273	96.26	2.56	1.6	1.5
1956	266	377	[3] 106.22	2.81	[3] 1.2	[3] 1.2
1957	161	136	110.53	3.02	.9	1.6
1958	136	1	102.38	3.02	1.2	2.5
Metal mining:						
1954	9	392	84.46	2.07	3.2	4.1
1955	19	638	92.42	2.19	4.5	3.9
1956	16	812	[3] 96.83	2.30	[3] 3.8	[3] 3.6
1957	13	59	98.74	2.42	2.5	3.7
1958	7	117	96.22	2.48	2.6	3.9
Iron:						
1954	[4]	[4]	82.03	2.17	1.6	4.3
1955	[4]	[4]	[3] 92.86	[3] 2.31	2.8	1.6
1956	[4]	[4]	[3] 96.71	2.43	[3] 1.9	[3] 1.7
1957	[4]	[4]	103.49	2.62	.8	1.6
1958	[4]	[4]	100.27	2.77	2.6	4.2
Copper:						
1954	[4]	[4]	[3] 87.13	2.05	3.6	3.9
1955	[4]	[4]	95.70	2.17	5.2	4.5
1956	[4]	[4]	[3] 100.28	[3] 2.30	[3] 4.1	[3] 4.1
1957	[4]	[4]	97.75	2.39	2.5	4.6
1958	[4]	[4]	94.62	2.42	2.8	3.7
Lead-zinc:						
1954	[4]	[4]	[3] 76.92	1.89	2.1	2.2
1955	[4]	[4]	83.82	2.01	2.5	2.1
1956	[4]	[4]	[3] 89.24	[3] 2.14	[3] 3.0	[3] 2.9
1957	[4]	[4]	88.97	2.17	2.0	3.8
1958	[4]	[4]	85.93	2.17	2.1	3.7
Nonmetal mining and quarrying:						
1954	14	33	77.44	1.76	[4]	[4]
1955	18	164	80.99	1.82	[4]	[4]
1956	23	75	85.63	1.92	[4]	[4]
1957	16	34	87.80	2.00	[4]	[4]
1958	17	80	89.63	2.07	[4]	[4]
Cement:						
1954	20	113	75.71	1.82	1.6	1.5
1955	4	4	78.85	1.90	2.0	1.7
1956	14	68	[3] 83.84	2.03	[3] 1.9	[3] 1.9
1957	6	436	87.91	2.16	1.8	2.1
1958	6	39	92.92	2.30	2.1	2.9
Coke and byproducts:						
1954	1	7	[3] 80.93	1.95	[4]	[4]
1955	1	[5]	86.31	2.06	[4]	[4]
1956	3	56	[3] 91.32	[3] 2.19	[4]	[4]
1957	5	25	96.00	2.33	[4]	[4]
1958	[4]	[4]	97.28	2.42	[4]	[4]
Petroleum refining:						
1954	10	36	96.22	2.37	.5	.7
1955	8	43	100.37	2.46	.7	.8
1956	9	90	108.39	2.65	[3] .8	[3] .8
1957	9	200	112.88	2.76	.8	1.1
1958	16	141	114.90	2.83	.4	1.0

[1] Production and related workers only.
[2] Averages expressed as the number per 100 employees.
[3] Revised figure.
[4] Data not available.
[5] Less than 1,000 man-days.

ever, declined in anthracite and bituminous coal mining and in the metal mining industry during the year.

Labor Turnover.—All groups in the mineral industries for which data are available for 1958, as reported by the Bureau of Labor Statistics, show an increase in both the accession and separation labor turnover rates, with the exception of the petroleum industry.

NATIONAL SAFETY COMPETITION

The National Safety Competitions, sponsored and conducted annually by the Bureau of Mines, have proved effective in promoting accident-prevention work in the mineral industries. An encouraging number of mineral plants enrolled in the National Safety Competition and the National Sand and Gravel Safety Competition. Of the 849 establishments enrolled in these two contests, 378 (45 percent) of them reported injury-free records with an aggregate worktime for these injury-free participants of almost 30 million man-hours. The 29,729,565 injury-free man-hours was 23 percent of the total man-hours worked (129,942,345) at all participating operations in these two National Competitions. In addition, the Bureau of Mines conducted three other annual competitions, sponsored by National Associations connected with the mineral industries. These Associations were: National Crushed Stone, National Lime, and National Slag. In these three contests, of 190 plants enrolled, 76 (40 percent) had injury-free records during an aggregate worktime of almost 20 million man-hours.

Trophy awards for the best safety records in each of the six groups in the 1958 National Safety Competition were made to the following:

Anthracite Underground Mines.—The Germantown Colliery of the Raven Run Coal Company, Centralia, Pa.

Bituminous-Coal Underground Mines.—The No. 14 mine of the United States Steel Corporation, Gary, W. Va.

Metal Underground Mines.—Pioneer Underground mine of the Oliver Iron Mining Division, United States Steel Corporation, Ely, Minn.

Nonmetal Underground Mines.—The Grand Rapids mine of the Bestwall Gypsum Company, Grand Rapids, Mich.

Open-Pit Mines.—Erie Commercial Mining Pit of Pickands Mather and Company (Erie Mining Company), Hoyt Lakes, Minn.

Quarries.—The Thornton quarry of the Material Service Corporation, Thornton, Ill.

TABLE 3.—Employment and injury experience of the U.S. mineral industries

Year	Men working daily	Average active days	Man-days worked	Man-hours worked	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	194,512,359	1,618,479,042	1,571	83,451	.97	51.56
1945	637,220	271	172,672,431	1,437,533,530	1,270	73,411	.88	51.07
1946	676,254	240	162,630,674	1,354,822,190	1,167	72,805	.86	53.74
1947	721,792	256	185,076,018	1,496,101,097	1,407	76,919	.94	51.41
1948	740,988	249	184,551,937	1,457,690,518	1,227	70,939	.84	48.67
1949	723,390	205	148,304,347	1,170,590,880	760	51,576	.65	44.06
1950	719,862	221	159,443,478	1,259,436,140	843	53,229	.67	42.26
1951	684,544	235	160,558,417	1,270,186,435	980	52,155	.77	41.06
1952	644,554	226	145,771,805	1,155,623,605	777	45,831	.67	39.66
1953	598,784	230	137,910,860	1,093,950,835	638	39,540	.58	36.14
1954	515,640	222	114,314,878	909,977,122	549	30,334	.60	33.33
1955	505,191	245	123,926,748	987,292,666	594	33,164	.60	33.59
1956 [1]	527,985	252	132,866,567	1,059,123,049	641	34,082	.61	32.18
1957	569,456	245	139,516,384	1,116,244,286	689	34,472	.62	30.88
1958 [2]	500,990	229	114,908,637	921,718,510	536	26,066	.58	28.28

[1] Revised figures.
[2] Estimate.

The Mineral Industry of Alabama

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Alabama

By Avery H. Reed, Jr.[1] and Walter B. Jones [2]

RECORD high production of crude petroleum, crushed limestone, marble, salt, scrap mica, and miscellaneous clay and decreased output of bituminous coal and iron ore characterized the mineral industry of Alabama in 1958. Among the States, Alabama ranked second in production of native asphalt, bauxite, and slag cement and third in output of iron ore and scrap mica.

Alabama's mineral industry was dominated by the mining and processing of coal and iron ore, which furnished 51 percent of the total value, compared with 60 percent in 1957. Leading companies were Tennessee Coal & Iron Division of United States Steel Corp. (coal, iron ore, lime, and stone), Woodward Iron Co. (coal and iron

TABLE 1.—Mineral production in Alabama [1]

Mineral	1957		1958	
	Thousand short tons (unless otherwise stated)	Value (thousand)	Thousand short tons (unless otherwise stated)	Value (thousand)
Cement:				
Masonry---thousand 376-pound barrels	1,618	$6,041	1,673	$6,368
Portland---do	11,382	34,238	11,915	36,562
Clays [2]	1,316	1,504	1,548	1,788
Coal	13,260	86,114	11,182	72,359
Iron ore (usable)---thousand long tons, gross weight	6,223	40,518	3,659	23,393
Lime	554	6,271	520	4,660
Natural gas---million cubic feet	190	12	200	30
Petroleum (crude)---thousand 42-gallon barrels	5,406	(4)	[3] 5,887	(4)
Sand and gravel	5,065	4,883	4,129	4,210
Stone [5]	9,519	11,972	11,080	17,068
Talc	2	3	(4)	(4)
Value of items that cannot be disclosed: Asphalt (native), bauxite, slag cement, clay (kaolin), mica, salt, stone (dimension limestone, dimension marble, oystershell, and sandstone (1958), and values indicated by footnote) [4]	----	[6] 23,344	----	26,508
Total [7]	----	[6] 209,549	----	187,747

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes kaolin.
[3] Preliminary figure.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Incomplete figures; excludes dimension limestone, dimension marble, oystershell, and sandstone, 1958.
[6] Revised figure.
[7] The total has been adjusted to eliminate duplications in the values of clays and stone.

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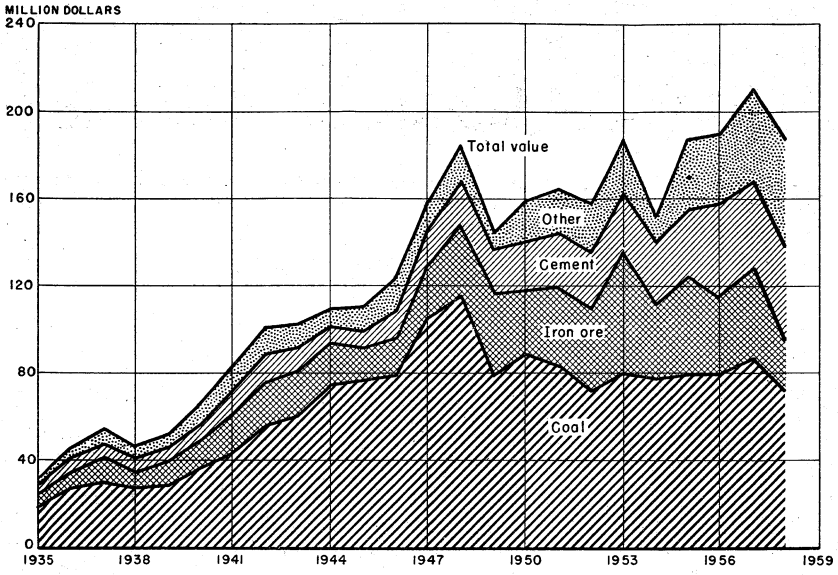

FIGURE 1.—Value of coal, iron ore, cement and total value of mineral production in Alabama, 1935–58.

ore), Southern Cement Co. Division of American Marietta Co. (cement, clays, lime, and stone), Alabama Power Co. (coal), and Ideal Cement Co. (cement, clays, and lime).

The total value declined 10 percent from 1957, the record year, and was the lowest since 1955. This decline was due to lower outputs of coal and iron ore.

Employment and Injuries.—Employment in the mineral industries declined 13 percent below 1957, because of less activity in coal and metal mining. Employment at coal mines decreased 25 percent, at metal mines 25 percent, and at coke ovens and smelters 12 percent. Owing to accelerated construction and highway development, other industries showed increases in employment. Employment at quarries and mills increased 15 percent, at sand and gravel mines 5 percent, and at nonmetal mines 36 percent. There were no serious strikes during the year. The total number of employees in the mineral industries declined 7 percent from 1957.

The frequency rate of injuries increased 11 percent in 1958. Increased rates were reported for coal mines, coke ovens and smelters, and sand and gravel mines, whereas decreased frequency rates were reported by metal and nonmetal mines. Twelve fatal injuries occurred in 1958, compared with 11 in 1957.

Consumption, Trade, and Markets.—Most of the mineral production of Alabama was used within the State. Virtually the entire output of coal was consumed in the Birmingham area by the steel industry or burned for electric power. Crude oil and natural gas were refined and used in the State. Large quantities of iron ore were imported. The integrated iron and steel industry at Birmingham and Gadsden used iron ore produced in the State, as well as imports from foreign countries and adjoining States. Bauxite produced in the State was

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-days worked	Fatal injuries	Nonfatal injuries	Injuries per million man-days
	1957						
Coal mines	247	8,697	203	1,765,239	5	179	104
Quarries and mills	48	2,700	285	768,674	2	112	148
Metal mines	21	3,279	220	720,363	1	38	54
Coke ovens and smelters	7	1,659	365	601,198	3	17	33
Sand and gravel mines	29	535	259	138,677		25	180
Nonmetal mines	28	457	236	107,844		25	232
Total	380	17,327	237	4,101,995	11	396	99
	1958 [1]						
Coal mines	193	7,153	185	1,325,917	8	158	125
Quarries and mills	62	3,316	266	882,800		125	142
Metal mines	33	2,993	181	541,139	1	23	44
Coke ovens and smelters	7	1,466	363	531,720	1	21	41
Sand and gravel mines	32	535	271	145,159	2	25	186
Nonmetal mines	34	646	227	146,499		30	205
Total	361	16,109	222	3,573,234	12	382	110

[1] Preliminary figures.

shipped to Eastern and Central States markets for refractory purposes; in addition, large quantities of bauxite were imported and consumed by the alumina plant at Mobile. Nonmetals were used within the State by local industries. Although Alabama was deficient in nonferrous metals, fertilizer materials, and various materials of construction, they were able to obtain them from other States.

Trends and Developments.—The mineral industry depends largely upon coal mining and processing and iron-ore mining and processing. These industries had been fairly stable for several years but showed a severe decline in 1958. Imported iron ore continued to displace local iron ore and in 1958 amounted to 25 percent of consumption.

The Federal Highway Building Program was mainly responsible for the record production of crushed limestone during the year.

Legislation and Government Programs.—The Alabama Oil & Gas Board approved 160-acre spacing for all zones deeper than 10,000 feet, following legislation passed in 1957.

The Bureau of Mines maintained the Southern Experiment Station at Tuscaloosa. Work was done on a wide variety of research projects concerning the mineral industry of the Southeast.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Asphalt (Native).—Alabama Asphaltic Limestone Co. crushed bituminous limestone in Colbert County for roads. Among the States, Alabama ranked second in output of native asphalt.

Coal.—Coal was mined at 141 mines in 9 counties, compared with 171 mines in 11 counties in 1957. Leading counties were Jefferson, Walker, and Tuscaloosa. Leading producers were Tennessee Coal & Iron Division of United States Steel Corp., Alabama Power Co.,

and Alabama By-Products Corp. Production was 16 percent below 1957 and 31 percent below 1947, the record year. Average production per mine increased to 79,300 tons from 77,500 tons in 1957. Of the total output, 76 percent was mined underground, and 59 percent was captive tonnage. Six percent of the coal was shipped from mines by truck, 13 percent by conveyor belt, and 81 percent by rail or water. Coal cut by machines amounted to 63 percent of the output and that mined by continuous mining machines to 35 percent.

Southern Electric Generating Co. is constructing a $150-million electric generating plant at Wilsonville which will use about 3 million tons of coal a year. The plant will be one of the largest power producers in the world. Two mines will be opened near Parrish and Maylane to supply coal for the plant.

TABLE 3.—Coal production by counties

County	1957		1958	
	Short tons	Value (thousand)	Short tons	Value (thousand)
Bibb	75,112	$337	22,976	$109
Blount	230,311	1,456	232,830	1,549
Cullman	30,378	167	21,134	133
Jackson	18,876	92	15,000	78
Jefferson	9,310,762	61,524	7,060,092	47,045
Marion	217,758	1,005	203,505	1,057
St. Clair	2,000	8	----	----
Shelby	78,724	513	74,697	536
Tuscaloosa	494,951	2,260	729,277	3,186
Walker	2,797,230	18,735	2,822,432	18,666
Winston	3,400	17	----	----
Total	13,259,502	86,114	11,181,943	72,359
Earliest record to date	923,506,000	(1)	934,688,000	(1)

[1] Data not available.

Coke.—Six companies produced byproduct metallurgical coke at seven plants in Etowah, Jefferson, and Tuscaloosa Counties. Leading producers were Tennessee Coal & Iron Division of United States Steel Corp. and Republic Steel Corp.

Natural Gas.—Marketed output of natural gas in Marion County was about the same as in 1957.

Petroleum.—Production of crude petroleum increased 9 percent over 1957 to a new record. Leading counties were Mobile and Escambia. During the year 67 new producing wells were drilled in Mobile County. The number of producing wells in 1957, by counties, was as follows: Mobile 173, Choctaw 66, Escambia 36, Clarke 8, and Baldwin 5—a total of 288. Operators were considering water flooding for the Citronelle field in Mobile County.

NONMETALS

Cement.—Seven companies produced masonry cement at eight plants in Blount, Jefferson, St. Clair, and Shelby Counties. Leading producers were Southern Cement Co. Division of American Marietta Co. (North Birmingham and Calera plants) and National Cement Co. (Ragland plant). Shipments increased 3 percent over 1957, but were 14 percent below 1955, the record year. Nineteen percent of the

masonry cement was consumed in Alabama. Shipments were made to Georgia (30 percent), South Carolina (11 percent), Florida (11 percent), Louisiana (10 percent), North Carolina (9 percent), Mississippi (6 percent), and other States (4 percent).

TABLE 4.—Production of crude petroleum, by counties in 42-gallon barrels [1]

County	1957	1958	County	1957	1958
Baldwin	27,357	38,392	Mobile	4,076,822	4,637,849
Choctaw	419,694	360,543			
Clarke	88,658	88,693	Total	5,406,000	5,887,000
Escambia	793,469	761,523	Earliest record to date	15,059,000	20,946,000

[1] Data from State Oil & Gas Board.

Seven companies produced portland cement at eight plants in five counties. Leading producers were Ideal Cement Co. (Mobile plant) and Lone Star Cement Corp. (Birmingham and Demopolis plants). Shipments increased 5 percent over 1957 but were 3 percent below 1956, the peak year. Thirty-eight percent of the output was used in Alabama. Shipments were made to Georgia (18 percent), Florida (16 percent), Mississippi (12 percent), Louisiana (8 percent), and other States (8 percent). Raw materials used during the year in portland cement included limestone and oystershell (62 percent), cement rock (21 percent), clay and shale (13 percent), and other materials (4 percent).

Southern Cement Co. Division of American Marietta Co. (North Birmingham plant) and Cheney Lime & Cement Co. (Algood plant) produced slag cement. Shipments increased 12 percent over 1957 but were 89 percent below 1952, the record year.

Annual capacity of Alabama's portland cement plants was 14,869,000 barrels.

Clays.—Nineteen companies mined 1,312,000 tons of miscellaneous clay at 20 mines in 11 counties. Leading producers were Ideal Cement Co. and Lone Star Cement Corp. The clay was used in manufacturing cement and heavy clay products, and some was used in stoneware. Production increased 15 percent compared with 1957 to a new record.

Ten companies mined fire clay at 11 mines in 7 counties. Leading producers were Russell Coal & Clay Co., and Natco Corp. Production increased 35 percent above 1957 but was 22 percent below 1956, the record year. Natco Corp., the Nation's leading producer of structural clay products, completed a new plant at Bessemer, begun in 1957, to manufacture clay conduit for telephone and power lines.

TABLE 5.—Finished portland cement produced, shipped, and in stock

Year	Production, thousand barrels	Shipments from mills		Stocks at mills on Dec. 31, thousand barrels
		Thousand barrels	Value (thousand)	
1949–53 (average)	10,432	10,325	$23,761	589
1954	10,997	11,122	28,583	682
1955	12,161	11,782	31,517	535
1956	12,969	12,312	35,256	750
1957	11,965	11,382	34,238	905
1958	12,372	11,915	36,562	981

TABLE 6.—Fire clay sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Firebrick and block	(1)	(1)	(1)	100,580	$268,415	$2.67
Fire-clay mortar	(1)	(1)	(1)	45,901	117,802	2.57
Foundries and steelworks	71,602	$186,074	$2.60	(1)	(1)	(1)
Other [2]	103,215	297,561	2.88	89,535	231,781	2.59
Total	174,817	483,635	2.77	236,016	617,998	2.62

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes foundries and steelworks, heavy clay products, and other refractories.

Thomas Alabama Kaolin Co. (Hackleburg mine) and Harbison-Walker Refractories Co. (Eufaula mine) mined kaolin for floor and wall tile, firebrick and block, paper filling, rubber filler, paint filler, fertilizer, and insecticides. Production decreased 5 percent below 1957.

Lime.—Seven companies produced quick and hydrated lime at eight plants in Jefferson, Mobile, and Shelby Counties. Leading producers were Southern Cement Co. Division of American Marietta Co. (Keystone and Roberta limekilns) and Longview Lime Corp. (Longview limekiln). Production decreased 6 percent below 1957, the record year. Output was consumed chiefly in Alabama (51 percent), but shipments also were made to Florida (15 percent), Georgia (13 percent), Tennessee (11 percent), Louisiana (4 percent), Mississippi (4 percent), and other States (2 percent).

TABLE 7.—Lime sold or used by producers, by uses

Use	1957		1958	
	Thousand short tons	Value (thousand)	Thousand short tons	Value (thousand)
Chemical and industrial	469	$5,315	426	$3,596
Other	85	956	94	1,064
Total	554	6,271	520	4,660

Mica.—Dixie Mines, Inc., mined scrap mica at the Dixie mine, which was shipped to Texas for grinding; production increased 6 percent over 1957, the previous record year. Six companies or individuals mined a small quantity of sheet mica in four counties; leading producers were Dixie Mines, Inc. (Dixie and Red Indian mines), and L. T. Bounds (Hurst mine); production was 36 percent more than in 1957. Among the States, Alabama ranked third in the production of scrap mica.

Salt.—Mathieson Chemical Corp., the State's only salt producer, has increased production each year since drilling the brine wells near McIntosh in 1952. Output increased 8 percent over 1957, the previous record year. A third salt dome was discovered in Southern Clarke

County within 20 miles of the other two domes. It is the most easterly salt dome in the United States. Salt was encountered below 9,200 feet and solid salt below 10,500 feet; drilling was stopped in salt at 15,350 feet.

Sand and Gravel.—Twenty-nine companies mined sand and gravel at 33 mines in 21 counties. Leading producers were Birmingham Slag Division of Vulcan Materials Co., Tennessee Valley Sand & Gravel Co., and Alabama Gravel Co. Production decreased 18 percent below 1957, the record year. Ninety-six percent of the total production was washed; 59 percent was shipped by truck and 41 percent by rail or water.

Stone.—Thirty-five companies produced crushed limestone at 40 quarries in 22 counties. Leading producers were Lone Star Cement Corp. (Birmingham, Demopolis, and St. Stephens quarries), Madison Limestone Co. (Airport and Pluski Pike quarries), and Birmingham Slag Division of Vulcan Materials Co. Output increased 17 percent above 1957 and 14 percent above 1956, the previous record year. Of the total production, 54 percent was shipped by truck and 46 percent by rail or water.

Alabama Limestone Co. (Rockwood and Aday quarries) quarried dimension limestone for rubble, rough architectural and dressed building stone, and curbing and flagging. Production increased 18 percent over 1957 but was 28 percent less than in 1956, the record year.

Three companies crushed marble for terrazzo, whiting, and other uses at three quarries in Talladega County. The leading producer was Thompson-Weinman & Co., which operated its new marble grinding plant at Sylacauga. Grinding material was formerly shipped to Cartersville, Ga., for grinding. Production increased 17 percent over 1957 and established a new record.

Moretti-Harrah Marble Co. and Alabama Marble Co. quarried dimension marble for rough building stone, sawed and cut dressed building stone for interior use, and dressed monumental stone. Production increased 51 percent over 1957 and established a new record.

TABLE 8.—Sand and gravel sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Baldwin			8,320	$7,738
Bibb	2,388	$1,194		
Calhoun	197,921	240,941	187,011	155,985
Cherokee	1,457	2,981	(1)	(1)
Clarke	410,468	267,018	36,893	39,122
Cleburne	1,900	950		
Covington	11,000	5,500		
Escambia	55,051	53,150	(1)	(1)
Hale	80,000	80,000		
Macon	46,696	59,601	59,240	69,566
Monroe	14,196	13,145	18,900	17,000
Montgomery	(1)	(1)	807,705	802,690
St. Clair	3,819	8,060	2,265	5,097
Sumter	32,000	32,000	30,000	24,300
Undistributed	4,207,949	4,118,896	2,978,232	3,088,510
Total	5,064,845	4,883,436	4,128,566	4,210,008

[1] Figure withheld to avoid disclosing individual company confidential data.

TABLE 9.—Sand and gravel sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	1,158,652	$1,079,321	$0.93	1,266,812	$1,076,322	$0.85
Paving	603,894	489,192	.81	579,599	464,690	.80
Molding	132,433	212,239	1.60	(1)	(1)	(1)
Engine	86,423	64,422	.75	41,852	27,275	.65
Other	190,227	119,219	.63	(1)	(1)	(1)
Gravel:						
Structural	1,322,912	1,390,587	1.05	1,244,572	1,474,867	1.19
Paving	815,928	879,159	1.08	654,732	784,767	1.20
Railroad ballast	135,863	103,148	.76	66,135	46,341	.70
Other	618,513	546,149	.88	(1)	(1)	(1)
Other sand and gravel				274,864	335,746	1.22
Total	5,064,845	4,883,436	.96	4,128,566	4,210,008	1.02

[1] Figure withheld to avoid disclosing individual company confidential data, included with "Other sand and gravel."

Bay Towing & Dredging Co. and Southern Oyster Shell Milling Co. crushed oystershell from Mobile Bay for cement, lime, concrete and roads, agstone, and poultry grit. Production was 16 percent less than in 1957.

Universal Atlas Cement Division of United States Steel Corp. and Sam P. Acton crushed sandstone for cement, foundries, and refractories.

De Kalb Stone Co., Inc., and A. O. Brown quarried dimension sandstone for rough architectural building stone and flagging at two quarries in De Kalb and Blount Counties.

Talc.—American Talc Co., the State's only talc producer, mined and ground talc for insecticides at the Winterboro talc mine in Talladega County.

Vermiculite.—Zonolite Co. operated a vermiculite expanding plant at Birmingham, using materials from Montana and South Carolina.

TABLE 10.—Crushed limestone sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Blount	(1)	(1)	23,998	$28,318
Chilton			19,744	39,488
Colbert	(1)	(1)	740,074	931,494
Etowah	(1)	(1)	319,388	470,209
Henry			9,000	24,000
Jackson	112,990	$169,485	344,922	297,663
Jefferson	3,186,937	2,980,277	3,042,144	3,107,923
Lee			165,613	188,681
Limestone	45,000	63,000	61,069	85,497
Morgan	354,474	409,771	644,610	651,774
Shelby	2,404,387	3,443,908	2,717,468	4,053,850
Undistributed	3,188,487	3,500,384	2,769,190	3,324,179
Total	9,292,275	10,566,825	10,857,220	13,203,076

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 11.—Crushed limestone sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roads	2,625,195	$3,298,696	$1.26	4,381,270	$5,665,327	$1.29
Cement manufacture	3,255,272	2,381,537	.73	3,274,529	2,650,307	.81
Fluxing stone	1,992,420	2,711,752	1.36	1,340,816	2,087,899	1.56
Lime manufacture	728,059	897,993	1.23	782,233	988,601	1.26
Agstone	420,643	620,908	1.48	516,258	787,832	1.53
Asphalt filler	97,407	191,782	1.97	81,364	249,370	3.06
Rock dust for coal mines	(1)	(1)	(1)	56,918	246,169	4.32
Riprap	(1)	(1)	(1)	49,574	76,058	1.53
Railroad ballast	(1)	(1)	(1)	6,873	10,183	1.48
Mineral food	(1)	(1)	(1)	1,829	4,325	2.36
Other [2]	173,279	464,157	2.68	365,556	437,005	1.20
Total	9,292,275	10,566,825	1.14	10,857,220	13,203,076	1.22

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes paper and other fillers, stone sand, and other uses.

METALS

Aluminum.—Reynolds Metals Co. completed a new $70-million aluminum reduction plant adjacent to the recently modernized Listerhill reduction plant at Sheffield with which Reynolds entered the primary aluminum producing field in 1941. Total annual rated capacity of the new and old plants was 190,000 tons of aluminum.

Bauxite.—D. M. Wilson Bauxite Co. and R. E. Wilson mined crude bauxite at two mines in Barbour County for chemicals and refractories. Production declined 4 percent below 1957 and 27 percent below 1956. Among the States, Alabama ranked second in output of bauxite.

Ferroalloys.—Shipments of ferroalloys included ferromanganese, silicomanganese, ferrosilicon, and ferrophosphorus.

Iron Ore.—Shipments of iron declined 41 percent below 1957 and 59 percent below 1942, the record year, to the lowest level since 1935. Of the total shipments, 58 percent was direct-shipping ore, compared with 57 percent in 1957. The number of active mines decreased from 50 to 31, and average usable production per mine decreased from 126,000 to 117,000 tons. Among the States, Alabama ranked third in output of iron ore. Shipments of iron ore from 1840 to 1958 are shown in table 15.

Five companies mined red iron ore (hematite) at six mines in Jefferson and Tuscaloosa Counties. Leading producers were Tennessee Coal & Iron Division of United States Steel Corp. (Wenonah mines) and Woodward Iron Co. (Songo and Pyne mines). Production decreased 35 percent below 1957 and 59 percent below 1942, the record year, to the lowest figure since 1935.

Twenty-one producers mined brown iron ore (limonite) for iron and steel at 25 mines in 10 counties. Leading producers were Glenwood Mining Co., Inc. (Spring Hill and Glenwood mines), Shook & Fletcher Supply Co. (Taits Gap, Blackburn, and Adkins mines), and Pigeon Creek Mining Co. (Luverne mine). Shipments fell 63 percent below 1957 and 73 percent below 1942, the peak year, to the lowest figure since 1947.

Magnesium.—Alabama Metallurgical Corp. began constructing a $3.5-million, 6,000-ton-per-year, high-purity magnesium plant about 75 miles south of Birmingham. The new plant will produce magnesium from dolomite.

Pig Iron and Steel.—Tennessee Coal & Iron Division of United States Steel Corp. (Ensley and Fairfield plants), Republic Steel Corp. (Thomas and Gulfsteel plants), U.S. Pipe & Foundry Co. (Birmingham, North Birmingham, and No. 5 plants), and Woodward Iron Co. (Woodward plant) produced 3,415,000 tons of foundry, basic, low-phosphorus, intermediate-phosphorus, and direct-casting pig iron, compared with 4,904,000 tons in 1957. Value of shipments was $188,150,000, compared with $253,161,000 in 1957. Iron ore consumed was 75 percent domestic and 25 percent imported, compared with 82 and 18 percent in 1957. Imports, mainly from Venezuela and Peru, increased 10 percent above 1957 and 2 percent above 1956, the previous record year. Republic Steel Corp. completed two new electric furnaces at Gadsden, which will operate mainly on scrap iron. U.S. Pipe & Foundry Co. blew in its new No. 5 furnace at Birmingham.

TABLE 12.—Shipments of usable iron ore, by counties

County	1957		1958	
	Long tons	Value	Long tons	Value
Barbour	(1)	(1)	21,581	$102,098
Butler	246,811	$1,370,310	83,171	453,771
Jefferson	4,751,311	32,526,969	(1)	(1)
Pike	147,288	749,341	228,093	1,115,545
Undistributed	1,077,474	5,871,709	3,326,627	21,721,553
Total	6,222,884	40,518,329	3,659,472	23,392,967

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 13.—Mine production and shipments of crude iron ore

	1957		1958	
	Number of mines	Long tons	Number of mines	Long tons
Mine production:				
By varieties:				
Hematite	14	4,916,430	6	3,206,838
Limonite	36	5,447,849	25	1,971,996
By mining methods:				
Open-pit	45	5,548,782	26	2,051,852
Underground	5	4,815,497	5	3,126,982
Shipments from mines:				
Direct to consumers	14	3,564,447	8	2,123,226
To beneficiation plants	36	6,769,937	23	3,051,037

TABLE 14.—Production and shipments of usable iron ore

	1957		1958	
	Long tons	Iron content, natural (percent)	Long tons	Iron content, natural (percent)
Production:				
Hematite	4,850,651	36	3,139,777	36
Limonite	1,440,312	44	493,376	46
Shipments:				
Direct shipping ore	3,564,447	38	2,123,226	36
Concentrates	1,933,437	39	1,536,246	40
Sinter	725,000	44	(1)	42

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Concentrates."

TABLE 15.—Shipments of iron ore, 1840–1958

Year	Thousand long tons	Value (thousand)	Year	Thousand long tons	Value (thousand)
1840–90	8,604	$6,778	1926	6,871	$13,847
1891	1,987	1,987	1927	6,508	12,974
1892	2,312	2,200	1928	6,160	11,599
1893	1,742	1,447	1929	6,637	12,575
1894	1,493	1,239	1930	5,638	11,015
1895	2,199	1,452	1931	3,630	6,156
1896	2,042	1,409	1932	1,470	2,428
1897	2,099	1,553	1933	2,156	3,253
1898	2,402	1,633	1934	2,721	4,380
1899	2,663	2,610	1935	3,560	5,827
1900	2,759	2,621	1936	4,260	6,838
1901	2,802	2,579	1937	6,350	10,748
1902	3,574	3,937	1938	4,281	7,342
1903	3,685	3,940	1939	5,985	9,971
1904	3,700	3,737	1940	7,330	12,606
1905	3,783	4,274	1941	7,873	18,091
1906	3,995	5,107	1942	8,845	19,035
1907	4,039	4,863	1943	8,060	21,047
1908	3,734	4,359	1944	6,808	17,684
1909	4,321	4,601	1945	6,039	14,547
1910	4,801	6,095	1946	5,994	17,458
1911	3,956	4,876	1947	7,208	23,437
1912	4,777	5,734	1948	8,024	32,544
1913	5,333	6,649	1949	7,314	27,553
1914	4,515	5,728	1950	7,402	28,933
1915	5,135	6,798	1951	8,182	34,800
1916	6,802	10,843	1952	7,243	37,940
1917	7,102	13,050	1953	7,446	55,640
1918	6,121	15,335	1954	5,913	33,327
1919	4,895	11,954	1955	6,814	44,657
1920	5,833	15,994	1956	5,633	34,824
1921	2,836	5,058	1957	6,223	40,518
1922	5,295	8,791	1958	3,659	23,393
1923	6,923	15,540			
1924	6,558	13,928	Total	349,947	879,822
1925	6,891	14,135			

REVIEW BY COUNTIES

Mineral production was reported from 49 of the State's 67 counties. Leading counties were Jefferson (which supplied 51 percent of the total value), Walker, and Shelby.

Baldwin.—Crude petroleum production from 5 producing oil wells was 40 percent more than in 1957; no new producing wells were drilled during the year. Hinote Sand Supply Co. mined structural sand. Fairhope Clay Products Co. (Fairhope mine) mined 6,000 tons of miscellaneous clay for heavy clay products.

TABLE 16.—Value of mineral production in Alabama, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Baldwin	(2)	(2)	Petroleum, sand and gravel, miscellaneous clay.
Barbour	(2)	(2)	Bauxite, iron ore, kaolin.
Bibb	(2)	$108,676	Coal.
Blount	$2,455,757	2,340,007	Coal, iron ore, cement, fire clay, limestone, sandstone.
Butler	1,370,310	453,771	Iron ore.
Calhoun	409,210	345,822	Sand and gravel, fire clay, iron ore, limestone.
Cherokee	2,981	(2)	Sand and gravel.
Chilton	(2)	(2)	Sand and gravel, limestone, miscellaneous clay.
Choctaw	(2)	(2)	Petroleum.
Clarke	(2)		Petroleum, sand and gravel.
Clay		3,336	Mica.
Cleburne	(2)	(2)	Do.
Colbert	1,409,795	(2)	Limestone, native asphalt.
Conecuh	(2)	(2)	Limestone, iron ore.
Coosa	(2)	(2)	Mica.
Covington	5,500	(2)	Limestone.
Crenshaw	(2)	(2)	Iron ore.
Cullman	(2)	133,258	Coal.
Dallas	(2)	(2)	Sand and gravel.
De Kalb	(2)	(2)	Limestone, sandstone.
Elmore	(2)	(2)	Sand and gravel.
Escambia	(2)	(2)	Petroleum, sand and gravel, miscellaneous clay.
Etowah	(2)	(2)	Limestone, sand and gravel.
Fzanklin	2,362,295	1,531,468	Limestone, iron ore, sand and gravel, fire clay.
Greene	(2)		
Hale	80,000		
Henry		24,000	Limestone.
Houston	(2)	(2)	Sand and gravel.
Jackson	261,599	375,813	Limestone, coal.
Jefferson	121,652,301	95,399,374	Coal, cement, iron ore, limestone, lime, miscellaneous clay, sandstone, fire clay.
Lee		188,681	Limestone.
Limestone	63,000	85,497	Do.
Macon	59,601	69,566	Sand and gravel.
Madison	(2)	(2)	Limestone, sand and gravel, miscellaneous clay.
Marengo	(2)	(2)	Cement, limestone.
Marion	(2)	(2)	Coal, kaolin, natural gas.
Marshall		(2)	Limestone.
Mobile	(2)	(2)	Petroleum, cement, oystershells, lime, sand and gravel, miscellaneous clay.
Monroe	13,145	17,000	Sand and gravel.
Montgomery	(2)	(2)	Sand and gravel, miscellaneous clay.
Morgan	725,084	(2)	Limestone, sand and gravel.
Pike	749,341	1,115,545	Iron ore.
Randolph	(2)	(2)	Mica.
Russell	387,849	531,673	Miscellaneous clay, sand and gravel.
St. Clair	(2)	(2)	Cement, limestone, miscellaneous clay, fire clay, sand and gravel.
Shelby	10,825,311	12,573,703	Cement, limestone, lime, coal, miscellaneous clay, fire clay.
Sumter	32,000	24,300	Sand and gravel.
Talladega	2,053,019	5,136,645	Marble, limestone, talc.
Tuscaloosa	2,879,372	4,154,561	Coal, iron ore, sand and gravel.
Walker	18,929,315	(2)	Coal, fire clay.
Washington	(2)	(2)	Limestone, salt, miscellaneous clay.
Winston	17,068		
Undistributed	[3] 42,470,629	63,134,304	
Total	[3] 209,549,000	187,747,000	

[1] The following counties are not listed because no production was reported: Autauga, Bullock, Chambers, Coffee, Dale, Fayette, Geneva, Lamar, Lauderdale, Lawrence, Loundes, Perry, Pickens, Tallapoosa, and Wilcox.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.

Barbour.—R. E. Wilson and D. M. Wilson Bauxite Co. mined bauxite for chemicals and refractories. Rucker Mining Co. (Clio mine) and C. B. Hewitt Co. mined brown iron ore for iron and steel. Harbison-Walker Refractories Co. mined refractory kaolin.

Bibb.—Four companies mined coal; leading producers were Belle Ellen No. 5 mine (Hicks Coal Co.) and Belle Ellen No. 9 mine (H. E. Hicks Coal Co.).

Blount.—Four companies mined coal; leading producers were Southview strip mine (Robbins Coal Co., Inc.), and Hopewell strip mine (Alabama Coal & Ore Co., Inc.). Shook & Fletcher Supply Co. (Taits Gap mine) mined brown iron ore for sale to iron and steel plants. Cheney Lime & Cement Co. produced masonry and slag cement at the Graystone mill. Harbison-Walker Refractories Co. (Thermal mine) and Lehigh Coal Co. (Trafford mine) mined fire clay for firebrick and block and for heavy clay products. The Alabama State Highway Department crushed limestone for concrete and roads. A. O. Brown quarried dimension sandstone for rough architectural building stone.

Butler.—Six companies mined brown iron ore for pig iron and steel; leading producers were KMC Mining Co. (Greenville mine) and Woodward-Acree Mining Co. (Woodward-Acree mine).

Calhoun.—Wade Sand & Gravel Co., Inc., and John B. Lagarde, Inc., mined structural sand and gravel. Donoho Foundry Co. (Anniston mine) mined 42,000 tons of fire clay for fire-clay mortar. Pope & Sublett and B. F. Sweet mined brown iron ore for pig iron and steel. Hodges Stone Co. crushed limestone for concrete and roads.

Cherokee.—Wolf Creek Sand Co. mined molding sand.

Chilton.—Southeastern Sand-Gravel Co. mined structural, paving, and engine sand and structural and paving gravel. The State highway department crushed limestone for concrete and roads. Norman E. Smith mined a small quantity of miscellaneous clay.

Choctaw.—Crude petroleum production from 66 producing oil wells was 14 percent less than in 1957; no new producing wells were drilled during the year.

Clarke.—Crude petroleum production from eight producing oil wells was about the same as in 1957; no new producing wells were drilled during the year. Jackson Sand & Gravel Co. and Paul Sand & Gravel Co. mined structural and paving sand and gravel.

Clay.—L. T. Bounds (Hurst mine) mined 200 pounds of sheet mica.

Cleburne.—Dixie Mines, Inc. (Red Indian mine), mined sheet mica.

Colbert.—Ralph Rogers & Co., Inc., Tri-State Limestone, Inc., and Alabama Asphaltic Limestone Co. crushed limestone for riprap, concrete and roads, railroad ballast, agstone, and stone sand. Alabama Asphaltic Limestone Co. (Margerum quarry) mined native asphalt for roadstone.

Conecuh.—Conecuh Lime Co., Inc., crushed limestone for agstone. Birmingham Contracting Co. (Wilcox mine) mined brown iron ore for the iron and steel industry.

Coosa.—Rebel Mining Co. (Rebel mine) and Grover C. Williams (Bentley mine) mined a small quantity of sheet mica.

Covington.—Miller Lime Pit crushed limestone for agstone.

Crenshaw.—Davis Bros. Mining Co. (Davis mine), Glenwood Mining Co., Inc. (Spring Hill mine), and H. E. Bowden mined brown iron ore for iron and steel.

Cullman.—Six mines produced coal; leading producers were the Arkadelphia No. 2 strip mine (H. E. Drummond Coal Co.) and the No. 3 mine (Freeman Butler Coal Co.).

Dallas.—Dallas Sand & Gravel Co., Inc., and C. Pierson Cosby mined molding, structural, paving, railroad-ballast, and other sand and structural, paving, railroad-ballast, and other gravel.

De Kalb.—Miller Limestone Co. crushed limestone for concrete and roads. De Kalb Stone Co., Inc. (Skirum quarry), quarried dimension sandstone for rough architectural building stone and flagging.

Elmore.—Alabama Gravel Co. and Birmingham Slag Division of Vulcan Materials Co. mined structural, paving, and engine sand and structural, paving, railroad-ballast, and other gravel.

Escambia.—Crude-petroleum production from 36 producing oil wells declined 4 percent below 1957; no new producing wells were drilled during the year. Dixie Sand & Gravel Co. and Flomaton Gravel Co. mined structural and paving sand and gravel. Keego Clay Products Co. mined 20,800 tons of miscellaneous clay for heavy clay products.

Etowah.—Alabama Aggregate Co. Division of McCullough Industries and Double R Co. crushed limestone for riprap, fluxing stone, concrete and roads, agstone, and asphalt filler. Milner Sand Co. and Glencoe Paving Co. mined molding, structural, and paving sand and structural and paving gravel.

Franklin.—Alabama Limestone Co. (Rockwood quarry) quarried dimension limestone for rubble, rough architectural stone, and dressed building stone and for curbing and flagging. Clark & Ford, Inc., and Alabama Limestone Co. crushed limestone for concrete and roads, agstone, asphalt, and other fillers, rock dust for coal mines, mineral food, and other uses. U.S. Pipe & Foundry Co. (Russellville No. 15 mine), Shook & Fletcher Supply Co. (Blackburn mine), and two smaller operators mined brown iron ore for pig iron and steel. Tennessee Valley Sand & Gravel Co. (Spruce Pine mine) mined structural and paving sand and gravel. Tennessee Valley Sand & Gravel Co. mined fire clay for fire-clay mortar.

Henry.—Abbeville Lime Co. crushed limestone for agstone.

Houston.—L. C. Smith Sand & Gravel Co. (Dothan mine) and Speigner Concrete Block Co. mined structural sand.

Jackson.—The State highway department (Paint Rock Creek quarry) crushed limestone for concrete and roads. Widow's Creek Coal Co. (Armstrong mine) mined coal for sale to TVA.

Jefferson.—Forty-nine mines produced coal; leading producers were Maxine mine (Alabama By-Products Corp.), Concord No. 1 mine (Tennessee Coal & Iron Division of United States Steel Corp.), and Edgewater mine (Tennessee Coal & Iron Division).

Four companies produced portland cement; leading producers were Lehigh Portland Cement Co. (Birmingham mill) and Universal Atlas Cement Co. Division of United States Steel Corp. (Leeds mill). Five companies produced masonry cement; leading producers were Southern Cement Division of American Marietta Co. (North Birmingham mill) and Lone Star Cement Corp. (Birmingham mill). Slag cement was produced by Southern Cement Division of American Marietta Co. (North Birmingham mill).

Five mines produced red iron ore; leading producers were Tennessee Coal & Iron Division of United States Steel Corp. (Wenonah mines) and Woodward Iron Co. (Pyne and Songo mines).

Eight quarries crushed limestone for fluxing stone, concrete and roads, railroad ballast, agstone, asphalt filler, rock dust for coal mines, cement, and lime; leading producers were Tennessee Coal & Iron Division of United States Steel Corp. (Dolonah quarry) and Lehigh Portland Cement Co. (Birmingham quarry).

Tennessee Coal & Iron Division of United States Steel Corp. (Ensley works) produced quicklime.

Five companies mined miscellaneous clay for cement and heavy clay products; leading producers were Lehigh Portland Cement Co. and Universal Atlas Cement Division of United States Steel Corp. (Leeds mine).

Universal Atlas Cement Division of United States Steel Corp. (Leeds quarry) and Sam P. Acton crushed sandstone for cement, refractories, and foundries.

Dixie Fire Brick Co., Inc., and Bibby Coal, Shale & Clay Co. mined fire clay for fire-clay mortar and foundries and steelworks.

Zonolite Co. operated a plant for exfoliated vermiculite at Birmingham, using materials from South Carolina and Montana.

Lee.—The State highway department crushed limestone for concrete and roads.

Limestone.—Limestone County Board of Revenue crushed limestone for concrete and roads.

Macon.—Sharpe Sand & Gravel Co. mined structural and paving sand and gravel.

Madison.—Madison Limestone Co. (Pluski and Airport quarries) crushed limestone for concrete and roads and for agstone. Tennessee Valley Sand & Gravel Co. mined structural and paving sand and gravel. Alabama Brick & Tile Co. (Farley mine) and Huntsville Brick & Tile Co., Inc., mined miscellaneous clay for heavy clay products.

Marengo.—Lone Star Cement Corp. produced portland cement at the Demopolis mill and crushed limestone for use in making cement.

Marion.—Twenty-eight mines produced coal; leading producers were New River Strip mine (Brookside-Pratt Mining Co.), Brilliant strip mine (Webb Excavating Co.), and Little Creek No. 3 mine (Little Creek Coal Co.). Thomas Alabama Kaolin Co. operated the Hackelburg mine during the year and mined kaolin for floor and wall tile, firebrick and block, paper, rubber and paint fillers, fertilizers and insecticides. Production of natural gas increased 5 percent over 1957.

Marshall.—C. A. Langford crushed limestone for concrete and roads and for agstone.

Mobile.—Crude-petroleum output from 173 producing oil wells was 14 percent more than in 1957; during the year 67 new producing wells were drilled. Ideal Cement Co. produced portland cement at the Mobile mill using oystershell dredged from Mobile Bay, lime at the Mobile limekiln from oystershell, and miscellaneous clay for use in cement. Bay Towing & Dredging Co. dredged oystershell from Mobile Bay for use in manufacturing cement and lime and for concrete and roads; Southern Oyster Shell Milling Co. crushed oystershells for poultry grit. Radcliff Gravel Co., Inc., and Southern States Sand & Gravel Co. mined structural and paving sand and structural, paving, and other gravel.

Monroe.—Mannings Sand & Gravel Co. mined structural sand and gravel.

Montgomery.—Four companies mined structural, paving, and railroad-ballast sand and gravel; leading producers were Birmingham Slag Division of Vulcan Materials Co. (No. 2 mine) and Alabama

Gravel Co. Jenkins Brick Co. and Excelsior Brick Co. mined miscellaneous clay for heavy clay products.

Morgan.—Four companies crushed limestone for riprap, concrete and roads, agstone, and fillers; leading producers were Trinity Stone Co., Inc., and the State highway department. Decatur Sand & Gravel Co. mined structural and paving sand and gravel.

Pike.—Five mines produced brown iron ore for iron and steel plants; leading producers were Glenwood Mining Co., Inc., and Luverne Mining Co.

Randolph.—Dixie Mines, Inc. (Dixie mine), mined scrap mica which was shipped to Texas for grinding; a small amount of sheet mica was mined by Dixie Mines, Inc., J. J. New, and Fletcher Smith.

Russell.—Bickerstaff Brick Co. (Brickyard mine), Bickerstaff Co., Inc. (Ceramic mine), and Dixie Brick Co. mined miscellaneous clay for heavy clay products. Consolidated Gravel Co., Inc. (Dixieland mine), and Jones Sand & Gravel Co. (Kendricks mine) mined structural and paving sand and paving gravel.

St. Clair.—National Cement Co. produced masonry and portland cement at the Ragland mill and crushed limestone for cement and asphalt filler. National Cement Co. and Ragland Brick Co. mined miscellaneous clay for cement and heavy clay products. Riverside Clay Co. mined 8,700 tons of fire clay for foundries and steelworks. Wolf Creek Sand Co. mined a small quantity of molding sand.

Shelby.—Southern Cement Co. Division of American Marietta Co. produced masonry and portland cements at the Calera mill. Eight quarries crushed limestone for riprap, fluxing stone, concrete and roads, railroad ballast, agstone, paper and asphalt filler, rock dust for coal mines, cement, lime, and other uses; leading producers were Birmingham Slag Division of Vulcan Materials Co. (Calera quarry) and Southern Cement Co. Division of American Marietta Co. (Roberta quarry). Six limekilns produced quick and hydrated lime; leading producers were Southern Cement Co. Division of American Marietta Co. (Roberta limekiln) and Longview Lime Corp. (Saginaw limekiln). Twelve mines produced coal; leading producers were No. 2 mine (Alabama Red Ash Coal Co.), River Valley No. 8 mine (River Valley Coal Co.) and No. 4 Acton mine (Paramount Coal Co.). Southern Cement Co. Division of American Marietta Co. mined miscellaneous clay for cement. Montevallo Clay Co. mined 10,000 tons of fire clay for foundries and steelworks.

Talladega.—Thompson-Weinman & Co. (Hill quarry), Moretti-Harrah Marble Co., and Alabama Marble Co. crushed marble for whiting, terrazzo, and other uses. Moretti-Harrah Marble Co. and Alabama Marble Co. quarried dimension marble for rough and dressed building stone and dressed monumental stone. Nally & Boone crushed limestone for concrete and roads. American Talc Co. (Winterboro mine) mined a small quantity of talc which was ground for insecticides.

Tuscaloosa.—Eleven mines produced coal; leading producers were Kellerman No. 4 strip mine (Twin Seam Mining Co.) and Mitchell Nos. 2 and 3 strip mines (Mitchell Bros. Construction Co.). Southeastern Coal & Iron Co. (Dudley mine) mined red iron ore, and Shook & Fletcher Supply Co. (Adkins mine) mined brown iron ore for pig

iron and steel. Yazoo Gravel Co., Inc., and Tuscaloosa Sand & Gravel Co. mined structural and other sand and structural gravel.

Walker.—Twenty-six mines produced coal; leading producers were Gorgas mine (Alabama Power Co.), Waterside strip mine (DeBardeleben Coal Corp.), and Empire No. 3 mine (DeBardeleben Coal Corp.). Russell Coal & Clay Co., Natco Corp., and Harbison-Walker Refractories Co. mined fire clay for firebrick and block and for heavy clay products.

Washington.—Lone Star Cement Corp. crushed limestone and mined miscellaneous clay. The output was shipped to Louisiana for use in making cement. Mathieson Chemical Corp. recovered salt from brine at its plant near McIntosh.

The Mineral Industry of Alaska

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Department of Mines, Territory of Alaska.

By Alvin Kaufman,[1] Kevin Malone,[2] Phil R. Holdsworth,[3] and Ruth Robotham[4]

PRODUCTION of oil in commercial quantities, the first output since 1933, was the outstanding event of the 1958 Alaska mineral industry. Under a joint exploration program with Richfield Oil Corp., Standard Oil Co. of California began production testing on wells in the Swanson River unit; it continued exploratory drilling in this area as well as in the Deep Creek field. Other oil companies started or continued exploratory drilling in various parts of Alaska. Airborne geophysical crews were particularly active in the search for oil.

Arrangements for a 10-company cooperative geophysical survey by seismic methods of the Cook Inlet area were completed in 1958; work was expected to start early in 1959. The Swanson River dis-

TABLE 1.—Mineral production in Alaska

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Antimony ore and concentrate—antimony content	17	$4		
Chromite—gross weight	4,207	431		
Coal—thousand short tons	842	7,296	759	$6,931
Copper (recoverable content of ores, etc.)	(1)	(2)	5	3
Gold (recoverable content of ores, etc.)—troy ounces	215,467	7,541	186,435	6,525
Lead (recoverable content of ores, etc.)	9	3	2	(2)
Mercury—76-pound flasks	5,461	1,349	3,380	774
Natural gas—million cubic feet			50	6
Sand and gravel—thousand short tons	6,096	8,799	4,255	3,871
Silver (recoverable content of ores, etc.) thousand troy ounces	29	26	24	22
Stone—thousand short tons	528	1,953	615	2,065
Value of items that cannot be disclosed: Gem stones, platinum-group metals, crude petroleum (1958), uranium ore, and values indicated by footnote 2		1,390		1,253
Total Alaska		28,792		21,450

[1] Less than 1 ton.
[2] Less than $1,000.

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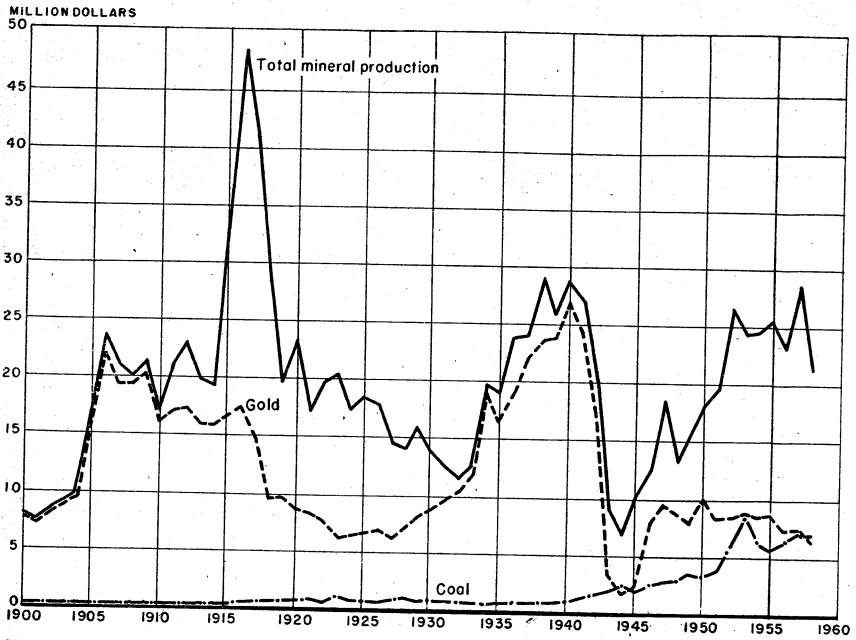

FIGURE 1.—Value of total mineral production, gold, and coal in Alaska, 1900–58. From 1911–31 copper production accounted for most of the value of minerals other than gold and coal.

TABLE 2.—Expenditures for exploration and prospecting by major companies in Alaska

Type and region	Expenditures (thousands)		Type and region	Expenditures (thousands)	
	1957	1958		1957	1958
Metals exploration:			Oil and gas exploration:		
Southeastern	$690	$850	All areas	$10,500	$5,900
Copper River and Prince William Sound	175	10	Total	11,640	7,080
Kuskokwim River and Yukon River	70	110			
Northwestern	205	210			

covery, made in 1957, resulted in an oil-lease boom. Acreage under lease at the close of the year was estimated at more than four times that of 1957. Exploration activity in metals and minerals increased in 1958.

Value of mineral production declined 25 percent compared with 1957 principally because of cessation of chromite mining as well as substantial drops in the value of sand and gravel, mercury, gold, and coal.

Four commodities (coal, gold, sand and gravel, and stone) furnished 90 percent of the value of mineral output. Mercury, platinum-group metals, uranium, and crude petroleum and natural gas were also produced.

TABLE 3.—Shipments of mineral commodities into Alaska [1] (coastwise receipts and imports)

Commodity	1955	1956	1957
	Short tons (unless otherwise stated)	Short tons (unless otherwise stated)	Short tons (unless otherwise stated)
Anthracite, bituminous coal and lignite, and coke	1,673	1,846	1,402
Motor fuel and gasoline—thousand barrels	1,628	2,148	1,980
Gas, oil, and distillate fuel oil—do	2,928	3,868	3,504
Kerosine—do	27	23	59
Residual fuel oil—do	311	362	266
Petroleum asphalt	18,448	28,357	15,701
Lubricating oils and greases—thousand barrels	24	30	31
Petroleum products, n.e.c—do	365	321	406
Building cement—376-pound barrels	489,255	372,144	353,904
Building, monumental, and other stone manufactures, n.e.c	1,674	1,173	1,983
Clays and earths	169	300	331
Brick and tile	1,135	1,340	1,440
Sand, gravel, and crushed rock, except limestone	5,463	5,514	684
Iron ore and concentrates	378	1,586	132

[1] Adapted from Waterborne Commerce of the United States, Part 4, Pacific Coast, Alaska, and Pacific Islands, calendar years 1955–57, by the U.S. Army Corps of Engineers.

Employment.—Activity at 276 mines and 2 milling plants furnished a total employment of 1,925 men. Data in the 1957 Alaska chapter reported only a small fraction of the active sand and gravel and stone production; consequently, figures for 1957 and 1958 are not comparable. In 1958, excluding employment in these industries, 197 operations employed 1,421 men, compared with 152 operations employing 1,584 men in 1957. The rise in total employment resulted chiefly because of better coverage of nonmetal-mining industries and of development and exploration activities.

Wage and Hours.—The average number of days worked in the mines dropped from 186 in 1957 to 160 in 1958. Both placer and lode gold mining furnished the decrease. Wage rates in 1958 were slightly higher than in 1957. Wages are generally higher in Alaska than in the States because the cost of living is higher. Figures compiled

TABLE 4.—Employment and injuries in 1958, by types of mines [1]

Type of mine	Number of men working (average)	Number of days worked (average)	Man-days	Injuries (number)	
				Fatal	Nonfatal
Metal mines:					
Lode	142	127	18,088	----------	7
Mills	10	208	2,075	----------	3
Placer:					
Dredge	712	193	137,638	----------	[2] 46
Nonfloat	247	104	25,741	----------	1
Hydraulic	23	83	1,907	----------	----------
Small-scale hand	20	62	1,231	----------	----------
Nonmetal mines [3]	280	134	37,553	----------	----------
Quarries and mills	224	106	23,797	----------	----------
Coal mines	267	224	59,855	----------	55
Total	1,925	160	307,885	----------	112

[1] Excludes prospecting and purely investigational work, but includes assessment and development work; excludes office workers.
[2] Includes 2 permanent partial injuries.
[3] Sand and gravel operations.

TABLE 5.—Average wage rates paid by coal and metal mining companies, by occupation

Occupation	Coal mines		Metal mines	
	1957	1958	1957	1958
Cook	$2.70	$3.51	$2.50	$2.50
Drill operator				3.90
Drill operator helper				3.20
Laborer		3.31	2.80	2.90
Loading and machine operator		4.36		
Miner	4.20	4.21	3.30	3.50
Shovel and dragline operator	4.00	4.21		4.00
Tractor operator	3.70	3.71	3.80	3.90
Truck driver	3.50	3.51	3.60	3.70

by the Department of State for the Civil Service Commission indicated that the cost of living in 1958 in Anchorage was 57 percent, in Fairbanks, 66 percent, and in Juneau, 47 percent greater than in Washington, D.C.

Injuries.—No fatalities were reported in the mineral industries—a decided improvement over the seven fatal injuries in 1957. Lost-time accidents decreased from 211 in 1957 to 112 in 1958.

Legislation and Government Programs.—Public Law 85–508, the Statehood Enabling Act, passed by the Congress of the United States on July 7, 1958, was the major piece of legislation of interest to the mineral industries of Alaska. This law provided for admission into the Union after fulfillment of certain requirements, which had not been completed at the end of 1958, but admission in early 1959 was anticipated. The Statehood Enabling Act grants the new State, within 25 years, the right to select 400,000 acres of National Forest land and 400,000 acres adjacent to established or prospective communities for recreational areas. All lands must be vacant, unappropriated, and unreserved (except National Forest lands) at the time of selection. The Act grants an additional 102.6 million acres (about 160,000 square miles) of public lands in other areas of the State. Mineral rights on this land may be leased as the legislature directs; they cannot be conveyed from the State to a second party. The Enabling Act recognizes the principle of separate surface and mineral rights and permits disposal of surface rights by sale, grant, deed, or patent; it expressly requires the State to retain ownership of mineral rights. A mineral-leasing system or some form of unpatented mining claim procedure will probably be developed to permit exploitation of State-owned mineral lands by private enterprise. Alaska will continue to receive 90 percent of the proceeds from mineral royalties and leases on Federally-owned land. It also may select oil, gas, or coal lands under lease before July 7, 1958, as part of the land grant. These lands must be selected within 5 years after passage of the Act. Lands leased after July 7, 1958, may not be selected.

Another legislative or regulatory development of the U.S. Department of the Interior was the withdrawal (primarily to protect the Alaska brown bear) of the Kodiak Wildlife Refuge from prospecting and mining, affecting approximately 1.8 million acres of Kodiak Island. The Secretary of the Interior also extended the time from 30 to 90 days, during which the Alaskan homesteader must consent to the Bureau of Land Management request that mineral rights be reserved to the Government, as required by the Act of March 8, 1922.

TABLE 6.—Office of Minerals Exploration activities in 1958

Region and contractor	District	Location	Property	Commodity [1]	Contract		Government participation (percent)
					Date	Total amount	
COOK INLET-SUSITNA							
MacLaren River Copper Corp.	Valdez Creek	MacLaren River	Kathleen-Margaret	Copper	May 29, 1957	$13,740	50
KUSKOKWIM RIVER							
DeCoursey Mountain Mining Co., Inc.	Aniak	West of Sleetmute	Red Devil	Mercury	Aug. 11, 1955	287,920	75
YUKON RIVER							
Alaska Metals Mining Co.	Fairbanks	Gilmore Dome	Yellow Pup	Tungsten	Sept. 28, 1954	52,308	75

[1] All contracts were for lode deposits.

This act expressly requires that mineral rights on homestead land be reserved before a patent is issued, whether the land is known to contain minerals or is a possible source.

Defense Minerals Exploration Administration (DMEA) contracts for exploration programs in effect totaled $353,968, declining 14 percent compared with 1957. There were no amendments to old contracts; no new contracts were signed.

Transportation.—After a public hearing before the Interstate Commerce Commission, the major water carriers received approval for a 15-percent rise (the full request) in steamship rates in April. Freight rates to Alaska increased approximately 7.5 percent in January. Rail rates remained relatively stable during the year; increased rail-water rates reflected the rise in water-transport rates. In some instances commodity rates declined as a result of a commodity rate reduction for those items that can be carried as consolidated carload units.

Some shipments to Alaska were delayed several weeks because of loading problems in the port of Seattle. A dock strike in British Columbia caused the diversion to Seattle of considerable freight that usually went through Vancouver, British Columbia, and associated ports.

TABLE 7.—Carload freight rates for selected commodities, Seattle to selected Alaskan cities per hundred pounds

Commodity	Seattle to—							
	Seward		Anchorage		Fairbanks via Valdez		Fairbanks via Seward	
	1957	1958	1957	1958	1957	1958	1957	1958
Machinery	$1.26	$1.45	$2.20	$2.39	$3.45	$3.97	$2.63	$2.82
Explosives	3.41	3.92	5.13	5.64	6.99	[1] 8.90	6.54	7.05
Diesel oil	1.18	1.36	1.73	1.91	3.51	4.17	2.71	2.89
Ores and concentrates (southbound only) [2]	.68	.78	1.08	1.18	--------	2.75	1.43	1.53

[1] Includes charges for transfer and handling at Valdez.
[2] Value not to exceed $60 per ton. Rate increases 25 percent for each additional $60 (or fraction) valuation.

Federal appropriations for road construction in the fiscal year ending June 30, 1959, which included the 1958 construction season, amounted to $13.5 million. More than $6 million was available from emergency highway-construction programs and $2.5 million, from National Forest highways. Funds available to the Bureau of Public Roads for highway construction from all sources (including State matching funds) totaled more than $24.6 million.

By the end of 1958, approximately 1,634 miles of the almost 2,000 miles of primary road planned was completed; 67 percent of the constructed mileage was paved. Of 3,301 miles of secondary roads programmed for construction, 2,559 miles actually have been completed. Only 27 miles of such roads have been paved.

The Bureau of Public Roads continued to construct the Livengood-Eureka road, eventually to become a part of the Fairbanks-to-Nome highway. Originally scheduled for completion by the summer of 1958 and now deferred until 1959, the Livengood-Eureka section would provide overland transportation for the placer mines in the

Hot Springs District. Additional work was done on the Nome section of the road.

The only major road project undertaken during the year was paving the Sterling Highway from Seward junction to Soldatna on the Kenai Peninsula. Plans were discussed during the year for replacing the bridge over the Chena Slough in Fairbanks with a more modern structure. Plans included dismantling and floating the old bridge down the Yukon River to the Bering Sea and then to Nome, where it would be hauled overland to the Kuzitrin River.

The city of Anchorage announced that construction of an $8.2 million harbor on Cook Inlet was under consideration and that financial arrangements were being completed. The harbor would provide direct access to interior Alaska and eliminate the 100-mile-rail haul from Seward to Anchorage. During periods of maximum tides the water level in Cook Inlet rises or falls approximately 1 foot every 12 minutes—presenting a major construction problem.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—No antimony ore was mined or shipped. Forty short tons of ore (50 percent antimony content), however, was recovered from old dumps and stockpiles by Sawtooth Mining Co., Tolovana district, Yukon River region. There was virtually no prospecting activity for antimony. Assessment work was reported by Kloss and Davis and by Tillicum Mining Co., Southeastern Alaska, as well as by Fred M. Wackwitz, Yukon River region.

Chromium.—No chromite ore was mined because the General Services Administration (GSA) purchase program expired on June 30, 1958. Kenai Chrome Co., Kenai Peninsula region, contemplated shipment of two barge loads of ore before the expiration date, but the GSA, the Government purchasing agent, could not accept the shipment.

Copper.—Totals of 5 tons of copper ore and 3 tons of copper-bearing gold concentrate were shipped to smelters from material recovered at inactive mines and mills. The copper ore was recovered from tailing from the Kennecott Mines, Copper River region, by Raymond F. Trotochaud. Gold concentrate that yielded some copper was recovered by Joe Lynch from various tailing piles in the Valdez Creek district, Copper River region, and by J. P. Ibach from the Reid Inlet Mine on Lemesurier Island, Juneau district, Southeastern Alaska region. Several companies continued exploration, among which companies were the Bear Creek Mining Co., Northwestern Alaska region; Totem Exploration Co., Southeastern Alaska region; and intermittently during the year, MacLaren River Copper Corp., Cook Inlet-Susitna region.

Gold.—Gold output from Alaska mines declined 13 percent compared with 1957, primarily because the value per yard of ground worked declined from $0.45 in 1957 to $0.36 in 1958. The decline in gold recovered appeared, on the surface, inconsistent with the increase in number of active washing plants from 96 in 1957 to 118. Gravel was washed principally by dredges, which produced 18.2 million cubic yards compared with 16.6 million cubic yards in 1957—

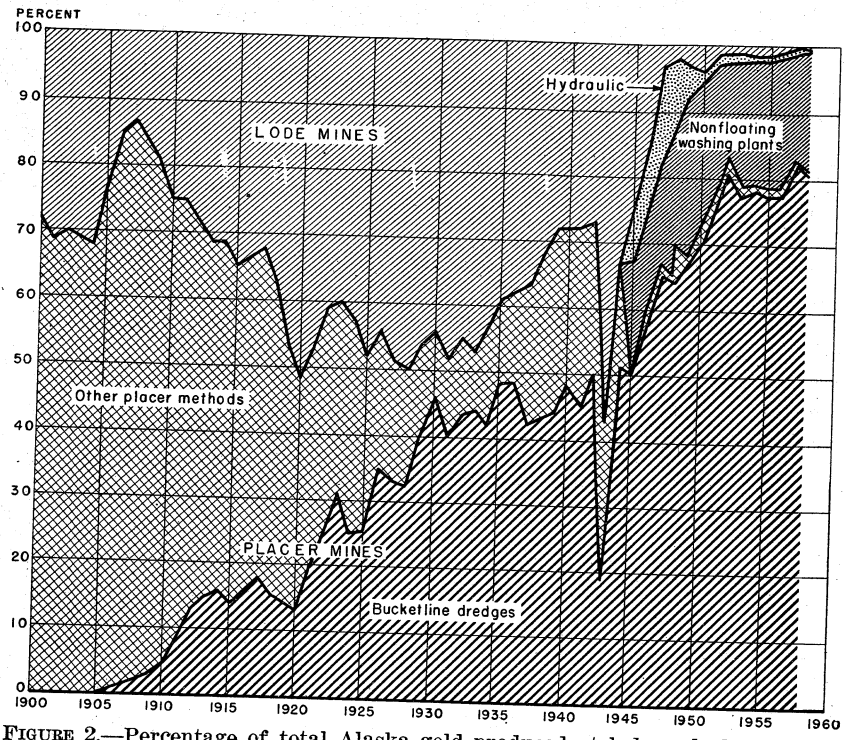

FIGURE 2.—Percentage of total Alaska gold produced at lode and placer mines and by various methods of placer mining, 1900–58. "Other placer methods" includes hydraulic and nonfloating washing plants, for which separate data are not available before 1943.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
1949–53 (average)	9	169	32,662	250,533	$8,769	37,987	$34
1954	5	146	19,747	248,511	8,698	33,697	31
1955	4	142	3,884	249,294	8,725	33,693	31
1956	3	120	265	209,296	7,325	28,360	26
1957	4	87	11,626	215,467	7,541	28,862	26
1958	3	108	55	186,435	6,525	23,507	22

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1949–53 (average)	2	$1	46	$13	2	$1	$8,818
1954	4	2					8,731
1955	1	1	1	[3]			8,757
1956	[4]	[3]	1	[3]			7,351
1957	[4]	[3]	9	3			7,570
1958	5	3	2	[3]			6,550

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore shipped to smelters during calendar year indicated.
[2] Does not include gravel washed.
[3] Less than $1,000.
[4] Less than 1 ton.

TABLE 9.—Fifteen leading gold-producing mines in 1958, in order of output

Rank	Mine	District	Region	Operator	Rank in 1957	Source of gold
1	Fairbanks Unit	Fairbanks	Yukon River	United States Smelting, Refining & Mining Co.	1	Dredge (7).
2	Nome Unit	Nome	Seward Peninsula	do	2	Do. (3).
3	Nyac	Aniak	Kuskokwim River	New York-Alaska Gold Dredging Corp	3	Do. (3).
4	Hogatza River	Hughes	Yukon River	United States Smelting, Refining & Mining Co.	4	Do. (1).
5	Woodchopper Creek	Circle	do	Alluvial Golds, Inc	(1)	Do. (1).
6	Colorado Creek	Innoko	do	Strandberg & Sons	5	Nonfloat.
7	Eva Creek	Fairbanks	do	Olive Creek Mines	(1)	Do.
8	Flat Creek	Iditarod	do	North American Dredging Co	8	Dredge (1).
9	Eureka Creek	Hot Springs	do	Strandberg & Sons	11	Nonfloat.
10	Slate Creek	Chistochina	Copper River	Beck & McFarland	(1)	Do.
11	Fairbanks Creek	Fairbanks	Yukon River	Alder Creek Mining Co	10	Do.
12	Ophir Creek	Innoko	do	Gus Uotila	15	Do.
13	Poorman Creek	Ruby	do	Miscovich Bros	13	Do.
14	Solomon Creek	Nome	Seward Peninsula	Lee Bros. Dredging Co	(1)	Dredge (1).
15	Otter Creek	Iditarod	Yukon River	Otter Dredging Co	7	Do. (1).

[1] Not among the fifteen highest in 1957.

a 12-percent increase. The number of active dredges increased from 21 to 23 during the year, but gold output from dredges dropped 15 percent. Apparently the dredges were operating in lower grade ground; this trend started in 1956.

During the year, Alluvial Golds, Inc., began operating the dredge formerly used by Gold Placers, Inc., in the Circle district, Yukon River region, and Nugget Mining Co., the Neubauer Mining Co. dredge in the Council district, Seward Peninsula region. In the Aniak district, Kuskokwim River region, New York Alaska Gold Dredging Corp. began operating a third dredge. Inmachuk Mining Co. put a dredge into operation on the Inmachuk River in the Fairhaven district, Seward Peninsula region.

The number of nonfloat operations (when gravel is delivered to washing plants by bulldozer or dragline) rose to 78 compared with 70 for the preceding year; however, yardage washed declined 7 per-

TABLE 10.—Gold produced at placer mines, by classes of mines and methods of recovery

Class and method	Number—		Material treated (cubic yards)	Gold recovered		
	Mines producing [1]	Washing plants		Fine ounces	Value	Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucketline dredges:						
1949–53 (average)	17	25	13,866,000	189,278	$6,624,730	$0.478
1954	14	24	11,936,100	196,028	6,860,980	.575
1955	10	17	11,030,100	194,131	6,794,585	.616
1956	13	22	12,350,400	161,410	5,649,350	.457
1957	12	21	14,286,700	177,563	6,214,705	.435
1958	13	23	16,042,590	150,342	5,261,970	.328
Nonfloating washing plants: [2]						
1949–53 (average)	96	96	3,339,100	53,415	1,869,525	.560
1954	85	85	2,866,300	48,880	1,710,800	.597
1955	90	91	3,390,000	51,023	1,785,805	.527
1956	76	76	2,295,200	44,533	1,558,655	.679
1957	70	70	2,223,500	36,211	1,267,385	.570
1958	78	78	2,077,470	34,664	1,213,240	.584
Gravel hydraulically handled:						
1949–53 (average)	19	----	125,860	2,292	80,220	.637
1954	17	----	97,400	1,481	51,835	.532
1955	15	----	58,900	908	31,780	.540
1956	14	----	24,100	866	30,310	1.258
1957	3	----	115,600	974	34,090	.295
1958	9	----	33,810	567	19,845	.587
Small-scale hand methods (wet):						
1949–53 (average)	34	----	24,750	730	25,550	1.032
1954	29	----	30,400	1,106	38,710	1.273
1955	25	----	35,200	898	31,430	.893
1956	17	----	22,000	724	25,340	1.152
1957	2	----	19,100	314	10,990	.575
1958	8	----	13,980	662	23,170	1.657
Underground placers (drift):						
1949–53 (average)	3	----	690	112	3,920	5.648
1954	1	----	200	14	490	2.450
1955	2	----	400	42	1,470	3.675
1956–58	----	----	----	----	----	----
Grand total placers:						
1949–53 (average)	169	----	17,356,400	245,827	8,603,945	.496
1954	146	----	14,930,400	247,509	8,662,815	.580
1955	142	----	14,514,600	247,002	8,645,070	.596
1956	120	----	14,691,700	207,533	7,263,655	.494
1957	87	----	16,644,900	215,062	7,527,170	.452
1958	108	----	18,167,850	186,235	6,518,225	.359

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others, who gave no evidence of legal right to property.

[2] Includes all placer mines, using both power excavator and washing plant on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

TABLE 11.—Mine production of gold, silver, copper, and lead in 1958, by months, in terms of recoverable metals [1]

Month	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)
January				
February				
March	584	72		
April	3,213	453		
May	10,564	1,189		
June	25,861	3,154		
July	36,222	4,584		
August	40,798	5,968		
September	33,572	3,392		
October	32,586	4,175	[2] 5	[2] 2
November	3,035	520		
December				
Total	186,435	23,507	5	2

[1] Derived mostly from mint and smelter receipts; receipts from the first part of 1958 are excluded because they were previously credited to 1957 production; and expected receipts in 1959, part of the actual output of 1958, are included. No zinc produced in 1958.
[2] Includes all smelter receipts of copper and lead produced in 1958.

cent and value of output dropped 4 percent. The gravel output from nonfloat production decreased mainly because time was spent in preparatory work rather than in sluicing. Virtually all nonfloat, as well as some dredge producers, actively reworked old tailings; virgin ground was rarely mined. The trend (noted in earlier Yearbook Chapters) continued toward using elevated sluiceboxes using

TABLE 12.—Production of gold and silver at placer mines, 1958, by regions and districts

Region and district	Mines producing	Gold (troy ounces)	Silver (troy ounces)	Total value of production
Cook Inlet-Susitna:				
Valdez Creek	3	69	11	$2,425
Yentna	3	636	98	22,349
Copper River:				
Chistochina	1	2,137	194	74,971
Prince William Sound		4	1	141
Yakataga		5		175
Kuskokwim River:				
Aniak	3	12,511	1,197	438,968
Bethel	1	145	22	5,095
Seward Peninsula:				
Fairhaven	5	1,813	241	63,673
Kougarok	3	1,352	129	47,437
Koyuk	2	623	46	21,847
Nome	6	33,392	3,727	1,172,093
Port Clarence	2	70	9	2,458
Yukon River:				
Bonnifield	1	90	22	3,170
Chandalar	2	1,132	186	39,788
Circle	6	5,364	521	188,212
Eagle	1	43	4	1,509
Fairbanks	14	93,124	12,478	3,270,633
Fortymile	9	611	125	21,498
Hot Springs	5	2,676	597	94,200
Iditarod	6	7,187	1,025	252,473
Innoko	11	6,901	853	242,307
Koyukuk	4	144	11	5,050
Melozitna	1	295	26	10,349
Rampart	4	354	31	12,418
Ruby	4	3,709	638	130,392
Tolovana	2	361	47	12,678
Other districts [1]	9	11,487	681	402,660
Total	108	186,235	22,920	6,538,969

[1] Includes the following districts for which quantities and values cannot be shown separately: 1 placer each in Willow Creek, Cook Inlet-Susitna Region; Nelchina, Copper River region; Goodnews Bay and McGrath, Kuskokwim River region; Selawik and Shungnak, Northwestern Alaska region; Council, Seward Peninsula region; and 2 placers in Hughes, Yukon River region.

various devices permitting raising, lowering, or changing sluice direction for tailing disposal.

The number of hydraulic and small-scale hand mines active in the Territory rose from three hydraulic and two small-scale hand in 1957 to nine and eight, respectively. The increased activity in gold mining can be attributed to the effect of the business recession in 1957 and 1958 as well as to an expected rise in the price of gold. In addition, some earth-moving equipment formerly used on defense contracts was diverted to gold mining. It should be noted that the value of ground washed by nonfloat, hydraulic, and small-scale hand methods increased. It may well be that several new mines were sluicing small high-grade pockets.

A total of 108 placer and 3 classed as lode mines were active, compared with 87 placer and 4 lode mines in 1957. Placer mines continued to be the major source of gold. The 78 nonfloat producers supplied more than 18 percent of total gold output; dredge methods yielded 81 percent. Hydraulic, small-scale hand, and lode mines contributed less than 1 percent. Output of gold classed as lode mining came from reworking old tailing in the Cook Inlet-Susitna, Kenai Peninsula, Southeastern Alaska, and Yukon River regions.

As in past years the Fairbanks district, Yukon River region, was the major gold-producing area in Alaska, and the Nome district, Seward Peninsula region, was next in value of output. The United States Smelting, Refining and Mining Co. was the leading gold producer with seven dredges in the Fairbanks district, three in Nome, and one on the Hogatza River. During the year, it announced that it planned to move one Fairbanks dredge to Chicken Creek, Fortymile district, Yukon River region, sometime in 1959 or early in the spring of 1960.

The outlook for the gold-mining continued to be unfavorable because of rising operating costs. Large blocks of ground previously classed as ore have become economically submarginal. Production in the great dredge fields of the Fairbanks and Nome districts has been materially shortened by adverse economic factors since World War II. According to its annual reports, the United States Smelting, Refining and Mining Co., did not expect to operate at Fairbanks and Nome beyond 1963 or 1964. Thus, this major industry that contributed largely to the early settlement and development of Alaska may become a casualty of inflation and changing economic trends.

Placer mine producers reported that 1,700 ounces of natural gold, (nuggets, grains, and dust, not melted or amalgamated) was sold to buyers and jewelers—representing the sale of more than 1,000 ounces above the quantity sold in 1957. Prices generally were from $3 to $5 higher per fine ounce than the U.S. mint price of $35.

Iron Ore.—No iron ore was shipped. Exploration activity remained high. The number of active companies rose from 6 in 1957 to 8—almost entirely active in Southeastern Alaska.

Lead.—Lead was recovered from gold concentrate produced in other years and from lead-silver ore shipped from mines in the Fairbanks district, Yukon River region. There was little prospecting or exploration for lead deposits.

TABLE 13.—Mine production of gold, silver, copper, lead, and zinc at lode mines, in terms of recoverable metals

Year	Mines producing	Gold		Silver		Copper		Lead		Zinc		Total value
		Troy ounces	Value	Troy ounces	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1949–53 (average)	9	4,706	$164,710	4,543	$4,112	2	$892	4	$13,248	2	$484	$183,446
1954	5	1,002	35,070	229	207	4	2,360	----	----	----	----	37,637
1955	4	2,292	80,220	526	476	1	746	1	298	----	----	81,740
1956	3	1,763	61,705	566	512	(1)	----	1	314	----	----	62,531
1957	4	405	14,175	1,836	1,662	(1)	----	9	2,574	----	----	18,411
1958	3	200	7,000	587	531	5	2,630	2	468	----	----	10,629

[1] Less than 1 ton; value not included in total.

TABLE 14.—Equipment used at placer gold mines,[1] 1958, by region

Region	Number of operations [2]	Gravel washed (cubic yards)[3]	Equipment used (number)				
			Bulldozers	Draglines	Hydraulic giants	Dredges	Other [4]
Cook Inlet-Susitna	8	41,430	7		3		1
Copper River	3	133,590	3		3		
Kuskokwim River	5	2,415,330	11	5	7	4	
Northwestern Alaska	2	26,500	2				
Seward Peninsula	20	4,122,460	27	5	26	7	3
Yukon River	85	11,428,540	109	29	129	12	8
Total	123	18,167,850	159	39	168	23	12

[1] Includes equipment used at 1 operation, from which gold is a byproduct of platinum-group-metals recovery.
[2] Includes 15 mines, which conducted assessment and/or preparatory work but made no valuable mineral recovery.
[3] Partly estimated.
[4] Includes hydraulic elevators, power shovels, pumping units, screen stackers, and "dryland" dredges.

Mercury.—Production of mercury declined 38 percent compared with 1957, largely because the lower market price reduced production incentive, because condenser units at the major producer required replacement and the attendant furnace shutdown of several weeks, and because of difficulties in operation.

The bulk of mercury was produced from the Red Devil Mine, DeCoursey Mountain Mining Co., Kuskokwim River region. The only other mercury producer in Alaska was Russel R. Schaefer, at the Schaefer mine in the same region. Mercury was sold to buyers in the United States and to local placer operators.

Exploration for mercury continued high. In the Kuskokwim River region Cordero Mining Co., Western Alaska Mining Co., and Sunshine Mining Co. investigated properties near Parks, Russian Mountain, and Kagati Lake, respectively.

TABLE 15.—Production of mercury

Year	Number of producing mines	76-pound flasks	Price per flask [1]	Value
1949-53 (average) [2]	1	34	$152.60	$5,188
1954	2	1,046	264.39	276,552
1955	1	(3)	290.35	(3)
1956	2	3,280	259.92	852,538
1957	2	5,461	246.98	1,348,758
1958	2	3,380	229.06	774,223

[1] Value calculated at average New York price.
[2] No production, 1950-51.
[3] Figure withheld to avoid disclosing individual company confidential data.

Nickel.—Admiralty Alaska Gold Mining Co. continued diamond drilling and drifting in a nickel-copper deposit on Funter Bay, Admiralty Island. Devamin Co., Inc., drilled a nickel deposit at Bohemia Basin on Yakobi Island, Southeastern Alaska region. Two drills, serviced by helicopter, worked on a two-shift basis. Results of the drilling program were not released by the company.

Platinum.—Goodnews Bay Mining Co., again the only primary producer of platinum in the United States, continued dredge mining, 10 miles south of Platinum, Kuskokwim River region.

Scrap Metals.—Approximately 14,543 short tons of scrap metal (mostly ferrous) was shipped from Alaska. A considerable per-

centage of the metal was salvaged from abandoned mines and obsolete military installations. Almost all the nonferrous metal was shipped to Seattle, Wash.; the ferrous metals was sold mostly to Japanese industry.

Silver.—As in other years most silver produced was a byproduct of gold. Ninety-eight percent of the silver was obtained from placer-gold mining, and the remaining 2 percent from lode mines, compared with 94 percent from placer-gold mining in 1957. Production of silver declined 19 percent under 1957 because of declining gold recovery. Major gold producers were also leading silver producers. United States Smelting, Refining and Mining Co., the principal gold and silver producer, recovered silver as a byproduct of gold dredging in the Fairbanks and Hughes districts, Yukon River region, and in the Nome district, Seward Peninsula region. Silver was recovered from gold-ore concentrate and old tailing produced in the Cook Inlet-Susitna, Kenai Peninsula, Southeastern Alaska, and Yukon River regions. It was recovered also from copper ore in the Copper River region, chiefly from Kennecott Mine tailing, and from lead-silver ore mined in the Yukon River region by Fred M. Wackwitz (Flume Creek Mine, Fairbanks district).

Tungsten.—No tungsten ore or concentrate was shipped. Exploration by the Alaska Mining and Metals Co., Inc., Gilmore Dome, Fairbanks district, Yukon River region, and Kodiak Exploration Co., Kodiak Island, continued. Hyder Mines, Inc., was reported engaged in exploratory work in the Hyder district, Southeastern Alaska region.

Uranium Ore.—There was no mine production of uranium ore. Accountability for uranium ore, however, does not begin until the ore has been drawn from the Government stockpile for processing. A substantial part of Alaska ore produced in 1957 by the Kendrick Bay Mining Co., Southeastern Alaska region, was not withdrawn from the stockpile until 1958; this part is therefore considered for statistical purposes as 1958 output.

MINERAL FUELS

Coal.—Output of coal declined 10 percent compared with 1957. The reduction resulted principally from large stockpiles remaining after the relatively warm winter of 1957 as well as from the reduced power requirements of military steam plants, which purchased dump power from the Eklutna Project during the summer months. The computed monthly average temperatures at Anchorage and Fairbanks (the chief coal-consuming areas) was 32° F., compared with 37° F. in 1957.

An estimated 70 percent of Alaska coal production was sold for heat and power at Ladd and Eielson Air Force Bases near Fairbanks and at Fort Richardson and Elmendorf Air Force Base near Anchorage as well as at other military bases in the Territory. Additional quantities of coal were sold to local utilities to produce heat and power and to others for domestic heating and cooking. Retail prices in Anchorage and Fairbanks were approximately $24 a ton. This price compared favorably with that of other years.

Four underground and seven strip mines (excluding two producers, whose combined total output was less than 1,000 tons) were operated by nine companies compared with four and six, respectively,

in 1957. Pioneer Mining Co., Inc., reentered production on a small scale during the year; in addition, a new producer, Castle Mountain Coal Co., was activated. Coal output continued to come from the

TABLE 16.—Production of coal, by fields

(In thousands)

Year	Field						Total	
	Matanuska		Nenana		Barrow			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1955	258	$3,055	381	$2,690	1	$14	640	$5,759
1956	269	3,273	457	3,055	1	46	727	6,374
1957	237	2,947	604	4,337	1	12	842	7,296
1958	290	3,532	468	3,392	1	7	759	6,931

Matanuska field, Cook Inlet-Susitna region, the Nenana (or Healy River) field, Yukon River region, and the Barrow field, Northern Alaska region. All underground production was broken by blasting or cut by hand; virtually all drilling was done with power equipment. Only 1 percent of total production was mechanically loaded. Two mobile loaders were in use, comparing rather unfavorably with the four mobile loaders, one scraper loader, and eight duck bills used in 1957. The decline did not necessarily indicate a trend but appeared to reflect different ground conditions found in mining. Average value of coal a ton at the tipple or mined underground rose from $8.41 in 1957 to $8.72 in 1958, reversing the downward trend of other years. Strip-mined coal continued to increase in value from $8.80 a ton in 1957 to $9.28. The percentage of coal produced by strip mining rose from 65 percent in 1957 to 73 percent, despite a rise in the stripping ratio from 2.9:1 in 1957 to 3.9:1 in 1958. Overburden ranged from 30 to 80 feet deep in 1957, and from 15 to 98 feet, in 1958. Of total coal production, 43 percent was cleaned, compared with 37 percent in 1957, increasing because the Castle Mountain Coal Co. output was washed in the Evan Jones Coal Co. plant. Cleaning plants were operated as in previous years by Evan Jones Coal Co. and Mrak Coal Co. in the Matanuska field, and Usibelli Coal Mines, Inc., in the Nenana field.

The suit that Suntrana Mining Co. filed in 1957 against Usibelli Coal Mines, Inc., and Cripple Creek Coal Co. involved a demand for $80,000 damage and a restraining order to prevent the two defendants from dumping the overburden from hydraulic strip mining into the Healy River. The settlement in favor of Suntrana was arranged out of court, after the United States District Court at Fairbanks ruled that the Suntrana Healy River operations were being injured by the overburden and mine waste from the two neighboring properties, and it also involved construction of drainage controls and other structures.

Petroleum and Natural Gas.—Government agencies consumed 50 million cubic feet of natural gas at Barrow. This gas was obtained from wells drilled by the U.S. Navy during its exploration program in 1944–53 on Naval Petroleum Reserve No. 4, Northern Alaska region.

The year 1958 was the first since 1933 that crude petroleum was produced in appreciable quantities. As a result of testing activities by the Standard Oil Co. of California on its Swanson River No. 1 and No. 2 wells, crude petroleum was produced from October to the end of the year. Earlier production of petroleum had been obtained from the Katalla area. The Geological Survey and various companies have examined the Katalla area intermittently since 1903. It was reported that Tom White, a prospector, noted oil seeps in the Katalla area in 1896. The first well was drilled in 1901; this was followed 1 year later by the first producing well. From 1901 to 1932 an estimated 37 wells were drilled in the area; of these 19 were abandoned or never completed because of poor shows or accidents to equipment. Eighteen wells, all on 40 acres of patented land at the head of Katalla Slough, produced a total of 154,000 barrels of oil. These wells, all yielding oil from Tertiary formations, ranged in depth from 366 feet to 1,810 feet. The Chilkat Oil Co., operators of the Katalla field, treated its crude oil at a topping plant on Katalla Slough and sold the products locally principally for fishing-boat fuel, at Cordova. Production stopped in 1933 when fire destroyed the plant.

The first signs of oil in Alaska had been noted at Iniskin Bay across Cook Inlet from Kenai in 1853 by the Russians and in areas 60 miles east of Point Barrow, north of the Arctic Circle, by whalers and explorers. During the years since these reported seeps, exploration expeditions have been sponsored by various oil companies. In 1910 the oil resources of the Territory were withdrawn from entry; 17 years later they were reopened. Consequently interest in exploration lagged until recently. In total, more than a hundred holes probing for crude oil were drilled in Alaska at Oil Bay, Katalla field, at Dry Bay, Katalla Meadow, Cold Bay, Iniskin Bay, and in other areas.

The 1957 discovery of oil on the Kenai Peninsula resulted in a land boom similar to the gold rushes of the early Alaska days. The acreage under oil lease at the end of 1958 was more than four times that under lease at the end of 1957, but it does not include acreage filed on, for which the Bureau of Land Management had not issued leases. Ten wells were started or being drilled during 1958. Companies drilling included Standard Oil Co. of California at the Swanson River and Deep Creek units, both in the Kenai Peninsula region; Colorado Oil and Gas Corp. near Yakutat, Southeastern Alaska; Humble Oil and Refining Co. on the Alaska Peninsula; Anchorage Gas and Oil Development Co., Inc., in the Willow Creek district, Cook Inlet-Susitna region; Aledo Oil Co. and Alaska Oil and Gas Development Co., Eureka, Copper River region; and Alaska Consolidated Gas and Oil Co., Iniskin Bay, Cook Inlet-Susitna region. At various times more than fifty helicopters were working out of Anchorage on geophysical surveys. Virtually every major U.S. oil company was represented in the search.

TABLE 17.—Acreage (approximate) under oil lease [1]

1954	1,832,800	1957	6,516,700
1955	2,519,800	1958	27,900,000
1956	2,814,700		

[1] Data from Bureau of Land Management.

In 1958 the Secretary of the Interior issued regulations permitting drilling operations to continue on the Kenai National Moose range (part of which included the Swanson River unit), which had been closed to further leasing and other activity, pending the establishment of regulations by the Fish and Wildlike Service for the protection of the moose. Oil and gas leasing was permitted on approximately 1,500 square miles of the northern section of the range. An additional 1,700 square miles was closed to leasing because the Fish and Wildlife Service believed that such activity would be incompatible with wildlife management. The regulations required that lessees must protect the wildlife as well as the land from fires and erosion. Applications for oil leases in the Moose range were again accepted, beginning in August 1958.

In compliance with the Secretary of Interior's order of November 1957, approximately 20 million acres in northern Alaska were auctioned for mineral leasing and mining claims in September 1958. An additional 4 million acres of adjacent land were opened to noncompetitive leasing. A total of 47 bids were received; amounts bid per acre ranged from $1.07 to $103. Ninety percent of the receipts from the leases and 90 percent of any receipts from royalties and rentals were to go to the State of Alaska. It was estimated that the total of high bids on the various parcels would be more than $220,000—the first competitive leasing of Government oil-and-gas land in Alaska.

NONMETALS

Clays.—Basic Building Products Co., Anchorage, Cook Inlet-Susitna region, began constructing a down-draft kiln, preparing to resume brick-making.

Gem Stones.—Shungnak Jade Project, Shungnak, Northwestern Alaska region, continued to purchase jade from Eskimo claim owners. Members of the project, operated by Eskimos but sponsored by the Indian Arts and Crafts Board, continued to cut, polish, and shape jade for souvenirs and jewelry. Its output was retailed to tourists through a store in Kotzebue and was sold at wholesale to individual jewelry and gifts shops throughout Alaska as well as to the Alaska Native Arts and Crafts. Sales increased tremendously, largely because of increased tourist trade. Other gem-type materials and specimens produced included jasper, cinnabar, realgar, agate, petrified wood, cassiterite, gypsum, garnet, gold, scheelite, and galena.

Sand and Gravel.—Production of sand and gravel declined 30 percent compared with 1957, dropping substantially because the White Alice and DEW line projects in the Alaska Peninsula, Aleutian Islands, and Yukon River regions were completed and because on-base military construction in the Cook Inlet-Susitna and Yukon River regions also declined substantially.

The average value for sand and gravel dropped from $1.44 a ton in 1957 to $0.91 in 1958. The 1958 value compares favorably with the 1956 average value of $0.99 a ton. The $0.53 drop in value compared with 1957 resulted from cessation of activity of high-labor-cost areas such as the Alaska Peninsula and Aleutian Islands.

Eight commercial producers and six Government agencies (or their contractors) produced sand and gravel, compared with nine commercial and six Government producers in 1957. Commercial producers included the Alaska Railroad, an agency of the U.S.

TABLE 18.—Sand and gravel sold or used by producers, by uses

(In thousands)

Use	1957		1958	
	Short tons	Value	Short tons	Value
Sand:				
Structural	159	$552	94	$191
Paving	198	682	219	569
Gravel:				
Structural	330	720	118	190
Paving	5,108	6,589	3,581	2,649
Railroad ballast	277	241	203	254
Other sand and gravel [1]	24	15	40	18
Total	6,096	8,799	4,255	3,871

[1] Includes: 1957—fill gravel, and blast, engine, and mason sand; 1958—fill and roofrock gravel, and blast and engine sand.

Department of the Interior, which is considered as a commercial producer to maintain comparability with data published for the States.

The major producers of sand and gravel remained the Bureau of Public Roads, U.S. Department of Commerce and Corps of Engineers, Department of the Army. The Bureau of Public Roads became the leading producer, replacing the Corps of Engineers. The total sand and gravel produced by Government agencies or their contractors dropped from 92 percent in 1957 to 87 percent in 1958 (the same as in 1956), primarily because of decreased output by the Corps of Engineers.

Stone.—Basalt, granite, and miscellaneous stone were produced; miscellaneous stone represented 49 percent of total production. The entire stone output came from quarries operated by Government agencies or their contractors; the Alaska Railroad, owned and operated by the U.S. Government, was the only producer classified as commercial, permitting data for stone in Alaska to be comparable with that of the States.

By far the leading production (92 percent) came from quarries operated by the Army Engineers. Approximately one-half of the stone produced was used as riprap for harbors and for erosion control. Stone output rose 17 percent compared with 1957. This increase is not particularly significant as indicating a trend, because stone often is used when suitable sand and gravel deposits are not available for riprap or in harbor projects.

TABLE 19.—Stone sold or used by producers, by uses

(In thousands)

Use	1957		1958	
	Short tons	Value	Short tons	Value
Crushed and broken:				
Riprap	98	$326	324	$965
Concrete and road stone	350	1,544	291	1,100
Other [1]	80	83		
Total	528	1,953	615	2,065

[1] Includes acid neutralizer, building, chips for seal coating, and fill material.

REVIEW BY REGIONS

Regions and districts used in this report conform to the boundaries defined in a report [5] published in 1954.

As in past years, the Yukon River region was foremost in value of mineral production. The Cook Inlet-Susitna, Southeastern Alaska, and Kuskokwim River regions were next in importance. As in the previous 5 years, no mineral production was reported from the Bering Sea region.

Alaska Peninsula.—A small tonnage of sand used for ice control on runways was produced by the Civil Aeronautics Administration in the Alaska Peninsula region. The Corps of Engineers produced no sand and gravel because completion of the DEW line project reduced sand and gravel output virtually 100 percent. Humble Oil and Refining Co., associated with Shell Oil Co., continued exploration on the Bear Creek Unit No. 1 well at Jute Bay. The well, spudded in on September 23, 1957, was down 13,070 feet by the end of December 1958. Approximately 6,500 feet was drilled during the year. Considerable difficulty was found in drilling.

TABLE 20.—Value of mineral production in Alaska, by regions [1]

Region	1957 (thousands)	1958 (thousands)	Minerals produced in 1958 in order of value
Alaska Peninsula	$818	(2)	Sand and gravel.
Aleutian Islands	4,242	$430	Stone, sand and gravel.
Bristol Bay	----------	(2)	Sand and gravel, gem stones.
Cook Inlet-Susitna	5,048	4,418	Coal, sand and gravel, stone, gold, silver.
Copper River	113	365	Sand and gravel, gold, copper, silver.
Kenai Peninsula	1,027	104	Petroleum, sand and gravel, gold, silver.
Kodiak Island	192	1,143	Stone, sand and gravel.
Kuskokwim River	3,370	1,824	Mercury, platinum-group metals, gold, silver, gem stones.
Northern Alaska	12	14	Coal, natural gas.
Northwestern Alaska	21	31	Gem stones, gold, silver.
Seward Peninsula	1,780	1,396	Gold, sand and gravel, silver.
Southeastern Alaska	698	1,966	Sand and gravel, uranium, stone, gem stones, gold, silver.
Yukon River	11,471	9,759	Gold, coal, sand and gravel, stone, silver, lead, gem stones.
Total Alaska	28,792	21,450	

[1] No mineral production from Bering Sea Region.
[2] Less than $1,000.

Aleutian Islands.—Value of mineral production in the Aleutian Islands region, third in 1957, declined 90 percent because the demand for sand and gravel and for stone was reduced when construction on military installations was completed and on-base construction projects were cut back. The Aleutian Islands region dropped to seventh place in the State. The 17th Naval District and the Corps of Engineers reported production of basalt for concrete and roadstone.

Bristol Bay.—Sand and gem stones were produced. Humble Oil and Refining Co. drilled an iron deposit in the Dillingham area during the summer and was making metallurgical tests and evaluating results at the close of the year. The deposit was discovered in the course of geophysical exploration for petroleum. The company staked a number of lode and placer claims.

[5] Ransome, Alfred L., Kerns, William H., Names and Definitions of Regions, Districts, and Subdistricts in Alaska: Bureau of Mines Inf. Circ. 7679, 1954, 91 pp.

Cook Inlet-Susitna.—Coal was again the leading mineral produced in the Cook Inlet-Susitna region. The value of coal produced rose 20 percent over 1957; tonnage increased 22 percent. The average value of coal produced was $12.18 a short ton. Coal mined in the region came from underground and strip mines of the Evan Jones Coal Co., Mrak Coal Co., Castle Mountain Coal Co., and Pioneer Coal Mining Co. All of these mines are in the Matanuska coalfield, Willow Creek district.

A report of a reconnaissance examination of the Beluga River coal field[6] was published. Numerous outcrops of bituminous coal were observed in an area 30 miles long by 3 miles wide. At two places, thick beds of 30 feet or more were seen, and beds 5 to 20 feet thick are fairly abundant along the Beluga River and its tributaries. Burden, composed of glacial gravel and sandstone, ranges from 20 to 400 feet in thickness. Samples collected during the examination indicated calorific values a pound of 6,240 to 8,246 B.t.u.

The pits of the Cook Inlet-Susitna region were the chief commercial producers of sand and gravel in Alaska, used mostly as aggregate in concrete production. Production of sand and gravel by the Corps of Engineers for projects at Fort Richardson and at Elmendorf Air Force Base declined substantially because of reduced construction activity. The Bureau of Public Roads also produced less sand and gravel compared with 1957, largely because various highway projects were completed.

The Alaska Railroad and Corps of Engineers produced granite for riprap, concrete aggregate, and roadstone.

Anchorage Gas and Oil Development Co., Inc., continued the Rosetta No. 3 well in the Willow Creek district. Drilling was suspended in October at a depth of 6,150 feet; approximately 2,700 feet were drilled in the 1958 season. Alaska Consolidated Oil and Gas Co. began drilling the Iniskin-Antonio Zappa No. 1 well at Iniskin Bay on December 25; 227 feet were drilled by yearend. It took over the Havenstrite lease of some 60,000 acres but did not plan to deepen the Iniskin Unit No. 1 well. Humble Oil and Refining Co. continued geophysical work in the Susitna River Valley.

Gold was obtained from ore shipped by Brown and Renshaw from the Gold Cord mine in the Valdez Creek district, from old tailing from a cleanup at the Independence Mine, Willow Creek district by Harry Rice, and from concentrate from the cleanup of an unknown mill by Joe Lynch. The concentrate shipped by Mr. Lynch yielded a small quantity of copper in addition to gold and silver.

Basic Building Products Co., wholly-owned subsidiary of Anchorage Sand and Gravel Co., spent much of 1958 constructing a new down-draft kiln. The brick used in this construction was produced in its scove kiln from clay mined in other years.

Copper River.—Richfield Oil Co. obtained rights to a 489,662-acre tract along the Gulf of Alaska in the Katalla-Yakataga area—approximately one-half the area formerly held by Phillips Petroleum and Kerr-McGee Oil Industries. Richfield must drill three holes on the property, the first to be spudded in by January 1, 1960; expenditures of $150,000 per year are required for exploration at first, increasing to $500,000 by 1962. Aledo Oil Co. and Alaska Oil

[6] Maloney, Raymond P., Reconnaissance of the Beluga River Coalfield, Alaska: Bureau of Mines Rept. of Investigations 5430, 1958, 18 pp.

and Gas Co. continued drilling the Eureka No. 1 well near Eureka Lodge. This well was spudded in originally on September 20, 1953; drilling has been in process intermittently since that date. Activity was suspended for the year on October 23 at a depth of 4,820 feet. This was the only well drilled in the Copper River region in 1958.

The Bureau of Public Roads produced substantial quantities of sand and gravel. Output by this agency rose from 1,312 short tons in 1957 to 447,280 tons in 1958, mostly because of construction of the Copper River highway.

The Jewell Ridge Coal Corp. of Tazewell, Va., began a $100,000 exploratory drilling program in the Bering River coalfield. The program was planned to develop reserves of coal for export to Japan, South Korea, and South Vietnam. A team of Japanese industrialists examined the coal deposits and later shipped 3,300 pounds to Japan for testing. The Japanese, currently importing coal from the Jewell Ridge east coast operations, are interested in coking coal. Jewell Ridge has working agreements covering 20,000 to 30,000 acres. One of the major problems faced by the company is the high degree of folding and faulting that will make mining difficult. The company planned extensive drilling and other exploratory work in 1959. Estimates of development costs for the coalfield, including a railroad from Cordova and construction of port facilities, range from $80 to $100 million.

Seven tons of copper ore from a tailing pile at the old Kennecott Mine in the Nizina district was shipped. Copper and silver were recovered from this material.

Kenai Peninsula.—The mineral of major interest was petroleum. Standard Oil Co. of California, operating the Swanson River Unit, began production testing on the Swanson River No. 1 and No. 2 wells in October. Swanson River No. 1, spudded in on April 3, 1957, was drilled to 12,384 feet and yielded oil from the 11,150- to 11,250-foot horizon; No. 2, spudded in on November 10, 1957, was drilled to 12,045 feet. Swanson River No. 1 was producing from the Upper Hemlock formation only and No. 2, from both the Upper and Lower Hemlock formations. Swanson River No. 3 was spudded in on August 21, 1958, drilled to 11,653 feet, and abandoned as a dry hole on November 21. Standard also drilled one well (the Deep Creek area south of the Moose Range), which was spudded in on March 19, drilled to 14,221 feet, and abandoned as a dry hole on August 5. Alaska Oil and Mineral Co., Inc., entered into an agreement with King Oil Co. and the Halbouty interests to drill two wells on a 5,440-acre tract, adjacent to the Swanson River Unit. Standard Oil and nine other companies (Ohio Oil, Pan American Oil, Richfield, Shell, Sunray Mid-Continent, Superior, Texaco, Union, and Western Gulf) will conduct a $1 million over-water seismic survey of the Cook Inlet area. Work was expected to start early in 1959 and to be completed by spring. Four boats, specially equipped for winter survey, will be used.

Production of sand and gravel decreased greatly over 1957. Completion of highway projects by the Bureau of Public Roads accounted for the decrease.

No chromite ore was shipped. Kenai Chrome Co. closed down the Star Four mine and mill at Red Mountain after the GSA pur-

chase program expired in June. The company, formed by Mike Seiler and John and Karl Bachner in 1953, acquired the Star Four and the Edith 11 claims from Union Carbide Corp. Kenai Chrome spent several hundred thousand dollars in mine development, road building, and construction of loading and dock facilities at Jakolof Bay near Seldovia. In 1957 a concentrating mill was built near the loading facilities. During the 5 years the company was active, it became one of the leading U.S. producers of metallurgical-grade chromite. In May 1958, it attempted to ship a substantial quantity of chromite to GSA, but the proffered shipment was refused. At the time of shutdown, about 2,000 tons of low-grade ore was stockpiled at the mine and 5,000 tons of ore and concentrate was stored at the concentrator at Jakolof Bay. Part of the ore at Jakolof Bay had been milled to produce some 1,300 tons of shippable concentrate.

A report[7] on metallurgical test work on samples from chromite deposits on Red Mountain was published. The ores were found amenable to gravity concentration for production on concentrates assaying plus-48 percent CR_2O_3. Recoveries ranged from 20 percent for low-grade ores to more than 95 percent for one high-grade sample. The iron content of the ores varies with the ore grade. Chrome-iron ratios of concentrates range from 1.8:1 on low-grade samples to 3.1:1 for high-grade samples.

Kodiak.—Substantial quantities of sand and gravel were produced by the Corps of Engineers and the Bureau of Public Roads. The Corps of Engineers produced miscellaneous stone for riprap. Kodiak Exploration Co. continued work on its tungsten property on Kodiak Island. A sample shipment, estimated to contain 4 percent WO_3, was sent south for test purposes.

Kuskokwim River.—Mercury again was the leading mineral commodity produced in the Kuskokwim River region. Russel R. Schaefer and the DeCoursey Mountain Mining Co. were the only producers in Alaska, both in the Aniak district. DeCoursey Mountain Mining Co. continued sinking the Dolly shaft at the Red Devil Mine during the year. A raise was driven from the 300-foot level to connect with the Dolly shaft, resulting in a heavy flow of water that almost flooded the mine workings before being brought under control. When the connection with the Dolly shaft was completed the company started drifting above the 300-foot level, thus opening additional ground. DeCoursey also did considerable exploration and development on the 450-foot level. Furnacing operations at the mine were suspended for several weeks while new condensers were installed. The Sunshine Mining Co. completed examination of a mercury prospect in the Kagati Lake area near Bethel. Results were not encouraging. Cordero Mining Co. investigated the Parks property, and Western Alaska Mining Co. developed the Russian Mountain Mine.

Goodnews Bay Mining Co. continued output of platinum as a primary product. In 1957 a dredge and a nonfloat plant were operating. In 1958, only the dredge was active. The dragline previously used to feed the nonfloat plant was used to strip overburden. New York-Alaska Gold Dredging Corp. added a third dredge for use in the Aniak district.

[7] Wells, R. R., Sterling, F. T., Erspamer, E. G., and Stickney, W. A., Laboratory Concentration of Chromite Ores, Red Mountain District, Kenai Peninsula, Alaska: Bureau of Mines Rept. of Investigations 5377, 1958, 22 pp.

Northern Alaska.—A small quantity of coal was produced at Meade River for consumption in Barrow. Exploration wells on Naval Petroleum Reserve No. 4 supplied some 50,000 thousand cubic feet of natural gas to Government agencies in Barrow Village, to the Air Force Barrow Camp and to the DEW line site.

The wells were drilled some 6 years ago during an exploration program on the Reserve and later sealed. The Weather Bureau, Public Health Service, Bureau of Standards, and the Interior Department finally arranged for a Navy waiver that permitted these agencies to use the gas free of charge. The Navy also turned over pipe and other surplus materials for constructing pipelines and complementary facilities. The Air Force permitted the use of its bulldozers and other construction equipment at Point Barrow. Approximately $350,000 was expended to build a 5½-mile pipeline and to install a generating plant for producing electricity from some of the gas. It was estimated that the system would save the Government $150,000 to $200,000 a year in fuel and hauling charges.

Northwestern Alaska.—Small quantities of gem stones and gold and silver were obtained in the region. Jade was produced or processed by Alaska Jade Co., Empire Jade Co., Shungnak Jade Project, and Wolk and Hess. The Shungnak Jade Project remained the leading processor of jade in Alaska. The Project produced no jade but purchased jade boulders from individual Eskimo claim owners. Most of the claims were along the Shungnak River where jade occurs in placer deposits. Mining was largely confined to finding and removing loose jade boulders. The Project manufactured and sold jade jewelry, book ends, and souvenir articles. A summer retail shop for the tourist trade was maintained at Kotzebue where many of the manufactured items were sold; surplus material was wholesaled. A new building, with equipment for 14 jade cutters, was erected at Shungnak during the year, and another was under construction at Noorvik.

Alaska Jade Co. of Fairbanks reported purchases of raw jade from the Kobuk area. This material was sawed and finished into various articles. A substantial quantity of raw jade was purchased from E. Ferguson and Associates of Kotzebue by Wolk and Hess of San Francisco, Calif., and Skagway, Alaska. Wolk and Hess report that importation and smuggling into the United States of inferior jade (dyed jade green with vegetable or chemical dyes) was causing difficulty in the sales of unaltered or natural jade.

Bear Creek Mining Co., subsidiary of Kennecott Copper Corp., continued exploration in Northwestern Alaska along the Kobuk River.

Seward Peninsula.—Gold was again the leading mineral commodity produced. Value of gold output decreased 21 percent because of lower grade ore. The yardage washed decreased slightly. United States Smelting, Refining and Mining Co., the leading gold producer in the region, operated three dredges in the Nome district. One dredge was expected to complete its work by the close of 1958 or early in 1959 season, when it was to be deactivated; and the other two were expected to finish by the end of the 1961 season or sooner. The company planned to hold the Nome property for future use if conditions justify.

A small quantity of silver was a byproduct of gold placering. There was no lode gold production.

A report[8] published on lode-tin mining in the Lost River area gives general information on the area and detailed data on the United States Tin Corp. Lost River operation that shut down in 1955.

Southeastern Alaska.—Sand and gravel, uranium, and stone were the leading mineral commodities. The value of total mineral production tripled compared with 1957. Output of sand and gravel increased from 285,000 short tons in 1957 to 674,000 tons and from $413,000 to $1,145,000 in value, principally because it was used by the Corps of Engineers in civil works projects. The Bureau of Public Roads also increased its use of sand and gravel for road construction. The output and value of stone also increased.

A report[9] on mineral resources and factors affecting their development was published. The report stated that factors affecting development of Southeastern Alaska mineral industries were generally favorable. An adequate labor supply can be developed but will be expensive because of Alaska's high cost of living. The report points out that only high-grade ores and concentrates can bear the cost of presently available transport to market and that costs can probably be reduced by utilizing larger back hauls and employing tugs and barges. Water supply is ample for most industrial purposes, and in many places water power can be developed. The Pacific Coast offers possible market outlets through the use of base-metal smelters on tidewater. Direct ocean shipment to Japan also is a possibility.

Private investigations of the iron ore resources of the region continued. Columbia Iron Mining Co. continued the examination of the Klukwan deposit near Haines. Columbia did exploratory diamond and churn drilling. The magnetic concentrator, built by Columbia to upgrade Klukwan ores before shipment to the States for metallurgical testing, was not operated. The Owen Ore Co. and W. S. Pekovich reported performance of assessment on their adjacent claims near Port Snettisham. Owen diamond-drilled 515 feet on its Douglas, Everest, and Rainey claims in the Juneau district. Columbia Iron Mining Co. continued exploration in the Ketchikan district and diamond-drilled its Cleveland Peninsula claims; no work was done in the Duke Island area.

Mt. Andrew Mining Co. continued examination work on Prince of Wales Island. Preliminary to development, some 1,000 feet was diamond drilled. The Prince of Wales Mining Co. proceeded with exploration on Prince of Wales Island; 225 feet of hole was drilled on the Iron King and White King claims.

Colorado Gas and Oil Corp. drilled in the Yakutat area, having earlier abandoned Yakutat No. 1 well at 9,314 feet. Results of this well were not conclusive because of drilling difficulties. Yakutat No. 2 was spudded in on July 17, 1957, and reached a depth of 11,765 feet, when drilling was suspended on March 1, 1958. Yakutat No. 3, spudded in on July 21, 1958, was drilled to a depth of 10,554 feet by the end of the year. Drilling also was difficult in putting down No. 3 well.

[8] Lorain, S. H., Wells, R. R., Mihelich, Miro, Mulligan, J. J., Thorne, R. L., and Herdlick, J. A., Lode-Tin Mining at Lost River, Seward Peninsula, Alaska: Bureau of Mines Inf. Circ. 7871, 1958, 76 pp.

[9] Kaufman, Alvin, Southeastern Alaska's Mineral Industry: Bureau of Mines Inf. Circ. 7844, 1958, 37 pp.

The I. and L. Co. continued exploration on its group of uranium claims on Prince of Wales Island. It reported drilling a total of 42 feet, averaging 3 feet per hole in depth in 1958. It also was exploring a deposit on Prince of Wales Island, drilling a total of 20 feet at an average depth of 3 feet per hole. Kendrick Bay Mining Co., producer of uranium ore in 1957, was inactive. Pritchett, Heath, and Tucker completed an aerial reconnaissance in Southeastern Alaska during the summer. Southeastern Mining and Exploration Co. did assessment work only on its Lucky 6 claims in the William Henry Bay area. Lora Kay Co. was using a portable drill in exploration at the Lora Kay Mine.

J. P. Ibach, Lemesurier Island, shipped a small quantity of gold concentrate from the Reid Inlet mine. This concentrate, recovered from earlier mining and milling, yielded some gold and silver as well as copper and lead. George Roberts (operating as Tillicum Mining Co.) and Kloss and Davis did assessment work on antimony claims in the region. Tillicum Mining Co. reported 40 feet of diamond drilling at the Klemm Mine near Ketchikan. Hyder Mines, Inc., was engaged in reduced-scale exploration on its tungsten property in the Hyder district. Devamin Co., Inc., diamond-drilled a nickel prospect at Bohemia Basin on Yakobi Island. It contracted for 12,000 feet of hole and for service roads and operated two drills (serviced by helicopter) on a two-shift basis. Results of drilling were not released.

The Alaska Rock and Minerals Club, Fairbanks, reported purchases of cassiterite from Prince of Wales Island and gypsum from Chichagof Island. The Alaska Lapidary Service also reported sales of agate and petrified wood from the town of Baranof. Larry Heiner reported a collection of garnets from the Stikine River.

Yukon River.—The mines of the Yukon River region supplied 45 percent of the mineral production of Alaska. Gold, coal, sand and gravel, stone, and silver, in that order, were the leading mineral commodities. Value of gold produced declined 8 percent, and coal declined 22 percent. The value of mineral production for the region declined 15 percent in line with the general trend.

A report [10] of the results of investigating the tin-bearing placer deposits of the Hot Springs district was published. Fieldwork on this project began in 1954 and ended in the season of 1956. No reserves were established by the Bureau's work, but a compilation of churn-drill and drift-mine sampling data infer a substantial strategic tin resource that could be recovered in an emergency or as a byproduct of gold placer mining. Eleven representative placer tailing piles were trenched and sampled. It was estimated that all the tailing piles in the district contained about 733,000 pounds of tin in about 1.26 million cubic yards of tailing.

There were 12 dredges digging gold in the region. United States Smelting, Refining and Mining Co., operating seven dredges in the Fairbanks district and one in the Hughes district, was again the leading gold producer in the Yukon River region as well as in the Territory. It moved Dredge No. 6 from Gold Hill to Sheep Creek early in 1958. Others mining by dredge were Alluvial Golds, Inc., Circle district; North American Dredging Co., Inc., and Otter Dredging Co., Iditarod district; and Minalaska, Inc., Innoko dis-

[10] Thomas, Bruce I., Tin-Bearing Placer Deposits Near Tofty, Hot Springs District, Central Alaska: Bureau of Mines Rept. of Investigations 5373, 1958, 56 pp.

trict. Alluvial Golds moved the dredge formerly used by Gold Placers, Inc., from Coal Creek to Woodchopper Creek, both in Circle district.

Flat Creek Placers used an elevated sluice box mounted on a dragline base at a deposit near Flat. The tracks were replaced with rubber tires that gave flexibility in tails disposal and greater mobility. Leveling tubes on the hopper were used to aline the plant and to adjust sluice box grades for different types of feed material. Sluices were lined with expanded metal lath over cocoa matting and fed by a 3-yard dragline. Capacity was given as 180 cubic yards per hour. Miscovich Bros., also operating in the Flat area, were using a somewhat similar washing plant; a 1½-yard back-hoe served as a feeding unit; and a dragline was employed for tails disposal. A bulldozer was used for stripping overburden; its capacity was 200 yards per hour. Other placers in the Flat area included Otter Dredging Co. on Otter Creek, Prince Creek Mining Co. on Prince Creek, and North American Dredging Corp. on Flat Creek.

A few individuals shipped small quantities of concentrates from the Fairbanks district to smelters in the United States. All concentrates yielded gold and silver; Flume Creek Mine concentrate also yielded several tons of lead.

Fred M. Wackwitz stripped overburden with a bulldozer and did some blasting as part of his assessment work at the Polaris Bedrock antimony mine in the Fairbanks district. Sawtooth Mining Co. recovered 40 short tons of ore (50 percent antimony content) from old dumps and stockpiles at the Sawtooth Mine, Tolovana district. No production was reported from the Stampede antimony mine (owned by Earl R. Pilgrim), Kantishna district.

The Alaska Metals Mining Co. completed 168 feet of drifting. 136 feet of diamond drilling, and 400 feet of trenching at its Gilmore Dome tungsten property. A small mill constructed in 1956 was not used.

The Mineral Industry of Arizona

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Arizona Bureau of Mines.

By William H. Kerns,[1] Frank J. Kelly,[1] and D. H. Mullen [1]

ARIZONA, "the copper State," supplied 50 percent of the National mine production of copper in 1958. Copper alone supplied $255.6 million (81 percent) of the $314.5 million total value of mineral production in the State. A $55-million decline in value of copper production, caused by a reduced output and a drop in the average annual price for the metal, was the primary reason for a decrease of $58.1 million in the total value of mineral production. The remainder of the overall value decline largely resulted from drops (one-half million or more) in the output value of lead, manganese ore and concentrate, silver, and zinc, only partially offset by an increase in the value of uranium-ore and vanadium production. Metal production furnished 92 percent of the Arizona mineral production; nonmetals, including asbestos, cement, lime, pumice, sand and gravel, and stone, 8 percent; and other nonmetals and mineral fuels, less than 1 percent.

Employment and Injuries.—According to the Employment Security Commission of Arizona, the average employment in copper mining (13,800 in January 1958) dropped gradually each month to a low level of 13,300 in July, then began rising and reached 13,700 in December. Average weekly earnings showed a similar trend, $102.96 in January, $81.12 in August, and $104.41 in December. As shown in table 2, employment and earnings in copper mining in 1958 were substantially below 1957.

The State mine inspector reported [2] six fatal accidents in underground and two in open-pit mines in Arizona from December 1, 1957 to November 30, 1958. Three of the fatal accidents in underground mines were caused by motor haulage, two by fall of person, and one by electrocution. The two fatalities in open-pit mines were caused by machinery. In addition, 183 serious accidents (resulting in loss of 14 days or more) occurred in underground mines and 47 in open-pit mines.

Legislation and Government Programs.—One Defense Minerals Exploration Administration (DMEA) contract was executed in Arizona in 1958. This contract for $9,680 (75-percent Federal Government participation) was for exploration for asbestos on the Walnut Creek and Tony Mesa areas in Gila County by Arizona Asbestos, Inc. DMEA expired June 30, 1958, and was superseded by the Office of Minerals Exploration (OME), under the U.S. Department of the Interior.

[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

[2] Hersey, R. V. (Roy), Forty-seventh Annual Report of the State Mine Inspector for the Year Ending November 30, 1958: 1958, 30 pp.

TABLE 1.—Mineral production in Arizona [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Beryllium concentrate—gross weight	5	$2	18	$10
Clays [2]—thousand short tons	118	177	119	179
Columbium-tantalum concentrate—pounds	2,435	7		
Coal—thousand short tons	9	62	[3] 8	[3] 54
Copper (recoverable content of ores, etc.)	515,854	310,544	485,839	255,551
Gem stones	[4]	75	[4]	86
Gold (recoverable content of ores, etc.)—troy ounces	152,449	5,336	142,979	5,004
Lead (recoverable content of ores, etc.)	12,441	3,558	11,890	2,782
Lime—thousand short tons	138	2,127	126	1,817
Manganese ore and concentrate (35 percent or more Mn)—gross weight	79,505	6,626	62,279	5,220
Manganiferous ore and concentrate (5 to 35 percent Mn)—gross weight			1,455	32
Mercury—76-pound flasks	28	7	53	12
Mica (scrap)	1,650	17	1,717	25
Molybdenum (content of concentrate)—thousand pounds	2,385	3,071	2,320	2,827
Perlite	15,646	114	[5]	[5]
Pumice—thousand short tons	397	640	401	1,025
Sand and gravel—do	10,287	9,222	12,208	9,526
Silver (recoverable content of ores, etc.)—thousand troy ounces	5,279	4,778	4,685	4,240
Stone—thousand short tons	2,101	2,982	1,528	2,731
Tungsten concentrate—60-percent WO_3 basis	5	9		
Uranium ore	286,037	6,277	257,756	7,049
Zinc (recoverable content of ores, etc.)	33,905	7,866	28,532	5,821
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite), feldspar, fluorspar, gypsum, nitrogen compounds, petroleum (1958), pyrites, vanadium, and values indicated by footnote 5		10,441		11,734
Total Arizona [6]		372,641		314,520

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite; value included with "Items that cannot be disclosed."
[3] Preliminary figure.
[4] Weight not recorded.
[5] Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."
[6] Total has been adjusted to eliminate duplication in the value of raw materials used in the manufacture of cement and lime.

TABLE 2.—Employment data in mining and related industries

[U.S. Department of Labor, Bureau of Labor Statistics and Unemployment Compensation Division, Employment Security Commission of Arizona]

Industry	Annual average employment		Percent of total nonagricultural		Average hourly earnings [1]		Average weekly hours [1]		Average weekly earnings [1]	
	1957	1958	1957	1958	1957	1958	1957	1958	1957	1958
Mining	16,600	15,800	6.2	5.7	[2]	[2]	[2]	[2]	[2]	[2]
Copper mining	14,100	13,500	5.3	4.8	$2.43	$2.40	43.90	39.76	$106.68	$95.49
Other mining and quarrying	2,500	2,300	.9	.8	[2]	[2]	[2]	[2]	[2]	[2]
Manufacturing [3]	39,500	39,200	14.8	14.0	2.23	2.31	40.60	40.43	90.54	93.26
Copper smelting	2,000	[4] 1,800	.8	.6	2.31	[2]	47.10	[2]	108.78	[2]
Other manufacturing	37,500	37,400	14.0	13.4	[2]	[2]	[2]	[2]	[2]	[2]
Contract construction [5]	22,400	26,500	8.4	9.5	2.97	3.12	36.60	37.88	108.70	118.25
Other nonagricultural	188,600	198,100	70.6	70.9	[2]	[2]	[2]	[2]	[2]	[2]

[1] Production workers; excludes administrative and nonworking supervisory personnel.
[2] Data not available.
[3] Includes smelting and refining ferrous and nonferrous metals from ore and concentrate, which was part of the mineral industry.
[4] Excludes Kennecott Copper Corp. smelter at Ray and San Manuel Copper Co. smelter at San Manuel, which have been included with copper mining.
[5] Includes some mine contract employment.

Reports were published by the Arizona Department of Mineral Resources on mine taxation in Arizona.[3]

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—Exploration and development at the Midnight Owl and Outpost Lode claims by Earl Anderson and at the Dixie Queen mine by Dixie Queen Mines, Inc., increased output of beryl to 18 tons, compared with 5 tons in 1957. The handcobbed beryllium concentrate was sold to the Government Purchase Depot at Custer, S. Dak.

Copper.—Arizona supplied one-half of the United States copper output and was again the leading copper-producing State, a position held since 1910. A decline of 6 percent in copper output and a drop in the annual average price for copper resulted in an 18-percent reduction in value of copper production; value dropped from $310.5 million in 1957 to $255.6 million. As copper furnished 81 percent of the total value of mineral production, the drop of $58.1 million in value of mineral production was supplied largely by the $55-million decline in value of copper output.

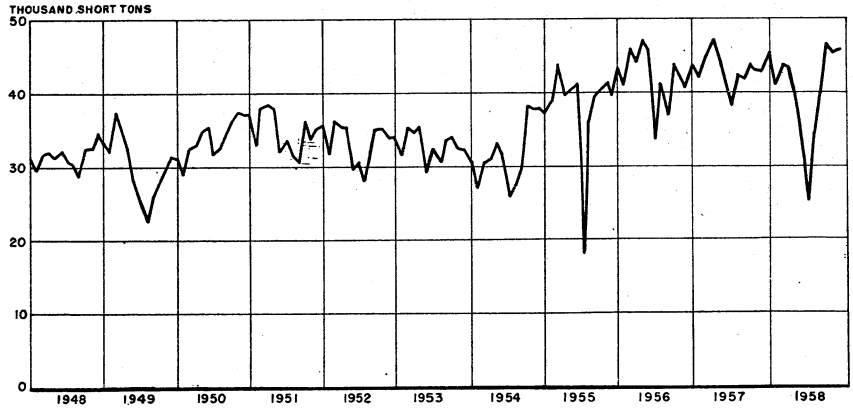

FIGURE 1.—Mine production of copper in Arizona, 1948–58, by months, in terms of recoverable metal.

[3] Arizona Department of Mineral Resources; Arizona Mine Tax Laws—Past and Present; November 1958, 3 pp.
Arizona Department of Mineral Resources; Mine Taxation in Arizona, A Compilation of Mine Taxes for Years 1953–58, Inclusive: November 1958, 10 pp.

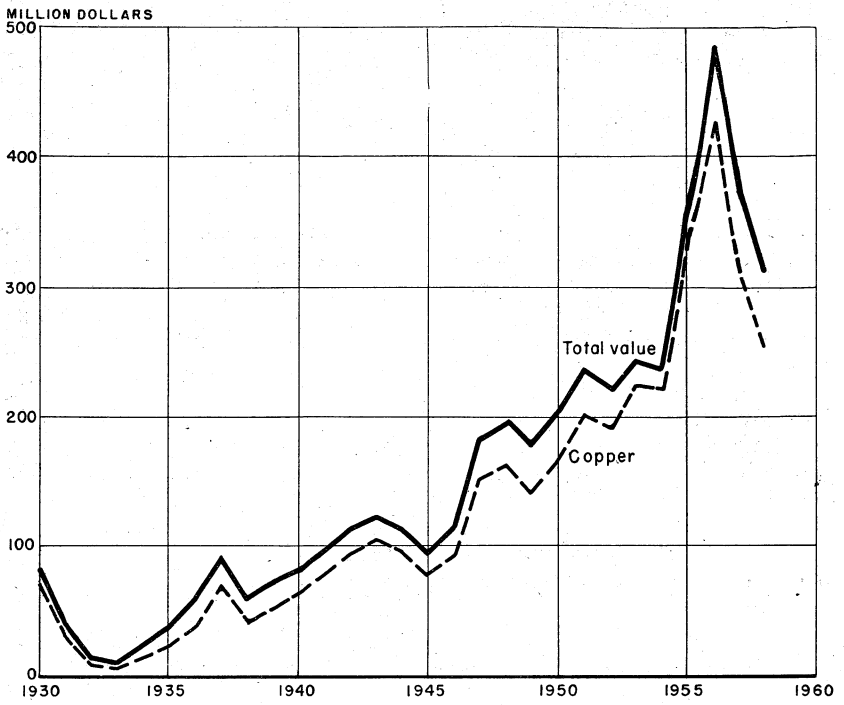

FIGURE 2.—Value of mine production of copper and total value of mineral production in Arizona, 1930–58.

TABLE 3.—15 leading copper-producing mines in 1958, in order of output

Rank in 1958	Rank in 1957	Mine	District	County	Operator	Source of copper in 1958
1	1	Morenci	Copper Mountain.	Greenlee	Phelps Dodge Corp.	Gold-silver, copper ores, copper precipitates.
2	4	San Manuel	Old Hat	Pinal	San Manuel Copper Corp.	Copper ore.
3	2	Copper Queen Lavender pit.	Warren	Cochise	Phelps Dodge Corp.	Copper ore, copper precipitates.
4	3	New Cornelia	Ajo	Pima	do	Gold leached tailings, gold-silver, copper ores.
5	5	Ray pit	Mineral Creek	Pinal	Kennecott Copper Corp.	Copper ores, copper precipitates.
6	6	Inspiration	Globe-Miami	Gila	Inspiration Consolidated Copper Co.	Do.
7	10	Silver Bell Unit.	Silver Bell	Pima	American Smelting and Refining Co.	Copper ore.
8	7	Magma	Pioneer	Pinal	Magma Copper Co.	Do.
9	8	Copper Cities	Globe-Miami	Gila	Miami Copper Co. Copper Cities Division.	Do.
10	11	Pima	Pima	Pima	Pima Mining Co.	Do.
11	9	Miami	Globe-Miami	Gila	Miami Copper Co. Miami Copper Division.	Copper ore, copper precipitates.
12	12	Bagdad	Eureka	Yavapai	Bagdad Copper Corp.	Copper ore.
13	13	Mineral Hill-Daisy.	Pima	Pima	Banner Mining Co.	Do.
14	14	Castle Dome dump.	Globe-Miami	Gila	Miami Copper Co. Castle Dome Division.	Copper precipitates.
15	17	United Verde	Verde	Yavapai	Big Hole Mining Co.	Copper ore.

TABLE 4.—Ore mined, waste and leach material removed, and total copper production at principal copper open-pit and underground mines [1]

Mine	Ore mined (short tons)		Waste and leach material removed (short tons)		Total copper produced from all sources [2] (short tons)	
	1957	1958	1957	1958	1957	1958
Open pit:						
Morenci	14,767,611	13,039,187	32,608,512	26,899,850	106,793	96,588
New Cornelia	8,813,134	7,711,440	14,014,755	13,691,784	62,459	54,929
Ray	4,751,463	4,311,334	[3] 11,038,562	[3] 9,912,120	56,879	42,932
Inspiration	4,456,378	4,621,091	8,151,872	5,462,587	35,728	41,821
Lavender	4,440,768	4,027,522	6,025,455	4,423,439	38,789	34,452
Silver Bell [3]	2,832,600	2,748,600	5,141,480	3,342,060	[4]	[4]
Copper Cities	3,482,482	2,768,390	3,037,708	2,103,269	20,746	18,036
Pima	1,094,559	1,098,742	[3] 3,119,907	[3] [5] 3,120,835	[4]	[4]
Bagdad	[3] 1,479,034	[3] 1,663,614	[3] 3,743,300	[3] 6,343,233	[6] 9,813	[6] 12,232
Castle Dome dump					[7] 2,495	[7] 2,632
Esperanza [3]			410,342	4,917,331		
Underground:						
San Manuel	8,825,130	11,486,300			59,899	74,701
Copper Queen	630,068	499,257			34,601	29,265
Magma	442,134	391,084			21,776	20,651
Miami	3,455,120	1,870,865			20,448	12,700

[1] Source: Company-published annual reports except where otherwise specified.
[2] Includes copper recovered from leaching of material in place and in dumps.
[3] Source: Mining World Catalogue and Directory Number, Apr. 25, 1959, p. 201.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Cubic yards.
[6] Gross metal in concentrate shipped.
[7] Water leaching of mine dumps only.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousand)	Troy ounces (thousand)	Value (thousand)
1949–53 (average)	253	17	43,198	113,716	$3,980	4,894	$4,429
1954	164	5	43,460	114,809	4,018	4,299	3,891
1955	173	7	52,710	127,616	4,467	4,634	4,194
1956	194	5	61,044	146,110	5,114	5,179	4,687
1957	141	8	60,166	152,449	5,336	5,279	4,778
1958	100	4	56,773	142,979	5,004	4,685	4,240
1860–1958			[3]	12,326,047	318,907	350,641	269,715

Year	Copper		Lead		Zinc		Total value (thousand)
	Short tons	Value (thousand)	Short tons	Value (thousand)	Short tons	Value (thousand)	
1949–53 (average)	393,485	$185,583	20,659	$6,308	51,762	$15,195	$215,495
1954	377,927	222,977	8,385	2,297	21,461	4,636	237,819
1955	454,105	338,762	9,817	2,925	22,684	5,580	355,928
1956	505,908	430,022	11,999	3,768	25,580	7,009	450,600
1957	515,854	310,544	12,441	3,558	33,905	7,866	332,082
1958	485,839	255,551	11,890	2,782	28,532	5,821	273,398
1860–1958	16,226,489	6,111,663	590,347	114,162	777,564	187,975	7,002,422

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old tailings, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Data not available.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1958, by counties, in terms of recoverable metals

County	Mines producing [1]		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
Cochise	11	--	4,528,720	44,710	$1,564,850	863,152	$781,196
Gila	14	--	9,248,093	1,429	50,015	139,069	125,864
Graham	2	--	24	1	35	97	88
Greenlee	1	--	13,040,057	8,071	282,485	639,302	578,601
Maricopa	2	--	105	42	1,470	123	111
Mohave	7	--	388	17	595	5,522	4,998
Navajo	--	--	(3)	2	70	758	686
Pima	20	2	11,757,647	29,798	1,042,930	951,275	860,952
Pinal	12	--	16,141,811	30,607	1,071,245	974,138	881,644
Santa Cruz	10	--	27,857	58	2,030	121,625	110,077
Yavapai	15	1	2,027,528	28,137	984,795	989,279	895,347
Yuma	6	1	589	107	3,745	240	217
Total: 1958	100	4	56,772,819	142,979	5,004,265	4,684,580	4,239,781
1957	141	8	60,166,168	152,449	5,335,715	5,279,323	4,778,054

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Cochise	63,755	$33,535,235	28	$6,400	1	$204	$35,887,885
Gila	75,500	39,712,842	14	3,276	--	--	39,891,997
Graham	1	289	--	--	--	--	412
Greenlee	96,588	50,805,130	--	--	--	--	51,666,216
Maricopa	(4)	158	--	--	--	--	1,739
Mohave	5	2,867	34	7,979	1	255	16,694
Navajo	58	30,508	--	--	--	--	31,264
Pima	97,665	51,371,737	1,400	327,612	5,696	1,161,913	54,765,144
Pinal	138,390	72,793,193	113	26,372	5	1,091	74,773,545
Santa Cruz	61	32,086	2,549	596,524	1,990	406,001	1,146,718
Yavapai	13,805	7,261,483	7,746	1,812,623	20,839	4,250,993	15,205,241
Yuma	11	5,786	6	1,474	(4)	71	11,293
Total: 1958	485,839	255,551,314	11,890	2,782,260	28,532	5,820,528	273,398,148
1957	515,854	310,544,108	12,441	3,558,126	33,905	7,865,960	332,081,963

[1] Operations at miscellaneous cleanups not counted as a producing mine.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Byproduct of uranium ore.
[4] Less than 1 ton.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1958, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	13	806	133	247	18,400	----	----
Dry gold-silver	7	67,369	706	14,116	1,179,900	3,300	----
Dry silver	16	51,829	3	8,137	1,496,300	5,900	300
Total	36	120,004	842	22,500	2,694,600	9,200	300
Copper	43	56,255,809	114,262	3,543,044	913,973,800	21,500	683,700
Copper-zinc	2	5,961	11	3,204	301,100	6,300	1,524,600
Lead	19	6,571	189	56,153	14,300	3,179,100	169,900
Lead-zinc	3	361,488	27,420	1,052,987	1,059,500	20,555,700	49,411,300
Zinc	1	14,210	28	2,620	169,500	----	5,271,600
Total	68	56,644,039	141,910	4,658,008	915,518,200	23,762,600	57,061,100
Other "lode" material:							
Gold and silver tailings	2	8,075	70	748	52,300	----	----
Copper mill and smelter cleanings and cleanings	----	701	96	2,556	167,400	8,200	2,600
Copper precipitates	8	36,130	----	----	53,129,500	----	----
Uranium ore	----	----	2	758	116,000	----	----
Total	10	44,906	168	4,062	53,465,200	8,200	2,600
Total "lode" material	100	56,808,949	142,920	4,684,570	971,678,000	23,780,000	57,064,000
Gravel (placer operations)	4	----	59	10	----	----	----
Total, all sources	104	56,808,949	142,979	4,684,580	971,678,000	23,780,000	57,064,000

[1] Detail will not necessarily add to totals because some mines produce more than 1 class of material.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1958, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation: Ore	13	7	----	----	----
Cyanidation: Ore	3,086	27,601	----	----	----
Total recoverable in bullion	3,099	27,608	----	----	----
Concentration, and smelting of concentrates: Ore[1]	106,682	3,882,758	[2]865,428,300	20,643,400	56,891,200
Direct-smelting:					
Ore	32,973	770,900	52,900,500	3,128,400	170,200
Copper precipitates	----	----	53,129,500	----	----
Smelter cleanings, etc	166	3,304	219,700	8,200	2,600
Total	33,139	774,204	106,249,700	3,136,600	172,800
Other:					
Straight leaching of copper ore	----	----	(2)	----	----
Placer	59	10	----	----	----
Grand total	142,979	4,684,580	971,678,000	23,780,000	57,064,000

[1] Includes uranium-ore concentrate.
[2] Includes copper recovered from straight leaching; combined to avoid disclosing individual company confidential data.

Production of copper was 45,000 tons in January, dropped gradually each succeeding month to a low of 25,000 tons in July, rose to 46,000 tons in October, and held this level for November and December. Production closely reflected the demand for copper. The 5 leading copper producers furnished 69 percent of the total, and the 15 leading ones supplied 99 percent.

Several new developments of significance occurred in the copper industry. The new smelter and L–P–F (leach-percipitate-flotation) facilities at Hayden were completed and placed in operation by the Ray Mines Division, Kennecott Copper Corp. Released from smelting the Ray concentrate, the American Smelting and Refining Co. smelter at Hayden accepted a greater tonnage of custom ore and concentrate. Duval Sulphur & Potash Co. continued development of its new open-pit copper mine and the construction of its 12,000-ton-per-day mill at the Esperanza property, scheduled for completion early in 1959. A decision was made by Phelps Dodge Corp. to enlarge the Lavender pit and thereby extend the life of the mine by 7 years. A decision was made by Miami Copper Co. to terminate underground operations at the Miami mine by the middle of 1959 and leach all remaining ore in place. This will lower the annual output but reduce copper-recovery costs substantially. Preparation of the ground and installation of additional equipment and facilities for this change were begun. Exploration of a reported large newly discovered low-grade copper deposit at the Mission project, near Tucson, and tests of samples of the ore by the American Smelting and Refining Co. progressed throughout the year.

Gold.—Gold output declined 6 percent and reflected directly the decreased production of copper, because 80 percent of the gold output was recovered from copper ore alone. Of the remainder, 19 percent came from ores of lead and zinc and 1 percent from ores of gold and silver.

Three mining operations, Copper Queen and New Cornelia Branches of Phelps Dodge Corp. and Iron King Branch of Shattuck Denn Mining Corp. (in descending order of output), furnished 71 percent of the State total gold output in 1958. The next four producers, San Manuel Copper Corp. (San Manuel), Magma Copper Co. (Magma), Morenci Branch of Phelps Dodge Corp., and Ray Mines Division of Kennecott Copper Corp., supplied 27 percent of the remaining 29 percent of the gold output.

Iron.—Southwestern Iron and Steel Industries, Inc., reportedly acquired all interests of Garpac, Inc., the Omega Mining and Exploration Co., and the Black Hills Co. in the Omega iron-placer deposit northwest of Tucson. A magnetic-separation pilot plant consisting of two magnetic drums, an impact crusher, and an electromagnetic separator, all connected by conveyor belts, was constructed by the new organization and operated on material from the Omega deposit. The company reported that 500 tons of concentrate containing an average of 66 percent iron was produced; none was shipped.

Lead.—Lead output declined 4 percent below 1957, but because of a lower average price for the metal during the year, the value of production dropped 22 percent. The Iron King mine (Yavapai County) operated by Shattuck Denn Mining Corp. was the principal lead pro-

ducer with an output of 7,728 tons—two-thirds of the total lead production. Three other properties, San Xavier (Pima County) and Glove and Flux mines (Santa Cruz County), supplied most of the remaining lead output.

Manganese Ore and Concentrate.—Production of manganese ore and concentrate, 35 percent or more manganese content, declined 22 percent. All material was marketed under the "carlot" program administered by the General Services Administration (GSA) for the Government. Under this program, the minimum acceptable manganese content of the material purchased was 40 percent. Production was reported from 11 counties; the largest producers were Yuma, Maricopa, Mohave, Gila, and Pima.

During the last 2 months of the year, Mohave Mining & Milling Co. fulfilled a contract for a test shipment of 1,000 tons of manganiferous ore to the Kaiser Steel Corp. plant at Fontana, Calif. This ore, used by Kaiser in steelmaking, was supplied by Mohave from numerous mines and from at least six counties. Specifications for the ore included content of at least 25 percent manganese, less than 20 percent silica, and less than 1 percent combined copper, lead, and zinc.

Mercury.—Output of mercury was almost double the 1957 production. Four mines were operated, two each in Gila and Maricopa Counties. Two-thirds of the total produced in 1958 came from ore from the Gold Creek mine in Gila County operated by Grimes & Brunson.

Molybdenum.—Inspiration Consolidated Copper Co. (Inspiration mine) became a producer of molybdenum. Five other mines from which molybdenite was recovered as a byproduct from the copper concentrate include Miami, Morenci, Silver Bell, San Manuel, and Bagdad. Production from these five mines was lower, compared with 1957, except for Bagdad. Therefore, despite the substantial new production from Inspiration, the total output of molybdenum declined 3 percent.

Silver.—Silver production declined slightly and reflected directly the decreased production of copper, because 76 percent of the silver was recovered as byproduct of copper mining. The remainder, 24 percent, came from ores of mixed copper, lead, and zinc. The Iron King, Copper Queen Branch, Morenci, Magma, and New Cornelia Branch mines, listed in order of output, were the five leading silver producers and supplied 71 percent of the silver output.

Uranium.—Uranium ore produced declined 10 percent, compared with 1957. The grade of the ore shipped, however, increased from 0.26 percent (5.2 pounds per ton) uranium oxide to 0.32 percent (6.4 pounds per ton) and resulted in a 12-percent increase in the gross value of production. Production primarily was from Apache, Coconino, and Navajo Counties, and nearly all was processed at the Tuba City mill of Rare Metals Corp. of America. Shipments also were made to plants in Colorado, New Mexico, and Utah. Some ores containing appreciable quantities of copper were processed for the recovery of the contained copper. Principal producers were Rare Metals Corp., Kerr-McGee Oil Industries, Inc., Vanadium Corp. of America, Western Gold & Uranium, Inc., Gibralter Minerals Co., and Industrial Uranium Co.

Uranium ore reserve, as determined by AEC at the close of the year, was 1.4 million tons averaging 0.34 percent (6.8 pounds) uranium oxide per ton, compared to the estimated reserve at the close of 1957 of 1.4 million tons containing 0.32 percent (6.4 pounds per ton). The State mine inspector reported 469 men employed at uranium mines, exclusive of those employed at the processing plant at Tuba City.

TABLE 9.—Mine production of uranium ore [1]

County	1957				1958			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]
Apache	39	139,503	643,873	$2,619,495	30	112,364	650,045	$2,722,869
Cochise					1	10	59	255
Coconino	58	86,226	480,506	2,018,642	46	69,222	510,260	2,233,778
Gila	10	10,282	51,996	207,644				
Maricopa	1	(3)	(3)	(3)				
Mohave					1	(4)	(4)	(4)
Navajo	9	(3)	(3)	(3)	6	75,434	484,405	2,075,600
Pima	1	(3)	(3)	(3)				
Santa Cruz	1	(3)	(3)	(3)				
Yavapai	2	(3)	(3)	(3)	2	726	3,875	16,471
Undistributed		50,026	334,269	1,431,189				
Total	121	286,037	1,510,644	6,276,970	86	257,756	1,648,644	7,048,973

[1] Based on data supplied to the Bureau of Mines by AEC.
[2] F.o.b. mine value; base price, grade premiums, and exploration allowance.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Production of Mohave County combined with that of Coconino County to avoid disclosing individual company confidential data.

Vanadium.—Uranium ores containing significant quantities of vanadium, principally from Apache County, were processed at mills in Colorado for recovery of the vanadium. The quantity recovered was substantially greater than in 1957.

Zinc.—The Iron King mine, by far the principal producer of zinc (and lead), supplied 70 percent of the zinc output. Following the Iron King in descending order of output were the San Xavier, Atlas, Flux, and Old Dick mines, which furnished 28 percent of the remaining zinc produced. Mining and milling operations at the Iron King mine were maintained at a normal rate of 1,000 tons a day throughout the year. The Flux mine and Trench mill were acquired at the beginning of the year by J. P. Nash and E. W. McFarland (Nash & McFarland) from the American Smelting and Refining Co. and operated throughout the year. Cyprus Mines Corp. suspended mining operations at the Old Dick mine at the close of 1957, but milling operations of ore mined in 1957 continued to January 25, 1958. Considerable mine exploration and development was done.

NONMETALS

Asbestos.—Despite a 24-percent decline in the tonnage of asbestos sold by mine and mill operators, the value of these reduced shipments increased 15 percent compared with 1957. The reason for this appar-

ent reversal in expected relationship between quantity and value of shipments was the gain in sales at the Globe Government Purchase Depot. Receipts of Grades 1, 2, and 3 fiber at the Globe depot increased 68, 3, and 7 percent, respectively, compared with 1957, whereas shipments of filter fiber and shorts declined 41 percent from 1957. With the closing of the Government domestic asbestos purchase program set for December 31, 1958, considerable activity was generated by the desire to make maximum shipments of Grades 1, 2, and 3 fiber before the end of the year. Part of the decline in sales of asbestos through commercial channels can be attributed to this activity as well as to the overall national decrease in demand for asbestos.

The asbestos mill of Jaquays Mining Corp. was moved from its original location, on the east edge of Globe, to a new site 2 miles east of the city limits, on U.S. Highway No. 70. The new mill has a section for initial processing of crude ore with a capacity of 2 tons per hour and a fiberizing section with capacity for producing 10 tons of fiberized asbestos daily. The Metate Asbestos Corp. was constructing a small asbestos-processing plant during 1958. The plant, in the same area as that operated by Jaquays, is designed to process and produce filtration fibers for the building trade.

Cement.—Shipments of Types I and II (general use and moderate heat) portland cement increased only 1 percent in 1958—one of the smallest gains in a number of years. The Arizona Portland Cement Co. operated its three-kiln plant all year; the bulk of the output was sold in Arizona.

The American Cement Corp. announced the formation of the Phoenix Cement Co., which began construction early in 1958 of a 1.5-million-barrel cement plant at Clarkdale. Equipment will include two 10- by 12- by 350-foot dry-process kilns and three 1,250-hp. ball mills. The plant was being built to supply 3 million barrels of cement over a 5-year period for the Glen Canyon Dam and powerplant. Completion of the cement plant was scheduled for the last half of 1959.

Clays.—Production of clays recovered from the declines of the preceding 2 years and increased 17 percent above the 1957 total. Gain in the output of nonswelling bentonite from the Cheto mines near Sanders was the principal reason for the increase. The quantity of miscellaneous clay sold or used recorded a 1-percent increase over 1957, and a rise from 15 tons to 50 tons was reported in the output of fire clay. Producers active in 1957 also operated in 1958.

Feldspar.—Sena Mining Co., operating under contract for International Minerals & Chemical Corp., mined the entire output of feldspar; production was 14 percent greater than in 1957. The crude feldspar was ground at International's Kingman mill and used in manufacturing glass, pottery, and enamel, and as a flux by consumers in Arkansas, California, Colorado, Louisiana, Ohio, Texas, Canada, and Mexico.

Fluorspar.—A small quantity of mine-run fluorspar was shipped from the Snowball mine, Maricopa County, by Monolith Portland Cement Co. The fluorspar was used at the company California cement plant. Mining operations were discontinued in March. The

National Fluorspar & Chemical Co. produced 755 tons of fluorspar ore from the Bluebird mine, Gila County, from which 326 tons of Acid-grade fluorspar was shipped to the Government stockpile.

Gem Stones.—The $86,000 value of gem or ornamental stones collected compares with $75,000 in 1957. Collection activity appeared to be centered in Yavapai, Gila, and Navajo Counties, each credited with better than $11,000 worth of material. Copper specimens, including chrysocolla, were the most important in terms of value, although large quantities of turquoise, agate, and petrified wood reportedly were collected.

Gypsum.—An expanded market for calcined gypsum products—mainly wallboard and lath—produced by Union Gypsum Co., of Phoenix, resulted in a 28-percent advance in production of crude gypsum. Increased output by the Arizona Gypsum Corp. also was reported. This company produces crude gypsum for cement retarder and agricultural purposes.

Lime.—Lower copper output and the attendant drop in lime consumed in copper processing was the principal reason for the 9-percent decline in the production and sales of lime during the same period. Limekilns were operated by Paul Lime Plant, Hoopes & Co., Phelps Dodge Corp., San Manuel Copper Corp., and United States Lime Products Division.

Mica.—Producers of crude mica increased to two with the operation of the old Charleston lead mine near Tombstone by James C. Stewart Co. This company mined a gougelike material and recovered sericite mica at a mill adjacent to the mine.

Buckeye Mica Co. also operated its mines at Quartzite and Buckeye and its mill at the latter location. Dry-ground mica was sold to consumers for use in manufacturing roofing materials and paint.

Nitrogen Compounds.—Randall Mills Corp. continued to recover bat guano from the Bat Cave 600 feet above the Colorado River in Grand Canyon. The crude material was sold to United States Guano Corp., of Kingman, for processing, packaging, and distribution as a soil conditioner and fertilizer.

Perlite.—Production and sales of perlite dropped below the 1957 level, largely owing to closing operations of the Superior Industries, Inc., and Lee's Perlite Industries, Inc., in Pinal County. The principal producer was Perlite Industries of Arizona, Inc., which mined in Pinal County and shipped crude perlite to Sil-Flo Corp., Fort Worth, Tex. Perlite Industries also consumed 600 tons at its Phoenix expanding plant.

Pumice.—Material classified under this heading consisted almost entirely of volcanic cinder (scoria), although a small quantity of tuff was produced. Output of scoria increased slightly, compared with 1957, but the value of production gained 60 percent; a reduction in the quantity of low-value scoria used for railroad ballast was the reason for the increased overall value. The decrease in material used for ballast was more than offset by the gain in usage of higher quality scoria in manufacturing building blocks. The Winona scoria deposit near Flagstaff was worked by the Atchison, Topeka & Santa Fe Railway Co., Harenberg Block Co., Inc., and Superlite Builders Supply

Co., which made Coconino County the principal producing area in the State. San Xavier Rock Co. obtained its scoria for building block from a deposit east of Douglas, Gila Valley Cinder Co. from claims near Safford, and Arizona Precast Concrete Co. from properties near Mesa.

Pyrites.—Pyrite production consisted of concentrate recovered by Kennecott Copper Corp. at Hayden and Magma Copper Co. at Superior. The concentrate was used to manufacture sulfuric acid at the Hayden acid plant of Kennecott Copper Corp.

Sand and Gravel.—In terms of value, sand and gravel ranked second among all minerals produced; the 12.2 million tons was valued at $9.5 million. An increase in output from 10.3 million tons in 1957 was due largely to greater emphasis on highway-construction activity. A

TABLE 10.—Production of sand and gravel in 1958, by counties

County	Thousand short tons	Value (thousand)	County	Thousand short tons	Value (thousand)
Apache	120	$103	Pima	1,965	$1,565
Cochise	773	606	Pinal	1,328	909
Coconino	1,025	901	Santa Cruz	62	54
Gila	724	621	Yavapai	603	425
Graham	3	4	Yuma	395	279
Greenlee	2	2	Undistributed	68	75
Maricopa	5,036	3,870	Total	12,208	9,526
Mohave	7	9			
Navajo	97	103			

TABLE 11.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1957		1958	
	Thousand short tons	Value (thousand)	Thousand short tons	Value (thousand)
COMMERCIAL OPERATIONS				
Sand:				
Building	731	$754	1,022	$1,204
Paving	291	313	297	231
Engine	(1)	(1)	(1)	(1)
Filter	(1)	(1)		
Railroad ballast	1	1		
Other	167	187	57	32
Gravel:				
Building	1,162	1,344	1,381	1,335
Paving	594	647	1,443	1,098
Railroad ballast	20	23	(1)	(1)
Other	441	377	374	181
Total sand and gravel	3,407	3,646	4,574	4,081
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Paving	647	540	604	379
Gravel:				
Building	1	1		
Paving	6,232	5,035	7,030	5,066
Total sand and gravel	6,880	5,576	7,634	5,445
Grand total	10,287	9,222	12,208	9,526

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

report[4] showed that Arizona ranked 12th in the Nation with 98.4 miles of all construction underway on the system. Of all mileage completed in the 41,000-mile superhighway network, Arizona ranked 11th, with 105.8 miles.

Maricopa County continued to be the leading producing area, supplying 41 percent of the total output.

Stone.—Mainly as a result of completing construction work by the Federal Bureau of Reclamation in Coconino County, total output of stone decreased 27 percent from 1957. The total value of stone quarried was reduced only 8 percent, as no low-value crushed sandstone was produced in Coconino County. With this exception, the stone industry was somewhat static in terms of overall quantity produced.

Vermiculite.—Ari-Zonolite Co. continued to operate its Glendale exfoliated-vermiculite plant on crude ore from out-of-State sources. The finished product was used for loose-fill insulation, as a lightweight aggregate, and in acoustical and agricultural products.

TABLE 12.—Production of stone, in 1958, by counties

County	Short tons	Value	County	Short tons	Value
Apache	900	$4,090	Mohave	29,714	$159,705
Cochise	375,900	743,400	Pima	770,200	838,500
Coconino	24,953	342,301	Pinal	(1)	(1)
Gila	32,257	43,070	Yavapai	42,200	274,000
Graham	54	203	Other counties	251,800	325,300
Greenlee	(1)	(1)			
Maricopa	(1)	(1)	Total	1,527,978	2,730,569

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

TABLE 13.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1954	77,933	$116,900	-------	-------	1,172	$25,422	714,817	$803,366
1955	38,901	61,027	-------	-------	41	820	1,005,890	1,164,656
1956	90,899	135,102	640	$640	1,810	30,605	1,066,920	1,326,602
1957	(1)	(1)	800	800	1,700	29,500	1,138,200	1,504,000
1958	(1)	(1)	(1)	(1)	3,600	62,800	1,122,800	1,399,540

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1954	316,375	$820,417	95,155	$148,210	1,205,452	$1,914,315
1955	356,882	906,313	199,225	195,750	1,600,939	2,328,566
1956	367,760	934,070	95,000	47,500	1,623,029	2,474,519
1957	903,053	1,410,087	56,806	37,296	2,100,559	2,981,683
1958	322,747	1,194,746	78,831	73,483	1,527,978	2,730,569

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

[4] Bureau of Public Roads, Status of Federal-Aid Highway Programs; BPR 59–2, Dec. 31, 1958.

TABLE 14.—Stone sold or used by producers, by uses

Use	1957		1958	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction short tons	206	$146	20,903	$306,034
Rubble do			(1)	(1)
Architectural:				
Rough cubic feet			(1)	(1)
Approximate equivalent in short tons			(1)	
Dressed cubic feet	38,800	65,081	[2] 53,705	[2] 112,488
Approximate equivalent in short tons	2,910		4,028	
Flagging cubic feet	162,380	144,756	105,810	115,094
Approximate equivalent in short tons	12,343		7,936	
Other (quantity approximate in short tons)			1,280	8,530
Total dimension stone (quantities approximate in short tons)	15,459	209,983	34,147	542,146
Crushed and broken stone:				
Riprap short tons	900	1,500		
Metallurgical do	459,000	903,600	389,200	682,800
Concrete and roadstone do	598,500	382,200	97,231	107,873
Other do	[3] 1,026,700	[3] 1,484,400	[4] 1,007,490	[4] 1,397,750
Total crushed and broken stone	2,085,100	2,771,700	1,493,831	2,188,423
Grand total (quantities approximate in short tons)	2,100,559	2,981,683	1,527,978	2,730,569

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes 10,666 cubic feet (800 short tons) mill blocks valued at $40,000.
[3] Includes abrasives, cement, cleansers, food filler, lime, porcelain, pottery, roof granules, terrazzo, and tile.
[4] Includes cement, cleansers, lime, roof granules, and terrazzo.

MINERAL FUELS

Coal.—Although coal continued to be produced from mines in Coconino and Navajo Counties, the quantity was 11 percent, or 1,000 tons, below that in 1957.

Petroleum and Natural Gas.—Exploratory drilling increased considerably—54,284 feet. Most was in Apache and Mohave Counties, followed by Cochise, Navajo, and Yuma. The first commercial oil well in the history of the State was completed in Apache County. Connections were made to gas wells in Apache County and provided the State with its first commercial outlet for natural gas. A proposal to build a refinery at Phoenix was canceled because of the possibility that smoke and fume would produce smog.

REVIEW BY COUNTIES

Apache.—Apache County was the leading uranium-ore producer. The value of uranium ore from 30 operations represented two-thirds the value of county mineral production. The major producers were Kerr-McGee Oil Industries, Inc., operating the Mesa Group mines, and Vanadium Corp. of America operating the Monument No. 2 mine. Some uranium ores, principally in the Carrizo Mountains, contained enough vanadium to warrant recovery. These ores were processed at Colorado mills, and the value of the recovered vanadium was credited to Apache County. All vanadium recovered from Arizona uranium ores was from this area.

The Cheto bentonite mines of Filtrol Corp. (Alba Mining Co.) was the principal nonmetal operation. Contractors for the State highway department produced 120,000 tons of sand and gravel, and 900 tons of crushed limestone was quarried for use in concrete and as road metal.

Six exploratory oil wells were completed during the year. One, the No. 1 Navajo E, drilled by Humble Oil & Refining Co., was successful and thus became the first commercial oil producer in the State. Initial production was 562 barrels of oil a day from the Hermosa formation. Total depth of the well was 5,410 feet. Drilling in 1958 totaled 22,593 feet. Connections were made to gas wells in the Boundary Butte and Bita Peak fields by El Paso Natural Gas Co. for processing at its natural-gas plant in southeastern Utah.

TABLE 15.—Value of mineral production in Arizona, by counties

County	1957	1958	Minerals produced in 1958 in order of value
Apache	$3,164,474	$4,324,954	Uranium ore, vanadium, clays, sand and gravel, petroleum, stone, gem stones.
Cochise	50,474,007	38,065,293	Copper, gold, silver, stone, lime, sand and gravel, manganese ore and concentrate, pumice, mica (scrap), lead, manganiferous ore and concentrate, uranium ore, zinc, gem stones.
Coconino	2,864,384	4,394,124	Uranium ore, sand and gravel, pumice, stone, manganese ore and concentrate, coal, gem stones.
Gila	50,935,723	43,124,640	Copper, asbestos, sand and gravel, manganese ore and concentrate, molybdenum, lime, silver, gold, stone, gem stones, fluorspar, mercury, lead, clays.
Graham	290,079	20,402	Pumice, sand and gravel, manganese ore and concentrate, copper, stone, gem stones, silver, gold.
Greenlee	67,052,744	53,073,897	Copper, molybdenum, silver, lime, gold, stone, gem stones, sand and gravel.
Maricopa	6,206,000	5,370,894	Sand and gravel, manganese ore and concentrate, pumice, clays, stone, mica (scrap), gem stones, manganiferous ore and concentrate, fluorspar, mercury, gold, copper, silver.
Mohave	911,628	950,678	Manganese ore and concentrate, stone, feldspar, manganiferous ore and concentrate, sand and gravel, lead, nitrogen compounds, silver, gem stones, copper, gold, zinc.
Navajo	1,495,443	2,253,126	Uranium ore, sand and gravel, coal, copper, gem stones, silver, gold.
Pima	75,739,870	66,089,879	Copper, cement, sand and gravel, zinc, gold, silver, stone, manganese ore and concentrate, lead, molybdenum, clays, gem stones, perlite.
Pinal	87,710,021	78,450,806	Copper, molybdenum, gold, sand and gravel, silver, gypsum, manganese ore and concentrate, lime, pyrites, stone, perlite, lead, manganiferous ore and concentrate, zinc, gem stones.
Santa Cruz	2,491,068	1,266,720	Lead, zinc, silver, manganese ore and concentrate, sand and gravel, copper, gold, manganiferous ore and concentrate.
Yavapai	18,254,158	16,399,450	Copper, zinc, lead, gold, silver, sand and gravel, lime, stone, molybdenum, gem stones, uranium ore, beryllium concentrate, manganese ore and concentrate, clays.
Yuma	1,117,509	1,652,166	Manganese ore and concentrate, sand and gravel, manganiferous ore and concentrate, copper, gem stones, gold, lead, mica (scrap), silver, zinc.
Undistributed [1]	5,230,422	288,528	
Total [2]	372,641,000	314,520,000	

[1] Includes some manganese ore and concentrate, sand and gravel, gem stones, and manganiferous ore and concentrate that cannot be assigned to specific counties.

[2] Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.

Cochise.—Copper supplied 88 percent of the value of mineral production, gold 4 percent, and silver 2 percent. Most of this copper was produced by the Copper Queen Branch, Phelps Dodge Corp. This operation was the third largest copper producer in the State, first in gold, and second in silver. Output of copper, gold, and silver from this operation declined 13, 9, and 28 percent, respectively. According to the company annual report for 1958, 4.1 million tons of ore, consisting of 4.0 million tons from the open pit (Lavender) and 141,000 tons from the underground mine (Copper Queen), was treated in the concentrator at an average rate of 16,700 tons per operating day. From this ore, 307,100 tons of concentrate was recovered and shipped to the company smelter at Douglas. Also shipped to the smelter was 8,616 tons of cement copper recovered in the company precipitation plant at the mine. Plans were approved for expanding the Lavender pit operation—primarily, enlargement of the present open pit to the southeast. Reportedly, this will increase the life of the operation 7 years (total of 15 years) and will involve capital expenditures of $5 million. A semiautomatic hoist installed at the 2966 station of the Copper Queen underground mine was described.[5]

Other metals produced included lead, zinc, manganese and manganiferous ore and concentrate, and uranium ore. The Johnson Camp mine, formerly a major copper and zinc producer, was inactive except for small shipments of siliceous flux containing some silver, copper, and lead to two smelters by leasers Strong & Harris. Another partnership, Strong & Moseley, shipped siliceous flux containing silver and copper to a smelter from the Keystone mine. The Swisshelm mine, operated by Conam Mining Corp., was the major producer of lead and zinc. The Oregon-Prompter was the principal producer of manganese and manganiferous ore.

Cochise was one of the more important nonmetal-producing counties. Lime from the Paul Lime Plant was reported produced, as was mica for roofing and paint, from the James C. Stewart operation at Tombstone; pumice (scoria) by San Xavier Rock & Sand Co.; and 1 million tons of sand and gravel and stone, mainly by contractors, for the State highway department but also for use in manufacturing lime and as a smelter flux.

Four exploratory wells were completed during the year. All were dry and were abandoned. Drilling totaled 12,257 feet.

Coconino.—Coconino County ranked second in the value of uranium-ore production; shipments from 46 operations furnished half the value of mineral production. Major operators were Rare Metals Corp. of America (Huskon and Ramco groups) and Western Gold and Uranium, Inc. (Golden Crown and Orphan mines). At the Orphan mine, on the west rim of the Grand Canyon, contractors were sinking a three-compartment shaft to a depth of 1,600 feet. Lateral development to intersect the ore body was planned at the 1,500-foot level.

[5] Himebaugh, A. E., Semi-Automatic Hoist at Copper Queen Proves Safe and Economical: Min. Eng., vol. 10, No. 5, May 1958, pp. 566–567.

Current production was from adits 1,800 feet (inclined distance) below the canyon rim. The 300-ton-per-day (rated capacity) processing plant of Rare Metals Corp. of America at Tuba City operated the entire year.

The value of sand and gravel (produced by highway contractors) ranked second among the minerals produced, followed by pumice (scoria) from deposits around Winona. Coconino County was also the principal supplier of dimension sandstone with production valued at $342,000.

Coal from the Cow Spring No. 3 mine was sold locally.

Gila.—An overall $7.8 million drop in the value of mineral production resulted primarily from an $8.3 million decline in value of copper output and was partially offset by increases for sand and gravel, asbestos, and manganese ore and concentrate.

Copper furnished 92 percent of the value of minerals produced. The principal copper producers included, in order of output, Inspiration Consolidated Copper Co., Inspiration mine (6th largest copper producer in Arizona); Copper Cities Division, Miami Copper Co., Copper Cities mine (9th); Miami Copper Division, Miami Copper Co., Miami mine (11th); and Castle Dome Division, Miami Copper Co., Castle Dome dump (14th).

To lower production, Inspiration Consolidated Copper Co. operated its mine and plant at Inspiration on a 5-day workweek basis for the first 9 months of the year. In addition, the entire operation was closed from June 23 through July 6 to curtail production and give vacations. Because of an increased demand for copper, the workweek was increased to 6 days in the mine and 7 days in the metallurgical plants on October 13, and despite the curtailment in production during the first three-quarters of the year, the mine was producing at the rate of 17,500 tons of ore per day by the close of the year. This represented the highest daily tonnage of ore since open-pit mining began at Inspiration. On the 6-day-per-week schedule, mine production was enough for continuous operation of the metallurgical plants. The "dual process" of ore treatment was used throughout the year. By this process the ore is first acid-leached, and most of the copper oxide minerals, as well as part of the copper sulfide minerals, is dissolved. The ore treated in 1958 contained 0.448 percent copper as oxide minerals and 0.409 percent as sulfide minerals, according to the company annual report. The copper in solution is recovered by electrolysis as cathodes of refined copper. After leaching, the ore is treated by flotation concentration for recovery of the remaining copper sulfide minerals. The concentrate is treated to recover contained molybdenum, then smelted to recover the copper, which is cast into anodes and refined in the electrolytic plant. In addition, the company leached in-place low-grade material containing copper in mined-out areas of the inactive underground workings and dumps of waste material removed from the open-pit mine. Recovery of 3,157 tons of copper resulted from this leaching-in-place operation.

Development activities at the Christmas mine by Inspiration Consolidated Copper Co. continued at a slower pace than in 1957. During the first half of the year additional underground drifting and drilling was done in the mine. The small mill on the property was

run for preliminary metallurgical-testing purposes. During the last half of the year, the development shaft was deepened to the 1,600-foot level of the mine; this will be the main haulage level. At the end of 1958 a decision was made to complete development of the mine, to sink the main production shaft, and construct the necessary plant and surface facilities to bring the property into production. Planned production capacity of 4,000 tons of ore a day will result in production of 18,000 tons of copper a year. Proved and probable ore reserves of the Christmas mine totaled 20 million tons averaging 1.83 percent copper and having a recoverable copper content of 330,000 tons, according to the company annual report.

According to the Miami Copper Co. annual report, copper production from its three divisions, Miami Copper, Copper Cities, and Castle Dome, totaled 33,369 tons in 1958, compared with 43,690 tons in 1957. This reduction resulted primarily from curtailment of the Miami Copper Division underground mining and a 4-week vacation shutdown during July, when all production was halted except for the Miami in-place leaching. The Miami and Copper Cities Divisions operated on a 5-day workweek during the remainder of the year. The ore reserve as of the close of the year at the Copper Cities open-pit mine was 29.2 million tons. Mining operations in the Miami underground mine were curtailed, and the rate of production cut in half—from 12,000 to 6,000 tons of ore per day on April 1. In-place leaching of previously mined areas continued throughout 1958. A decision was made by company officials to terminate underground operations by mid-1959, because tests indicated that a large portion of the remaining copper in the mine could be recovered more economically by in-place leaching. Water-leaching of the old waste dumps at the Castle Dome mine continued. Installation of pipelines and pumps to distribute water to the top of the old dumps was completed, making all dumps available for leaching.

In addition to these 4 major operations, 10 other mines were reported active in the county, producing ores of gold, silver, copper, and lead. Most were small producers, but at least 500 tons each was marketed from the Chillito and Copper Hill mines and Christmas mine tailing dump.

Asbestos, sand and gravel, lime, and stone, in order of value, were the major nonmetallics produced. The principal producers of asbestos were the Jaquays Mining Corp. working the Regal mine, American Fiber Corp. operating the Rock House and Asbestos No. 2 claims, Phillips Asbestos Mines operating the Phillips claims, and Metate Asbestos Corp. working the Apache, Blue Mule, and Lucky 7 claims. These operations supplied 91 percent of Grades 1, 2, and 3 fiber sold to the Globe purchase depot and 94 percent of the total asbestos sold as filter fiber and shorts.

Manganese ore and concentrate shipped from 16 mines under the carlot program administered by the GSA was valued at $595,000. By far the largest producer was the Vertical Magnet mine operated by Mohave Mining & Milling Co. Mercury was shipped from the Gold Creek mine, operated by Grimes & Brunson, the principal producer in the State, and from the Bernice No. 1 mine, operated by Basic Minerals, Inc. Molybdenum was recovered as a byproduct of copper

mining at the Inspiration (a new producer of molybdenum in 1958) and the Miami mines.

Graham.—The value of mineral production declined from $290,000 in 1957 to $20,000 in 1958, because the major producer in past years, Head Center lead-zinc mine operated by Athletic Mining Co., had been closed in July 1957 and remained inactive in 1958.

Greenlee.—The Morenci open-pit mine operated by the Morenci Branch, Phelps Dodge Corp., was again the largest producer of copper in the State, second in molybdenum, sixth in gold, and third in silver, and supplied most of the value of mineral production in the county. According to the company annual report, 39.9 million tons of material was removed from the Morenci mine in 1958, of which one-third was ore and the remainder waste and leach material. The concentrator treated 13 million tons of ore at an average rate of 52,000 tons per working day. The smelter treated 381,000 tons of concentrate. The molybdenum byproduct plant recovered 725 tons of molybdenum concentrate from copper concentrate.

Maricopa.—Maricopa County was one of the leading producers of manganese ore and concentrate. Of the 27 operations that shipped to the Government carlot program, the major producers were Big Horn Mining Co. (Big Horn mine), P. T. Evans (Black Bart and Lucky), Christofferson Mines (Apache), Rico Mining Co. (Black Bart and Lucky) and Mohave Mining & Milling Co. (Little Horn). Mohave continued to operate its 300-ton-per-day custom manganese mill and sintering plant near Wickenburg throughout the year.

Mohave.—The value of manganese ore and concentrate produced supplied three-quarters of the county's total value of mineral production. Brown & Robinett (Priceless mine) and C. F. Heise (Priceless tailings) were the major producers of ore shipped under the Government carlot-purchase program. Floyd Brown and Wells Cargo, Inc., both producing from the Black Diamond mine, had substantial outputs.

Stone produced consisted primarily of crushed quartzite sold by International Minerals & Chemical Corp. and was used in manufacturing pottery, porcelain, tile, and cleanser. Crushed basalt and miscellaneous stone were quarried and used in connection with construction contracts let by the National Park Service, and a small quantity of dimension stone was sold for use as a building material.

Small quantities of gold, silver, copper, lead, and zinc were produced from seven active mines. Output of ore from each mine was small and shipped directly to smelters, mostly for use as a flux.

Six exploratory wells were completed during the year. All were dry and were abandoned. Drilling totaled 15,265 feet.

Navajo.—Navajo County ranked third in the State in the value of uranium ore produced and supplied 92 percent of the total value of mineral production. Principal producers were Industrial Uranium Co., Gibraltar Minerals Co., and Inar Norgaard. Shipments were made to mills in Arizona, Colorado, New Mexico, and Utah.

Sand and gravel produced in the county was valued at $103,000; coal, $32,000; copper, $31,000; and gem stones, $11,000. Less than $1,000 worth of gold and silver was produced. Two exploratory wells

were drilled; both were dry and were abandoned. Drilling totaled 2,163 feet.

Pima.—Copper furnished 78 percent of the value of minerals produced in Pima County. Four mines—New Cornelia (4th-ranking copper producer in the State), Silver Bell (7th), Pima (10th), and Mineral Hill-Daisy (13th)—supplied 99 percent of the copper production in the county and 20 percent in the State.

According to the 1958 annual report of the Phelps Dodge Corp., 21.4 million tons of material—an average of 86,000 tons per operating day—was removed from the New Cornelia open-pit mine. One-third of this material was ore and the remainder waste. The ratio of waste to ore was 1.78:1, compared with 1.59:1 in 1957. Ore totaling 7.7 million tons was treated in the concentrator during 1958, an average of 31,000 tons per working day. A total of 182,000 tons of concentrate was treated at the company smelter at this operation.

Mining operations at the American Smelting and Refining Co., Silver Bell Unit, Silver Bell mine, was continued on a two-shift basis, 5 days a week throughout the year. The concentrator was operated three shifts daily and 7 days a week. Ore production, averaging 7,500 tons a day, was obtained almost equally from the two open pits, Oxide and El Tiro. An average of 270 men was employed at this operation for the year.

Additional drilling by the American Smelting and Refining Co. at the Mission project, formerly known as the East Pima project, near Tucson, confirmed previous estimates of copper ore reserve, according to the company. A shaft was sunk 375 feet in the east section of the proposed open pit, and bulk samples for mill tests were provided. This work permitted a study of the depth behavior of the deposit, which was overlain with 200 feet of sand and gravel, the same as the Pima deposit. Metallurgical tests conducted on the drill cores from various sections of the deposit showed excellent copper recovery, according to the company.

Cyprus Mines Corp., which owned one-half interest in the Pima Mining Co., stated in its annual report that 1.1 million tons of ore was mined and milled during 1958 from the Pima mine, essentially the same as in 1957. Copper-concentrate production was 68,000 tons containing 10 percent or more copper than in 1957. This resulted from higher ore grade and improved metallurgy. The ore reserve at the end of the year was estimated at 6.4 million tons containing 2 percent copper. Several reports [6] describe this operation.

According to the 1958 annual report of the Banner Mining Co., the Daisy mine near Tucson was operated at full capacity, but the Mineral Hill mine in the same district was operated on a curtailed basis. The Glance mine at Twin Buttes remained idle but was kept unwatered and on a standby basis. The Daisy shaft was deepened to 690 feet, and development of the new 630-foot level progressed.

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[6] Thurmond, R. E., and Others, Pima: A Three-Part Story, Geology, Open Pit, Milling: Min. Eng., vol. 10, No. 4, April 1958, pp. 453–462.
Grundstedt, Henry G., Geophysics, Skip Hoisting Signify New Mining Trends Set by Pima Mine: Min. World, vol. 20, No. 8, July 1958, pp. 34–39.
Huttle, John B., Skip Hoisting Solves Deep Pit Problem and How Scientific Exploration Found Pima Mine: Eng. Min. Jour., vol. 159, No. 3, March 1958, pp. 98–106.

Core drilling on State leased lands near the Daisy mine was continued, and results were encouraging. As a result of this drilling, which was in progress for 34 months, at the close of the year the board of directors of the company authorized the sinking of a five-compartment shaft to a depth of 1,000 feet.

Cement ranked second in terms of value of output by commodity. Output came from the Rillito plant of Arizona Portland Cement Co. Pima County was also the principal producer of stone—mainly limestone used in manufacturing cement—and the county ranked second in terms of sand and gravel output. Local demand for clay used to produce building brick and other clay products provided the stimulus for increased output, as with the production of perlite.

Most of the gold and silver produced was a byproduct of copper mining. The entire output of molybdenum was from copper ore from the Silver Bell mine. Lead came mainly from the San Xavier mine operated by McFarland & Hullinger with smaller quantities from the Mineral Hill-Daisy, Lost Boy, and King in Exile mines. By far the major producers of zinc were the San Xavier and Atlas (B. S. & K. Mining Co.) mines. Gertrude M. Garen (Stella Marris No. 1 mine) and Smith-Wright Mines, Inc. (Black Jack), were substantial producers of manganese ore.

Pinal.—Copper supplied 93 percent of the value of mineral production. Gold and silver, mostly recovered from copper ore, and molybdenum, all from copper ore, furnished 4 percent of the value; the remaining 3 percent was primarily from sand and gravel, gypsum, manganese ore and concentrate, and lime.

The major copper-producing mines, in order of output, were San Manuel (second in the State), Ray (fifth), and Magma (eighth). These three mines supplied 99.9 percent of the county and 28 percent of the State copper output. All were among Arizona major gold and silver producers.

Magma Copper Co. (sole owner of the San Manuel Copper Corp., operator of the San Manuel mine) stated in its annual report for 1958 that 11.5 million tons of ore, averaging 0.716 percent sulfide copper, was produced from this mine, compared with 8.8 million tons of 0.755 percent sulfide copper in 1957. An average of 13.01 pounds of copper was recovered from each ton of ore treated, compared with 13.57 in 1957. The oxide copper content of the ore was not recovered by the treatment process used. San Manuel copper production was 25 percent above the 1957 output. Molybdenum concentrate and gold and silver recovered as byproducts of the copper concentrate showed similar increases. The operation led molybdenum producers in the State. Limestone (54,000 tons) and quartzite (15,000 tons) were mined and delivered to the plant for smelter flux and metallurgical purposes from the company quarry. A total of 264,000 tons of copper concentrate was smelted, and 75,177 tons of anode copper produced from it. The operation and ore transportation at the San Manuel mine were described.[7]

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[7] Skillings, David N., San Manuel Copper Mine in Arizona: Skillings' Min. Rev., vol. 47, May 3, 1958, pp. 4–5.
Cigliana, C. F., Ore Transportation at San Manuel: Min. Eng., vol. 10, No. 5, May 1958, pp. 573–576.

The first two carlots of anode copper from the new copper smelter of the Kennecott Copper Corp., Ray Mines Division, were shipped from Hayden on July 3. The 2-year smelter-construction project, begun in July 1956 and completed September 1, 1958, was part of the $40-million program of expansion of mining, milling, and smelting facilities of this division. The complete operation, except for the furnace "run-in" at the new smelter, was shut down from June 28 through July 14 to allow for employee vacations. The operation changed from a 5- to a 4-day workweek in May, which was effective until August 5, when a 5-day week was resumed. A 6-day work week became effective September 1, then a 7-day week was begun October 22 and was continued for the remainder of the year. These changes reflected primarily an alternating weakening and strengthening of the domestic copper market. Company officials stated that operation of the new smelter and completion of the shakedown stage of the leach-precipitate-float (L–P–F) process reduced smelting costs and increased copper recovery. New pumps were being installed at the close of the year to increase recovery of low-cost precipitate copper by leaching additional caved areas of the old underground mine. The project of expanding the open-pit mine, relocating various service facilities, and enlarging the capacity of the mill—all for the purpose of increasing copper output by 20,000 tons annually—continued and was scheduled for completion early in 1960.

The annual report for 1958 of the Magma Copper Co. stated that 391,000 tons of ore, assaying 5.66 percent copper, 0.03 ounce of gold, and 1.46 ounces of silver per ton, was produced from the Magma mine. The company purchased and smelted 396 tons of ore from other producers; this was a substantial drop from the 2,874 tons purchased in 1957. Production was adversely affected by the shortage of skilled underground miners in the last half of the year and by the interruptions caused by the transfer of some men and facilities from the west and central mining areas to the far-east area. Copper production declined 5 percent, compared with 1957. The ore reserve was slightly less at the end of the year than at the beginning. Compared with 1957, considerably less development was done at the Magma mine in 1958. Diamond drilling indicated a substantial tonnage of good-grade ore between the 4,800- and 4,900-foot levels, according to company officials. A decision was made to deepen the No. 5 shaft for development of the 4,900-foot level.

Santa Cruz.—Lead and zinc output together comprised $1 million of the $1.3-million value of mineral production—a substantial drop from $2.1 million and $2.5 million, respectively, in 1957. Although 10 mines produced ores of lead, zinc, gold, silver, and copper, most of the output came from two mines, Glove (operated by Sunrise Mining Co.) and Flux (operated by Nash & McFarland). Production of manganese ore and concentrate was reported from three mines; the Mina Prieta, operated by Alfredo Valenzuela, had the greatest output.

Yavapai.—The Iron King mine operated by the Iron King Branch of Shattuck Denn Mining Corp. was the leading producer of lead, zinc, and silver, third-ranking gold producer in the State and was

again one of the major contributors to the value of mineral production in the county. Approximately 1,000 tons of ore was mined and milled a day. Lead and zinc concentrates produced by flotation were shipped to the American Smelting and Refining Co., El Paso and Amarillo, Tex., smelters, respectively; and gold bullion produced by cyanidation of the flotation tailing was shipped to United States Smelting Refining and Mining Co., Midvale, Utah. Production of ore was largely from the 1,700-foot level, with some from the 1,800 and 1,900 levels. The 2,100 level was under development.

Bagdad Copper Corp. mine at Bagdad was again the principal producer of copper in the county. Haulage costs at the Bagdad mine were described.[8] The company completed an extensive stripping project uncovering a supply of ore that will mantain a rate of 5,000 tons of ore a day to the mill for a substantial period, according to company officials. This stripping operation also resulted in an accumulation of a substantial tonnage of oxide ore in dumps. Company officials stated that operation of the electrolytic plant would save an estimated 5 cents a pound in the cost of making electrolytic copper over the present system of shipment of the copper concentrate to El Paso for smelting and refining into electrolytic copper. The company endeavored to obtain finances to enlarge the pilot plant built and successfully operated in 1957 but inactive in 1958. In 1957 copper concentrate from the Bagdad mill was roasted and leached in the plant, and electrolytic copper recovered and shipped; in addition, sulfuric acid produced in the plant was used for leaching the copper from the oxide ore on the dumps.

Mining by Cyprus Mines Corp. at the Old Dick mine near Bagdad was suspended in January. However, development was continued and, according to the company annual report resulted in increasing the ore reserve from 214,000 to 311,000 tons, averaging 4.0 percent copper and 16.4 percent zinc. A new hoist was installed in preparation for the extension of development at deeper levels.

Other important metal producers included the Big Hole Mining Co., which produced copper ore from the United Verde open-pit mine (formerly operated by Phelps Dodge Corp.), and Fred D. Schemmer, who operated the Commercial mine under lease from the Phelps Dodge Corp. and produced fluxing copper ore for the corporation smelter at Douglas, Ariz. Molybdenum was recovered as a by-product of copper ore mined at Bagdad.

Yuma.—Output of manganese ore and concentrate and manganiferous ore furnished $1.4 million of the $1.7 million value of mineral production. The five leading manganese-producing mines in the county, in order of output value, were Black Diamond, Black Bird, Metate No. 3, Power No. 1, and Doyle.

Gold and silver was recovered from one placer mine, and ores of gold, silver, copper, lead, and zinc came from six lode mines.

One exploratory oil well, 2,006 feet deep, was drilled but was dry and subsequently was abandoned.

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[8] Huttle, John B., Bagdad Reports Haulage Costs: Eng. Min. Jour., vol. 159, No. 10, October 1958, pp. 112–116.

The Mineral Industry of Arkansas

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Arkansas Geological and Conservation Commission, Norman F. Williams, Director and State Geologist, Little Rock, Ark.

By Harry F. Robertson [1]

ARKANSAS mineral production in 1958 reversed an upward trend and decreased in value to $131.6 million—the lowest since 1953. Gains in production and value of natural gas, sand and gravel, and stone were minute in comparison with losses in barite, bauxite, coal, and especially crude petroleum. Less demand for most manufactured products during the year directly and indirectly caused major reductions of output by the metal and nonmetal industries of the State. By the end of the year, however, an upward trend became apparent and corresponding increases in production, new facilities, and proposed expansions were noted.

An important new market appeared to be developing for utilizing lightweight aggregate in concrete and should eventually be reflected in increased clay production in the State.

TABLE 1.—Mineral production in Arkansas [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite	477,327	[2] $4,537	182,779	$1,668
Bauxite, long tons, dried equivalent	1,356,898	[2] 12,314	1,257,916	11,394
Clays, thousand short tons	617	1,586	578	1,577
Coal, do	508	3,976	364	2,744
Gem stones	[3]	20	[3]	23
Iron ore (usable), thousand long tons, gross weight	7	35	[4]	[4]
Manganese ore (35 percent or more Mn), gross weight	23,261	1,726	22,221	1,737
Natural gas, million cubic feet	31,327	2,256	32,890	2,664
Natural-gas liquids:				
Natural gasoline and cycle products, thousand gallons	39,869	2,313	37,197	2,574
LP-gases, do	54,034	2,097	53,518	2,743
Petroleum (crude), thousand 42-gallon barrels	31,047	90,657	[5] 28,700	[5] 80,934
Sand and gravel, thousand short tons	8,599	6,949	8,644	7,040
Stone, do	7,278	8,378	8,461	10,178
Value of items that cannot be disclosed:				
Abrasive stones, bromine, cement, gypsum, iron ore (1958), lime, soapstone, and values indicated by footnote 4	----------	6,913	----------	7,240
Total Arkansas [6]	----------	[2] 142,685	----------	131,603

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Revised figure.
[3] Weight not recorded.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Preliminary figure.
[6] Value has been adjusted to eliminate duplicating the value of clays and stone.

[1] Commodity-industry analyst, Region IV, Bureau of Mines, Bartlesville, Okla.

Anticipating increased demand for power, the Arkansas Power & Light Co. began constructing a new steam-electric generating plant at Helena, Ark., with an ultimate total capacity of 1.5 million kw. The first unit of the new plant, scheduled for production by 1961, will have a capacity of 350,000 kw. and will be the largest of its type in the United States. Its fuel will be either coal, barged down the Mississippi River, or natural gas. Daily fuel consumption of the plant at full production was estimated as either 3,000 tons of coal or 50–80 million cubic feet of natural gas.

Arkansas Steel & Prestressed Concrete Corp. announced plans to build a $200,000 plant on a 14-acre site at North Little Rock. This new plant will house facilities for manufacturing prestressed concrete beams, piling, slabs, and other forms.

Employment and Injuries.—The average annual employment in the mining industries reversed an upward trend, decreasing about 10 percent. Increased employment in the crude petroleum and natural gas industries failed to compensate for the force reductions in the metal, coal, and nonmetallic industries.

No fatal accidents occurred in coal mines during the year; however, 10 nonfatal accidents were reported—eight in underground mines and two in open-pit mines. One fatality was reported by the metal mines. Injury data on the petroleum industry were not available.

TABLE 2.—Average annual employment of mining industries [1]

Industry	1954	1955	1956	1957		1958	
	Employment	Employment	Employment	Employing units	Employment	Employing units	Employment
Metal mining	905	910	868	42	962	43	797
Bituminous-coal mining	464	536	561	34	602	29	367
Crude petroleum and natural gas	2,967	2,909	3,061	333	3,230	368	3,498
Nonmetallic mining and quarrying	1,845	2,089	2,159	103	2,128	104	1,542
Total	6,181	6,444	6,649	512	6,922	544	6,204

[1] Arkansas Department of Labor, Employment Security Division, Little Rock, Ark.

The average weekly wage in the metal mining industry was $96.04, a gain of 8 percent over that of 1957; in the coal industry, $83.40, a gain of 4 percent; in the crude petroleum industry, $88.94, a very small decrease; and in the nonmetal and quarrying industries, $76.77, an increase of 5 percent.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—A total of 24 bituminous coal mines operated during the year. Of these, 16 were underground and 8 were open-pit all mined seams that ranged from 18 to 42 inches in thickness.

Cutting machines were used in the underground mines to produce 78,547 tons (22 percent of the State's coal production). At the 8 strip mines, 5.6 million cubic yards of overburden was excavated

and 280,353 tons of coal loaded—a stripping ratio of 20 cubic yards of overburden to 1 ton of coal mined.

TABLE 3.—Coal production, in thousands

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	977	$7,617	1956	590	$4,601
1954	477	3,589	1957	508	3,976
1955	578	4,319	1958	364	2,744

Arko Briquettes, Inc., of Fort Smith, processed semianthracite to manufacture fuel briquets.

Petroleum and Natural-Gas Exploration and Development.—Exploration and drilling activities in 100 fields in 30 counties resulted in completion of 501 oil wells, 68 gas wells, and 350 dry holes. Decreased well-drilling activity was attributed to diminished activity in the Buckrange sand of the Stevens-Wesson field area and in the Nacatoch sand of the West Woodly field area. The year's exploration program was quite fruitful. All formations that were generally considered to be drilling objectives scored at least one discovery each during the year.

TABLE 4.—Oil and gas well drilling and total crew-weeks spent in geophysical and core-drill prospecting in 1958, by counties

County	Drilling [1]							Crew-weeks [2]			
	Proved field wells			Exploratory wells			Grand total	Total	Reflection seismograph	Gravity meter	Core drill
	Oil	Gas	Dry	Oil	Gas	Dry					
Ashley								31	31		
Boone						2	2				
Bradley						3	3	2	2		
Calhoun						5	5	2	2		
Chicot								2	2		
Clark								7	7		
Columbia	91		27	1		13	132	46	46		
Conway		3	2		2		7				
Crawford		1			1		2	1			1
Crittenden						1	1				
Dallas								1	1		
Drew						1	1				
Faulkner						1	1				
Franklin		11			1		12	1			1
Hempstead						3	3	17	17		
Howard						3	3	1	1		
Johnson		6	1		3	1	11	1			1
Lafayette	28	3	31	8	3	27	100	31	29		2
Little River						1	1				
Logan		5	1		4	3	13				
Miller	19	5	21	3	2	13	63	5	5		
Nevada	28		15	1		18	62	18	18		
Ouachita	84		37	1		8	130	15	15		
Pope		1				1	2	1			1
Prairie						1	1	1	1		
Sebastian		14					14	2	1		1
Union	230	2	71	7	1	32	343	22	21		1
Van Buren						1	1				
Washington						2	2				
White						4	4	2		1	1
Total: 1958	480	51	206	21	17	144	919	209	199	1	9
1957	724	22	168	12	2	189	1,117	291	208	[3] 31	52

[1] State of Arkansas Oil and Gas Commission, Engineer's Report of Oil and Gas Reservoirs, 1958.
[2] National Oil Scouts and Landmen's Associations, Oil- and Gas-Field Development in the United States: Vol. 29, 1958.
[3] Includes 6 crew-weeks, prospecting with magnetometer.

Over the entire State, 38 wildcat wells were successfully completed as new sources of supply. These successful wildcat wells established 17 new fields (9 oil and 8 gas) and 21 new producing zones (12 oil and 9 gas) in existing fields. Also at least six fields were laterally extended to considerable dimensions by successful outpost wells. The 38 sources of oil and gas discovered established a new 10-year high.

In north Arkansas, dry natural gas was produced from relatively shallow sands of Pennsylvania age. Exploration and drilling activities in this part of the State resulted in the completion of 72 wells—a new high for the Arkansas Valley area. The 27 wildcat wells resulted in the discovery of 5 new fields and 8 new gas sources. Development drilling of 45 wells adjacent to natural gas-fields resulted in 41 producing gas wells and 4 dry holes.

In south Arkansas, all crude petroleum and gas production came from Upper and Lower Cretaceous and Jurassic formations at depths of 6,000 to 8,000 feet. Exploration and drilling activities conducted in 13 counties and 85 fields totaled 847 wells completed, compared with 1,080 wells in 1957. Of the 847 completions, 692 were in proved fields and included 480 oil wells, 10 gas wells, and 202 dry holes; of the 155 wildcat wells, 21 produced oil, 6 produced gas, and 128 were dry holes.

Pipeline Construction.—Arkansas Industrial Pipeline Corp., new subsidiary of Arkansas-Louisiana Gas Co., planned to build a 130-mile, $9 million pipeline for natural gas from near Malvern (southwest of Little Rock) to Helena (an industrial center on the Mississippi River). Arkansas-Louisiana Gas Co. will construct a 100-mile, $6-million pipeline from the Aetna gasfield near Clarksville in northwest Arkansas to connect with the new line at Malvern. It will then be able to supply fuel to the new electric-generating plant of Arkansas Power & Light Co. to be completed at Helena in early 1961.

TABLE 5.—Estimated proved recoverable reserves of crude oil, natural-gas liquids, and natural gas [1]

	Proved reserves, Dec. 31, 1957	Change in proved reserves 1958 [2]	Proved reserves,[3] Dec. 31, 1958	Percent change from 1957
Crude oil—thousand barrels	304,959	40,989	317,865	+4
Natural-gas liquids [4]—do	37,140	−217	34,150	−8
Natural gas—million cubic feet	1,283,022	148,818	1,388,337	+8

[1] American Gas Association, and American Petroleum Institute, Proved Reserves of Crude Oil, Natural-Gas Liquids, and Natural Gas: Vol. 13, Dec. 31, 1958, pp. 9, 10, 19.
[2] Changes are due to extensions and new discoveries in 1958.
[3] Production was deducted.
[4] Includes condensate, natural gasoline, and LP-gases.

The Arkansas-Louisiana Gas Co. also announced plans for constructing 34 miles of 4-inch transmission line to serve customers in Lonoke and Pulaski Counties and 21 miles of 8-inch pipeline to serve the new Arkansas Cement Corp. plant near Foreman.

Natural Gas.—Marketed production of natural gas, continuing an upward trend, increased 5 percent over 1957. This gain was entirely attributable to dry natural gas production in north Arkansas. Gas output in south Arkansas declined, principally because only a small number of gas wells were successfully completed and placed on

production in the last several years. Conway and Logan Counties began producing dry gas in 1958. Of the 14 producing counties, the leading 5, in order of production value, were Franklin, Columbia, Lafayette, Pope, and Sebastian.

Natural-Gas Liquids.—Paralleling the general decline of industrial activity in the State, production of natural-gas liquids decreased about 3 percent below that of 1957. Columbia, Union, and Lafayette Counties were the only producers in Arkansas.

The Arkansas-Louisiana Chemical Corp., subsidiary of the Arkansas-Louisiana Gas Co., began a $3-million expansion program to add facilities for ethane recovery and to increase capacity for recovering other liquid products from gas at the Hamilton Products extraction plant near Magnolia. This program, began in December, was scheduled for completion during the second quarter of 1959. The completed plant can process natural gas at a capacity of 350,000 million cubic feet a day, removing ethane, propane, butane, isopentane, and natural gasoline at more than double the former volume of liquids. Its capacity can be enlarged substantially as the market develops.

Petroleum.—Reduced crude oil production and depressed prices of refined petroleum products caused a less favorable year for the oil industry. An over-supply resulted in reduced allowable production in Arkansas during the early part of 1958. Petroleum stocks became normal and the daily rate of production before curtailment was reestablished during the latter part of 1958.

TABLE 6.—Gross withdrawals and disposition of natural gas, in million cubic feet

Year	Gross withdrawals [1]			Disposition			
	From gas wells	From oil wells	Total	Marketed production [2]		Repressuring	Vented and wasted [3]
				Million cubic feet	Value (thousand)		
1949–53 (average)	38,264	29,256	67,520	44,865	$1,863	18,652	4,003
1954	36,000	20,000	56,000	33,471	1,841	18,568	3,961
1955	19,000	36,000	55,000	32,123	1,799	16,649	6,228
1956	16,000	37,000	53,000	30,162	1,810	16,269	6,569
1957	18,000	36,000	54,000	31,327	2,256	16,045	6,628
1958	15,930	31,860	47,790	32,890	2,664	10,354	4,546

[1] Marketed production plus quantities used in repressuring and in vented and wasted gas.
[2] Comprises gas sold or consumed by producers, losses in transmission, quantities added to storage, and increases in gas in pipelines.
[3] Includes direct waste on producing properties and residue blown to air.

TABLE 7.—Natural gas liquids produced, in thousands

Year	Natural gasoline and cycle products		LP-gases		Total	
	Gallons	Value	Gallons	Value	Gallons	Value
1949–53 (average)	59,387	$4,191	43,981	$1,787	103,368	$5,978
1954	50,778	3,234	58,506	2,521	109,284	5,755
1955	47,483	3,239	57,088	2,169	104,571	5,408
1956	41,529	2,541	56,146	2,293	97,675	4,834
1957	39,869	2,313	54,034	2,097	93,903	4,410
1958	37,197	2,574	53,518	2,743	90,715	5,317

At its El Dorado refinery, Lion Oil Co., a division of Monsanto Chemical Co., completed a catalytic reformer that has a throughput of 5,000 barrels of charging stock per day, a hydrodesulfurization unit, and a 100,000 pound-per-hour steam boiler. Other major expansions were planned for 1959. At El Dorado the company also began operating facilities for a much improved quality of ammonium nitrate, which was developed in its laboratory and does not cake under ordinary storage conditions; the greater density of this product cuts handling costs.

TABLE 8.—Production of crude petroleum in Arkansas, by fields, in thousands

Field	1954 Barrels	1955 Barrels	1956 Barrels	1957		1958 [1]	
				Barrels	Value	Barrels	Value
Atlanta	554	483	438	399	$1,165	228	$643
Bradley West			499				
Buckner	529	478	444	415	1,212	363	1,024
Dorcheat-Macedonia	624	617	632	721	2,105	303	854
El Dorado	838	857	923	990	2,891	826	2,329
Fouke	1,210	1,241	1,431	1,468	4,287	1,279	3,607
Horsehead	706	816	403	188	549		
Magnolia	3,289	2,890	3,609	4,521	13,201	4,058	11,444
McKamie	1,480	1,331	1,349	1,337	3,904	976	2,752
Midway	2,262	2,048	2,238	2,299	6,713	2,046	5,770
Shuler	2,599	2,593	2,353	2,119	6,188	1,791	5,051
Smackover	4,370	4,678	4,466	4,206	12,281	4,114	11,601
Stephens	1,077	1,014	1,157	1,745	5,095	1,681	4,740
Village	850	846	811	776	2,266	721	2,033
Wesson	2,699	1,840	1,591	2,491	7,274	2,239	6,314
Other fields [2]	6,043	6,637	7,011	7,372	21,526	8,075	22,772
Total	29,130	28,369	29,355	31,047	90,657	28,700	80,934

[1] Preliminary figures.
[2] Includes oil consumed on leases and net change in stocks held on leases for entire State.

TABLE 9.—Production, indicated demand, and stocks of crude petroleum, by months, 1958. in thousand barrels

Month	Production	Indicated demand	Stocks [1]	Month	Production	Indicated demand	Stocks [1]
January	2,612	2,956	2,691	August	2,397	2,510	1,911
February	2,403	2,104	2,990	September	2,269	2,220	1,960
March	2,339	2,482	2,847	October	2,487	2,462	1,985
April	2,407	2,622	2,632	November	2,343	2,007	2,321
May	2,258	2,520	2,370	December	2,416	2,666	2,071
June	2,328	2,455	2,243				
July	2,441	2,660	2,024	Total	28,700	29,664	

[1] End of month stocks that originated in Arkansas.

NONMETALS

Abrasive Stone.—Novaculite quarried in Hot Spring County was classified as "Arkansas Stone" (very fine-grained, homogeneous rock) and "Ouachita Stone" (relatively more porous, resembling unglazed porcelain). The rough novaculite, usually mined without explosives, was hand-graded particularly for homogeneity and size of individual rock pieces. The larger chunks, ranging from 5 to 15 pounds in weight, were used in manufacturing grindstones. Material that was unsuitable for grindstones was used as rubble or gravel. Rounded pebbles of novaculite, ranging from 2 to 4 inches in diameter, were used in tube mills for grinding.

Barite.—Arkansas barite sold or used by producers declined 62 percent during the year. Nearly all barite was processed and used in oil-well drilling muds, and decreased purchases for this use drastically curtailed barite production.

TABLE 10.—Primary barite sold or used by producers

Year	Short tons	Value (thousands)	Year	Short tons	Value (thousands)
1949–53 (average)	384,584	$3,534	1956	486,254	$4,256
1954	370,621	3,488	1957	477,327	[1] 4,537
1955	462,986	3,755	1958	182,779	1,668

[1] Revised figure.

Magnet Cove Barium Corp. continued work on a new shaft at its mine near Malvern. Decreased demand for domestic barite caused a work stoppage at the plant and mine from March until August; at yearend the plant was operating at reduced production. Expanded crushing facilities were installed to allow larger boulders in the feed to the primary crushers.

Bromine.—Michigan Chemical Corp. recovered bromine from oil-well brines at its El Dorado plant. The end product of the plant was elemental bromine and ethylene dibromide.

Cement.—Arkansas Cement Corp., subsidiary of Arkansas-Louisiana Gas Co., completed building a new plant near Foreman. Rated at 1.4 million barrels of cement a year, the plant produced all the main types of portland cement, masonry cement, and specialty cements. There was an estimated 200-year supply of raw materials at the site, based on the present plant capacity. Plant employment averaged 100 workers. All electrical power was produced at a company generating plant using natural gas as fuel.

Quarrying at the Foreman installation incorporated techniques new to the cement industry. Chalk is ripped by bulldozer, scraped with a 33-cubic yard pan scraper, and transported to hoppers, where conveyors deliver it to stockpiles. The raw material is transported from the stockpiles to a hammermill crusher by conveyor belt. The crushed product is made into a slurry and pumped to concrete storage tanks. The 450-foot gas-fired rotary kiln converts liquid slurry into cement clinker with heat up to 2,700° F. The clinker is then air-cooled and delivered either to a nearby stockpile or to the mill for further grinding into finished cement. Output from the plant was shipped principally to Arkansas, North Louisiana, East Texas, and Eastern Oklahoma.

Chlorine.—The newly formed chemical firm, Arkansas-Louisiana Chemical Corp., began producing chlorine and caustic soda at Pine Bluff. Its plant facilities, a part of the Pine Bluff Arsenal, were leased from the U.S. Government. Originally built to produce 50 tons of chlorine a day, the plant was subsequently enlarged to 75 tons a day. In producing this quantity of chlorine, the plant also manufactures approximately 80 tons of caustic soda. The electrolytic decomposition process consumes nearly 135 tons of salt daily when operated at capacity.

Clays.—The major uses for clay remained essentially unchanged during the year, and sales depended on the volume of construction.

TABLE 11.—Clays sold or used by producers, by kinds, in thousands

Year	Miscellaneous clay		Fire clay		Total clay	
	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	186	$194	314	$1,115	500	$1,309
1954	[1] [2] 292	[1] [2] 932	[1] 325	[1] 1,624	617	2,556
1955	[3]	[3]	[3]	[3]	739	2,376
1956	[2] 444	[2] 447	275	1,189	719	1,636
1957	[4] 226	[4] 226	390	1,360	616	1,586
1958	[4] 265	[4] 264	313	1,313	578	1,577

[1] Revised figure.
[2] Kaolin and clay used for cement combined with miscellaneous clay to avoid disclosing individual company confidential data.
[3] Included in total clay.
[4] Includes clay used for cement.

Developments in processing clay for lightweight aggregate created a relatively new market.

Southwest Concrete Materials Corp. completed building the first 250 cubic-yard-a-day unit of its lightweight aggregate plant at Poyen, Grant County. The first kiln began producing in July; another kiln was under construction. Both kilns are 8 feet by 125 feet. The temperature at the feed end is 850° F. and at the discharge end, 2,100° F. Clay from the open pit, which is about one-half mile from the plant, was crushed, removed by conveyor belt to the concrete storage pad, where it was fed into the kiln and heated. The material discharged from the kiln was transferred to the cooling pile with a clamshell shovel. After cooling, the bloated product was crushed to specified sizes and shipped by rail to the consumer. The area of competitive trade for the plant was approximately 150 miles in radius and included Tennessee, Texas, Louisiana, and Arkansas.

Arkansas Lightweight Aggregate Corp. completed building its new plant 1½ miles northwest of England, Lonoke County, in April.

Gem Stones.—Mr. A. G. Slocum began diamond recovery at the Wilark mine near Murfreesboro in mid-1958. The weathered, peridotite breccia was processed by concentration in two steps—by washing first in a pan and then in a mineral jig. The jig concentrate was dried and hand-sorted for possible content of diamonds, usually ranging from 0.26 to 0.46 carats in weight. In quality, the usual distribution was 20 percent gem stones and 80 percent industrial diamonds.

Quartz crystals, valued at nearly $14,000, were found by nine producers.

Lime.—Production of lime declined sharply because of decreased activity in the aluminum industry, major consumers of Arkansas lime. Small quantities of lime were used for water purification and in the paper, petroleum, sugar refining, and other industries.

Nitrogen Compounds.—Monsanto Chemical Co. completed its 100 ton-a-day urea plant at El Dorado, expanding its service to the fertilizer industry by producing urea solutions and liquid and solid nitrogen fertilizers for direct application. Urea also was an important ingredient in mixed feeds for ruminants. The Monsanto plastic division produced urea formaldehyde resins, which were

used as plywood adhesives, textile finishes, binders in molding granulated wood, and for other industrial purposes.

Sand and Gravel.—Production of sand and gravel increased slightly over 1957. Consumption remained about equally divided between structural and paving uses. Also important were glass sands, molding sands, and sand and gravel used as ballast and fill.

Stone.—Production and sale of stone continued to rise for the seventh consecutive year to a record high of 8.5 million short tons valued at $10.2 million.

TABLE 12.—Sand and gravel sold or used by producers, by class of operation and uses

	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Building	1,168	$987	1,084	$728
Paving	905	750	1,294	1,076
Gravel:				
Building	1,198	1,247	1,347	1,401
Paving	1,678	1,582	1,661	1,680
Other	203	122	623	297
Undistributed [1]	342	656	247	537
Total sand and gravel	5,494	5,344	6,256	5,719
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Paving	1,065	398	710	142
Building			40	10
Gravel:				
Paving	2,041	1,207	1,638	1,169
Building				
Total sand and gravel	3,106	1,605	2,388	1,321
Grand total	8,600	6,949	8,644	7,040

[1] Includes glass, ground, molding, filter, and other sands, and railroad ballast sand and gravel; Bureau of Mines not at liberty to publish separately.

TABLE 13.—Stone sold and used by producers, in thousands

Year	Short tons	Value	Year	Short tons	Value
1954	4,604	$5,930	1957	7,278	$8,378
1955	6,176	8,026	1958	8,461	10,178
1956	6,325	8,113			

Malvern Gravel Co. leased 500 acres near its present sand and gravel operations and opened a novaculite quarry. The broken stone, loaded by power shovel into trucks, was hauled to a new portable crushing plant. This new plant, adjacent to the existing Malvern plant, screened its crushed rock in the Malvern sand and gravel screening circuit; this integration permits production of all sizes or specifications of sand and gravel and crushed stone.

Sulfur (Recovered Elemental).—Recovery of byproduct sulfur from gas cycle plants in Columbia and Lafayette Counties decreased 6 percent compared with 1957.

Olin Mathieson Chemical Corp. dismantled the Magnolia Sulfur Recovery plant in Columbia County before the end of 1958. It moved the plant to Beaumont, Tex., for reconstruction and operation sometime before June 1959.

METALS

Aluminum.—Production of primary aluminum in Arkansas was small in the first half of 1958. At midyear the production rate was about 50 percent of capacity. By the end of the year owing to the activation of new and idle facilities, the industry was operating at 85 percent of capacity.

Research for developing new markets and new uses for aluminum continued. At Newport, Victor Metal Products Corp. constructed a plant to produce aluminum cans of the Aerosol type.

Bauxite.—Production of bauxite from Arkansas mines amounted to 96 percent of the U.S. total. Approximately 92 percent of the bauxite was mined in Saline County and the remainder in Pulaski County.

Reynolds Mining Corp., at open-pit and underground mines in Saline County, was the leading bauxite producer. Aluminum Company of America ranked second, and Dulin Bauxite Co., at underground and open-pit mines in Saline and Pulaski Counties, ranked third.

In April, Allied Chemical Corp., General Chemical Division, completed building a new plant at Pine Bluff, Jefferson County, to manufacture aluminum sulfate from imported bauxite, using sulfuric acid from its Baton Rouge, La., plant. The aluminum sulfate was used locally in paper mills.

TABLE 14.—Mine production of bauxite and shipments from mines and processing plants to consumers, in long tons, in thousands

Year	Mine production			Shipments		
	Crude	Dried-bauxite equivalent	Value	As shipped	Dried-bauxite equivalent	Value
1949–53 (average)	1,740	1,471	$9,888	1,638	1,493	$11,704
1954	2,297	1,949	15,993	1,979	1,711	15,239
1955	2,050	1,721	14,027	1,939	1,660	14,845
1956	1,967	[1] 1,669	[1] 14,444	[1] 1,817	[1] 1,568	[1] 14,644
1957	1,625	1,357	[1] 12,314	2,004	1,696	[1] 16,476
1958	1,517	1,258	11,394	1,586	1,340	13,091

[1] Revised figure.

A publication of the Federal Geological Survey offers geologically interpreted Arkansas bauxite exploration data obtained during World War II. The report was concerned principally with the program of exploration, the stratigraphic occurrence, and geological relationship of the bauxite deposits, and with the reserves established.[2]

Porocel Corp., subsidiary of Minerals & Chemicals Corp. of America, increased its production facilities at Berger by acquiring a

[2] Gordon, M., Jr., Tracy, J. I., Jr., and Ellis, Miller, Geology of the Arkansas Bauxite Region: Geol. Survey Prof. Paper 299, 1958, 268 pp.

crushing and drying plant. Storage facilities at the plant also were enlarged to improve efficiency and customer service.

The Federal Bureau of Mines and Reynolds Mining Corp. cooperated in a research project to devise methods of increasing the recovery of high-grade bauxite in underground mining. A second

TABLE 15.—Manganese ores shipped from mines, in short tons

Year	Manganese ore [1]			Year	Manganese ore [1]		
	Gross weight	Mn content	Value (thousand)		Gross weight	Mn content	Value (thousand)
1949–53 (average)	3,232	1,404	[2]	1956	29,485	12,525	$2,066
1954	13,728	5,407	$1,021	1957	23,261	10,000	1,726
1955	23,744	11,685	1,727	1958	22,221	9,440	1,737

[1] Containing 35 percent or more manganese (natural).
[2] Data not available.

but potentially more important part of the work will contribute to developing the theories that concern behavior of incompetent rock under stresses produced by mining.

Manganese.—The value of manganese ore increased slightly over 1957. Ten producers in Independence County shipped a total of 16,137 long tons. Shipments were also reported from Izard, Montgomery, Polk, Searcy, and Sharp Counties. The Federal Bureau of Mines continued to sample, map, and correlate data on manganese and manganiferous limestone deposits in Arkansas and to obtain samples for ore dressing tests.

Zinc.—American Zinc, Lead & Smelting Co. operated its Fort Smith smelter at 60-percent capacity the entire year.

REVIEW BY COUNTIES

Ashley.—Sand for structural and paving uses was produced by S. C. Chadwick. Structural sand and structural and paving gravel were produced by St. Francis Material Co.

Benton.—Paul Davis furnished unprocessed gravel for fill purposes. White River Sand & Gravel Co. produced structural and paving gravel. Independent Gravel Co. quarried and crushed limestone for soil conditioning.

Bradley.—Carter Lyon produced structural sand. Earl Reynolds Truck Line produced structural and paving sand.

Calhoun.—The value of sand and gravel produced totaled $418,000. The material was used for structural, paving, and fill purposes. Active producers were Pine Bluff Sand & Gravel Co., St. Francis Material Co., Twin City Gravel Co., Ouachita Aggregate Co., and W. W. Grant. A moderate quantity of petroleum was produced from the two small fields in the county. Exploratory drilling was unsuccessful.

Carroll.—Garrett Gravel Co. and Southeast Construction Co. produced building and paving sand and gravel, part of which Arkansas State Highway Department bought for paving uses.

Clark.—Westlake Quarry & Material Co., an important producer, crushed sandstone for riprap. Sand and gravel for paving, build-

TABLE 16.—Value of mineral production in Arkansas, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Ashley	$97,903	(2)	Sand and gravel.
Baxter	(2)	$1,350	Do.
Benton	38,060	69,271	Stone, sand and gravel.
Bradley	6,128	6,007	Sand and gravel.
Calhoun	366,586	531,182	Sand and gravel, petroleum.
Carroll	4,528	74,852	Sand and gravel.
Chicot	16,298	4,781	Do.
Clark	141,639	88,876	Stone, sand and gravel, clays.
Clay	16,502	16,566	Sand and gravel.
Cleveland	4,610		
Columbia	27,516,890	26,453,520	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Conway	1,520	82,900	Sand and gravel, stone, natural gas.
Craighead	14,890	53,490	Sand and gravel, clays.
Crawford	(2)	376,657	Sand and gravel, natural gas, stone.
Crittenden	(2)		
Cross	219,240	273,000	Sand and gravel.
Desha	21,860		
Drew	35,176	41,891	Sand and gravel.
Faulkner	49,066		
Franklin	1,024,601	1,305,855	Natural gas, coal, stone.
Fulton	34,560	(2)	Iron ore.
Garland	(2)	63,476	Oilstones, grinding pebbles, sand and gravel, gem stones, whetstones.
Greene	103,112	104,174	Sand and gravel.
Hempstead	220,549	24,360	Clays.
Hot Spring	5,440,595	2,829,376	Barite, clays, stone, sand and gravel, coal, gem stones.
Howard	(2)	(2)	Cement, sand and gravel.
Independence	2,669,317	2,530,189	Manganese, lime, stone, sand and gravel.
Izard	1,379,907	1,191,477	Stone, sand and gravel, manganese.
Jackson	(2)	(2)	Sand and gravel.
Jefferson	(2)	(2)	Do.
Johnson	1,512,604	1,645,951	Coal, natural gas, clays.
Lafayette	16,849,467	13,271,812	Sulfur, petroleum, natural gas, sand and gravel, natural-gas liquids.
Lawrence	(2)	(2)	Stone, sand and gravel.
Lincoln	64,797	39,550	Sand and gravel.
Little River	(2)	400,430	Sand and gravel, stone, cement.
Logan	475,453	400,369	Stone, coal, natural gas.
Lonoke		(2)	Clays.
Madison	(2)		
Marion	2,200	12,150	Stone.
Miller	7,186,665	6,232,027	Petroleum, sand and gravel, clays, natural gas.
Mississippi	129,780	60,000	Sand and gravel.
Montgomery	552,884	658,041	Slate, manganese, barite, gem stones.
Nevada	2,798,580	2,380,760	Petroleum, sand and gravel, natural gas.
Ouachita	17,976,919	17,106,561	Petroleum, sand and gravel, natural gas, clays.
Perry	180,210		
Phillips	55,870	65,504	Sand and gravel.
Pike	156,090	180,108	Gypsum, sand and gravel, gem stones.
Poinsett	45,600	83,738	Sand and gravel.
Polk	301,726	218,791	Manganese, clays, stone.
Pope	294,269	787,027	Coal, natural gas, sand and gravel, stone.
Pulaski	7,995,450	7,678,231	Stone, sand and gravel, bauxite, clays.
St. Francis	333,946	263,268	Sand and gravel.
Saline	10,870,548	11,354,884	Bauxite, clays, sand and gravel, lime, talc and soapstone, stone.
Searcy	8,616	9,408	Manganese.
Sebastian	2,711,531	1,028,072	Coal, natural gas, stone, clays.
Sharp	5,392	(2)	Manganese.
Stone	2,500	2,500	Stone.
Union	25,179,979	22,971,993	Petroleum, bromine, natural-gas liquids, natural gas, clays.
Washington	132,621	229,517	Stone, natural gas.
White	(2)	(2)	Stone.
Undistributed	[3] 7,437,766	8,399,492	
Total	[3] 142,685,000	131,603,000	

[1] The following counties are not listed because no mineral production was reported: Arkansas, Boone, Cleburne, Dallas, Grant, Lee, Monroe, Newton, Prairie, Randolph, Scott, Sevier, Van Buren, Woodruff, and Yell.

[2] Figures withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Revised figure.

ing, molding, and other uses was produced by Arkadelphia Sand & Gravel Co., R. & P. Barringer, W. R. Britt, Nowlin & Sons, and Arlington Waggoner. Hope Brick Works mined miscellaneous clay for heavy clay products. The Reynolds Metals Co. aluminum-reduction plant at Arkadelphia contributed to the economy of the county.

Clay.—The Buckskull Gravel Co. produced paving sand and gravel at a stationary plant on the Current River. Clay gravel was produced by Claud Bradford and Jess McKinney.

Columbia.—Columbia County output led in value of total minerals, crude petroleum, and natural-gas liquids and ranked second in value of natural gas. Three natural-gasoline and cycle plants at Magnolia recovered natural-gas liquids (valued at $3.6 million) by the absorption process. The Lion Oil Co., division of Monsanto Chemical Co., recovered sulfur from natural gas by the "modified Claus" process. Exploratory drilling during the year resulted in the discovery of the Kilgore Lodge field. Of 94 development wells drilled in the Stephens field, 87 were completed as oil producers.

Columbia County Highway Department produced pit-run gravel for paving. Commercial producers of structural and fill gravel were Columbia Sand & Gravel Co. and Lambert & Barr.

Conway.—Structural and paving sand and gravel were produced by Southeast Construction Co. The U.S. Army Corps of Engineers produced considerable sandstone for riprap. Exploratory drilling resulted in discovery of the Old Hickory gasfield. Three development wells, completed as gas producers, extended the Jerusalem field.

Craighead.—Southeast Construction Co. produced structural and paving sand and gravel. The Wheeler Brick Co., Inc., mined red clay used for manufacturing face brick at a plant near Jonesboro.

Crawford.—Crawford County was a leading producer of sand and gravel in the States. Arkhola Sand & Gravel Co. produced a considerable quantity of sand and gravel for paving, structural, and miscellaneous uses. Development drilling augmented known gas reserves in the Kibler-Williams field.

Cross.—The production of sand and gravel was of major importance to the economy of Cross County. Producers during the year were Cross County Gravel Co., Humphries and Kail, and McGeorge Construction Co.

Drew.—O'Neill Bros. Sand & Gravel Co. produced a sizable amount of paving sand and gravel. Producers of pit-run gravel for paving and fill use were Mrs. R. F. Hyatt, Sr. (Trustee for A. J. Wilson Estate) and Clyde Rogers. Drew County Highway Department produced pit-run gravel for paving.

Franklin.—The county continued to lead in natural gas production. Exploratory drilling in the White Oak field discovered a new gas reserve in the Hale formation. Development drilling succeeded in extending the boundaries of the Cecil and Aetna gasfields. Arnold Coal Co. and Rickard Coal Co. operated strip and underground mines, respectively. Arnold Stone Co. quarried sandstone for use as rubble and flagging.

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Fulton.—Johnel Mining Co. continued to ship brown iron ore from the Mammoth Springs open-pit mine.

Garland.—Norton Pike Co. purchased novaculite from four mines for shipment to its New Hampshire plant. Arkansas Oilstone Co. mined novaculite during the year. Arkansas Abrasives produced oilstone material and grinding pebbles. Whetstone material was mined by Jackson Whetstone Co. Among various gem stones found in the county, quartz crystals were the most valuable. Paving sand and gravel was produced by L. C. Eddy & Sons Construction Co. and Smith Bros. Construction & Materials Co.

Grant.—The lightweight aggregate plant, built by Southwest Concrete Material Corp. near Poyen, began operating on June 30. Raw material was clay, hauled from the nearby company open pit.

Greene.—Structural and paving sand and gravel were produced by Arkansas Gravel Co., B. & S. Gravel Co., and Ted Cline.

Hempstead.—Hope Brick Works mined miscellaneous clay for building brick and other heavy clay products. Exploratory well drilling was unsuccessful during the year.

Hot Spring.—Crude barite was mined and ground by the Baroid Division of the National Lead Co. and by Magnet Cove Barium Corp. The county led in production of clay and continued as one of the State's leading stone producers. Acme Brick Co. and Malvern Brick & Tile Co. mined fire clay for refractory use and for heavy clay products and miscellaneous clay for building brick and tile. Sandstone was crushed and used for making refractory silica by Coogan Gravel Co. and Harbison-Walker Refractory Co. Malvern Gravel Co. produced paving sand and gravel at a stationary plant near Malvern. Reynolds Metals Co. continued operating an aluminum-reduction plant at Jones Mill.

Howard.—Ideal Cement Co. near Okay, Ark. mined chalk, marl, and limestone for cement manufacture. Gravel used for paving and railroad ballast was produced by Mrs. Nina Dildy.

Independence.—Manganese, valued at $1.4 million and mined by 10 producers, was the most important mineral product from the county. Hydrated lime and quicklime for industrial, chemical, and building uses were produced by the Batesville White Lime Co. The Company also quarried and crushed limestone for use in concrete, metallurgical flux, roadstone, soil conditioner, and various other purposes. Batesville Marble Co. was the State's only producer of dressed monumental marble. Sandstone for rough construction and dressed stone was produced by Bristow Stone Co., Salada Stone Co., and Varnell Sandstone Quarry. Galloway Sand & Gravel Co. produced structural sand and gravel and fill sand.

Izard.—The county ranked second in value of stone production and third in value of sand and gravel output. Sand for use in the glass and ceramic industries was mined and processed by Silica Products Co., Inc. Limestone was quarried and crushed by Aluminum Company of America and Arkansas Limestone Co. for metallurgical, agricultural, and other uses. Manganese ore was mined by Leonard Baxter and Delbert Fulbright.

Jackson.—Sand and gravel for structural use, paving, and fill was produced by Allbright Bros. Contractors, Inc., and Mobley Construction Co., Inc. The Arkansas State Highway Department purchased sand and gravel for road construction.

Jefferson.—Structural and paving sand and gravel were dredged from the Arkansas River by Pine Bluff Sand & Gravel Co. In April, the Allied Chemical & Dye Corp. plant at Pine Bluff began producing aluminum sulfate for paper manufacture.

Johnson.—The county led the State's coal producers. Both open-pit and underground methods of mining were employed to furnish coal for steel mills and domestic consumption. Eureka Brick & Tile Co. mined miscellaneous clay for heavy clay products. Exploratory and development drilling resulted in the discovery of two new gasfields, the Knoxville and Union City, and extension of the Coal Hill gasfield.

Lafayette.—The county led in output of by-product elemental sulfur and ranked third in production of natural gas and natural-gas liquids. Exploratory and development drilling by the oil industry resulted in the discovery of four new oilfields, two new gas-condensate fields, and oil-extensions for the Kress City and Mid-Stamps fields. Sand and gravel for structural use, paving, and fill was produced by Meriwether Gravel Co., Inc., and Lambert & Barr. Olin Mathieson Chemical Corp. recovered elemental sulfur from natural gas by the Mathieson process.

Lawrence.—L. F. Parker produced structural gravel from a pit near Black Rock. Ben M. Hogan & Co. produced paving sand and gravel and quarried and crushed limestone for use as concrete aggregate, roadstone, and screenings.

Lincoln.—Structural sand and gravel, fill gravel, and filter sand were produced by Glover Bros. Gravel Co. at a fixed plant near Star City.

Little River.—Braswell Sand & Gravel Co., Inc., produced structural and paving sand and gravel at a stationary plant near Wilton. The Arkansas Cement Corp. plant at Foreman was completed and production of portland cement reported. The Ark-La Limestone Corp. quarried and processed limestone for soil conditioning.

Logan.—Sandstone for rough construction and flagging was produced by the Schwartz Quarry. The Logan County Building Stone Co., Spicer Stone Co., and River Mountain Stone quarried and dressed dimension sandstone. Other producers of sandstone for rough construction were Rainbow Stone Co. and Paul Case.

Bituminous coal was machine-mined underground by four operators.

Exploratory drilling in Logan County resulted in the discovery of the Booneville and the Paris gasfields. New sources of gas were discovered in the Spadra field during the year.

Lonoke.—The plant of Arkansas Lightweight Aggregate Corp. was completed and production started about midyear.

Marion.—Jim Wilson quarried and crushed sandstone for concrete aggregate, roadstone, and screenings.

Miller.—The county ranked second in the value of production of sand and gravel and fifth in that of clay and petroleum. Natural gas was also produced.

Exploratory drilling resulted in the discovery of three new oil and one new gas source. Fields expanded were Christmas, Cypress Lake, Fouke-North, and McKinney Bayou.

Gifford-Hill Co., Inc., and General Construction Co., Inc., produced sand and gravel for structural, paving, railroad ballast, and

other uses. W. S. Dickey Clay Manufacturing Co. mined fire clay and miscellaneous clay near Texarkana.

Montgomery.—Slate was quarried and processed to form slate flour and roofing granules by Bird & Son, Inc. Crude barite was shipped from the stocks of Baroid Division of National Lead Co. Other commodities produced in the county were manganese and gem stones (quartz crystals).

Nevada.—The leading commodity was petroleum. Small quantities of sand and gravel and natural gas also were produced. Development drilling adjacent to the North Stephens oilfield resulted in a significant westward extension.

Ouachita.—Petroleum and sand and gravel supplied most of the value of mineral production in the county. The Center, Stephens, and Wesson oilfields continued to produce under pool unitization and water injection programs. Berry Asphalt Co. continued to operate its petroleum refinery at Stephens.

Structural and paving sand and gravel were produced by Pine Bluff Sand & Gravel Co., Standard Gravel Co., and Graves Bros. Construction Co. The Ouachita County Highway Department mined pit-run gravel for paving. Hope Brick Works mined miscellaneous clay for building brick and other heavy clay products.

Pike.—Gypsum was mined by Arkansas Gypsum Co. for use as a retarder in portland cement. The Company also produced a moderate quantity of structural sand and gravel. Diamond production was reported by A. G. Slocum (Wilark Mine) and by the "Crater of Diamonds", both near Murfreesboro.

Poinsett.—Crowder Construction Co. mined a considerable quantity of pit-run gravel for road base. About 12 percent of the production was washed and sized.

Polk.—Will H. Hargus purchased manganese ore for beneficiating in his mill. W. S. Dickey Clay Manufacturing Co. mined miscellaneous clay for heavy clay products. The U.S. Forest Service quarried and crushed 100 tons of sandstone for riprap.

Pope.—Mobley Construction Co., Inc., and Pope County Highway Department produced structural and paving sand and gravel. U.S. Army Corps of Engineers quarried sandstone for riprap. Sandstone was quarried and dressed to dimension stone and flagging by Eureka Stone Co., Pope County Stone Co., and Texas Ledgestone Co. Coal and natural gas were also important contributions to the economy of the county.

Pulaski.—The county led in value of sand and gravel, stone, and kaolinitic clay produced. Sand and gravel for construction, paving and fill use was produced by Big Rock Stone & Material Co., Horace A. Illing, Donna Fill Co., John D. Ott, and the Arkansas State Highway Department. Jeffrey Stone Co. quarried and crushed sandstone for riprap, concrete aggregate, and railroad ballast. Producers furnishing crushed limestone for concrete, roadstone, and screening were D. F. Jones Construction Co., A. L. Pritchard, and Reynolds & Williams. Noncommercial producers of crushed granite and limestone were the U.S. Army Corps of Engineers and Arkansas State Highway Department. Big Rock Stone & Material Co. quarried and processed sandstone and nepheline syenite for use as roofing granules, riprap, concrete aggregate, roadstone, and railroad ballast. Consolidated Chemical Industries, Division of Stauffer Chemical Co.

and A. P. Green Fire Brick Co. mined high-alumina kaolinitic clay from large residual deposits south and southwest of Little Rock.

Bauxite was mined or shipped from stocks by American Cyanamid Co., Consolidated Chemical Industries Division of Stauffer Chemical Co., and Dulin Bauxite Co. Five companies operated drying, calcining, chemical, and activating plants processing bauxite for abrasives, chemicals, and other industrial uses.

St. Francis.—Sand and gravel for structural, paving, and fill purposes was produced by St. Francis Material Co. and J. J. Crisp Gravel Sales.

Saline.—The county continued to rank fifth in total value of minerals produced and third in value of clay output. A. P. Green Fire Brick Co. mined kaolinitic clay for refractory use. Bauxite—the county's leading commodity—was recovered from open-pit and underground mines by Aluminum Company of America, American Cyanamid Co., Dickinson-McGeorge, Inc., Dulin Bauxite Co., and Reynolds Mining Corp. Lime for use in the combination process to produce alumina was mined by Aluminum Company of America.

Milwhite Co., Inc., quarried and processed soapstone and slate for use as fillers in asphalt, insecticides, roofing, and rubber. Structural and paving sand and gravel were produced by East Arkansas Materials Co., Holland Sand & Gravel Co., and others.

Sebastian.—The mining of coal from seven underground mines and one open-pit mine was the county's most important industry. Miscellaneous clay was mined by Acme Brick Co. and Rescolite Co. for heavy clay products and lightweight aggregates, respectively. The Anchor Construction Co. quarried and crushed sandstone for concrete aggregate, roadstone, and screenings. Limestone, mined and crushed by Arkhola Sand & Gravel Co., was used as railroad ballast, concrete aggregate, and roadstone. The Dixie Stone Co. quarried dimension sandstone for rough construction. The county ranked fifth in value of natural gas produced. A new gas reserve was discovered in the Orr sand of the Kessler formation in the Cecil gasfield.

Union.—Union County ranked second in total value of minerals produced, second in petroleum production, and second in natural-gas liquids production. Exploratory drilling resulted in the discovery of four new fields (three oil and one gas) and four new oil sources of supply. Primary pressure maintenance and secondary recovery programs were underway in the Cairo, Catesville, Nick Springs-West, Schuler, Schuler-East, and Urbana fields.

The Michigan Chemical Corp. plant near El Dorado recovered a considerable quantity of elemental bromine and ethylene dibromide by processing brine from the Reynolds limestone zone of the Smackover field.

Washington.—McClinton Bros. and Ozark Construction Co. quarried and crushed limestone for concrete aggregate and roadstone. Natural gas production was reported from the West Fork gasfield.

White.—Acme Materials Co. quarried and crushed sandstone for use as concrete aggregate, roadstone, and railroad ballast.

The Mineral Industry of California

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, U.S. Department of the Interior, and the California Department of Natural Resources, Division of Mines.

By L. E. Davis,[1] G. C. Branner,[1] J. B. Mull,[1] and R. Y. Ashizawa [2]

THE VALUE of California mineral production in 1958 totaled $147 million less than in 1957 and over $48 million below 1956. Lower output of petroleum and natural gas was chiefly responsible for the decline. Disruption caused by worldwide crude-oil overproduction resulted in a drop in California output. Although a continuing demand for natural gas increased receipts from other States, local production was below that in 1957. A lower yield of natural-gas liquids followed a drop in crude-oil output.

The one bright spot in the 1958 mineral-industry picture was created by nonmetallic minerals. Despite lower outputs of those minerals more or less closely associated with the production of mineral fuels

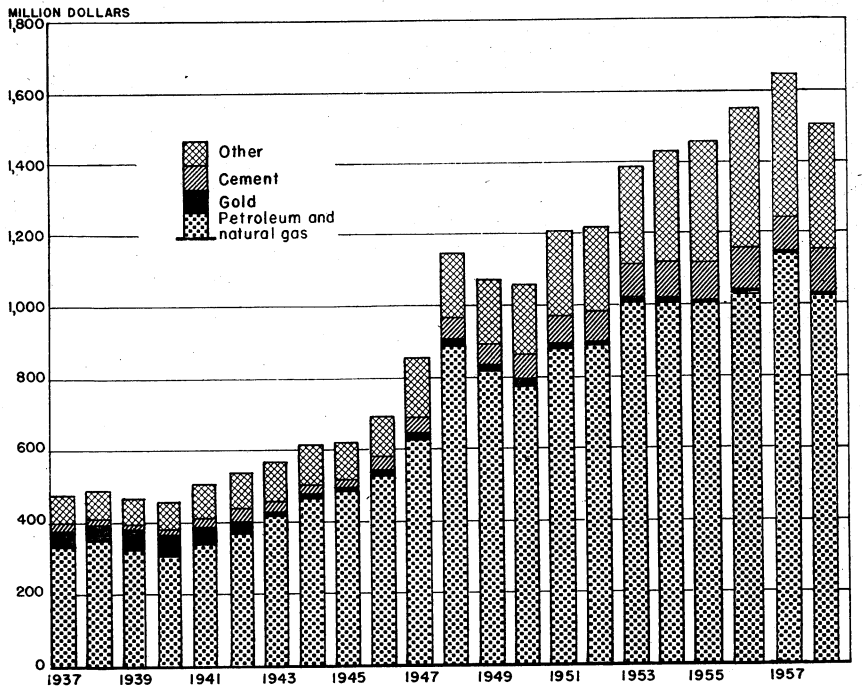

FIGURE 1.—Value of petroleum and natural gas, gold, cement, and total value of mineral production in California, 1937–58.

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and a nationally curtailed iron and steel industry, many mineral commodities essential to construction had production and value gains attributable to greatly increased activity in the construction industry near the end of 1958. Value gains were achieved in some instances by higher average unit prices, while in others, demand for the mineral commodities rose perceptibly owing to price reductions.

TABLE 1.—Mineral production in California [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite (crude)	(2)	(2)	24,812	$272
Boron minerals	[3] 541,124	[3] $38,041	528,209	38,310
Cement [4]—376-pound barrels	37,731,340	117,852	39,583,000	124,367
Chromite—gross weight	34,901	2,789	20,588	1,646
Clays	[5] 2,729,000	[3 5] 5,740	2,394,000	5,012
Copper (recoverable content of ores, etc.)	945	569	749	394
Feldspar—long tons	[6] 67,869	[6] 581	71,193	624
Gem stones	(7)	100	(7)	150
Gold (recoverable content of ores, etc.) troy ounces	170,885	5,981	185,385	6,489
Gypsum	1,268,000	2,995	1,423,000	3,184
Lead (recoverable content of ores, etc.)	3,458	989	140	33
Lime (open-market)	325,000	5,408	262,000	4,470
Magnesium compounds from sea water and bitterns (partly estimated)—MgO equivalent	[3] 74,295	[3] 5,077	74,132	4,854
Manganese ore (35 percent or more Mn) gross weight [8]	9,009	802	17,644	1,516
Mercury—76-pound flasks	16,511	4,078	22,365	5,123
Natural gas—million cubic feet	492,338	116,684	465,582	108,481
Natural-gas liquids:				
Natural gasoline and cycle products thousand gallons	843,378	81,355	853,045	68,485
LP-gases—do	390,743	20,421	342,992	18,678
Peat	35,916	424	28,617	374
Perlite	15,109	113	14,883	114
Petroleum (crude) thousand 42-gallon barrels	339,646	1,035,920	[9] 314,429	[9] 911,844
Pumice, pumicite, and volcanic cinder	459,000	1,510	376,789	1,670
Salt (common)	1,330,000	8,721	1,297,000	(2)
Sand and gravel	[3] 78,983,000	87,030	84,137,000	95,340
Silver (recoverable content of ores, etc.) troy ounces	522,000	473	188,000	170
Stone	41,351,000	53,591	[10] 32,423,000	[10] 48,345
Talc, pyrophyllite, and soapstone	133,915	1,526	148,806	1,439
Tungsten concentrate—60-percent WO_3 basis	1,750	2,735	(2)	(2)
Wollastonite	(2)	(2)	1,652	17
Zinc (recoverable content of ores, etc.)	2,969	689	51	10
Value of items that cannot be disclosed: Asbestos, bromine, calcium-magnesium chloride, masonry cement, coal (lignite), clay (kaolin, 1957), diatomite, fluorspar, iodine, iron ore, lithium minerals (1958), magnesite (1958), mica, scrap, molybdenum, platinum-group metals (crude), potassium salts, pyrites, rare-earth metals concentrates, slate (1957), sodium carbonate and sulfate, strontium minerals, sulfur ore, uranium ore, and values indicated by footnote 2	----------	65,352	----------	68,562
Total, California [11]	----------	1,650,035	----------	1,502,660

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Revised figure.
[4] Excludes masonry cement.
[5] Excludes kaolin, which is included in "Undistributed" to avoid disclosing individual company confidential data.
[6] Revised to include only feldspar content of crude and concentrate produced.
[7] Weight not recorded.
[8] Excludes shipment to Government low-grade depots and custom mills, but quantity and value for this material are as follows: 1957—manganese ore, 112 short tons, $4,000, and low-grade manganese ore, 43 short tons, $1,814; 1958—none.
[9] Preliminary figure.
[10] Beginning with 1958, slate is included with stone.
[11] The total has been adjusted to eliminate duplicating the value of clays and stone used in making cement and lime.

The nearly $6 million drop in the total value of metals and metal ores produced in 1958 was due to several factors: Market prices for copper, lead, and zinc were appreciably lower than in 1957; tungsten production continued a decline because of low open-market prices; and all chromite mines had shut down by midyear, following termination of the domestic purchase program. Iron-ore mining slumped, reflecting reduced iron and steel sales. Only gold, manganese, mercury, molybdenum, and uranium experienced increases in both quantity and value of production.

Employment and Injuries.—Employment statistics compiled by the California Division of Labor Statistics and Research, in cooperation with the Federal Bureau of Labor Statistics, revealed a 7-percent decline in the number of nonsupervisory workers employed in the mineral industries within the year. Although declines of 17 and 9 percent, respectively, were reported for metal mining and mineral-fuel production, employment in nonmetallic mining and quarrying increased 5 percent compared with 1957.

Despite an increase in fatal injuries, particularly among workers engaged in crude-oil and natural-gas production, the number of disabling injuries per thousand workers declined for all aspects of the mineral industries except rock and sand and gravel quarrying. The total number of workers injured on the job declined 27 percent from 1957. Total injuries in metal mining dropped 36.5 percent yet retained the highest rate in the mineral industries.

Average weekly earnings per employee in metal mining dropped to $98.88 ($1.05 below the 1957 average) for an average work week that was about 1 hour shorter. For workers in mineral-fuel production and nonmetallic mining and quarrying the averages rose to $109.97 and $113.98, respectively, for a workweek only a few minutes shorter than in 1957.

TABLE 2.—Employment [1] and injuries [2] in the mineral industries

Industry	1957				1958			
	Employees [3]	Fatal	Nonfatal	Total	Employees [3]	Fatal	Nonfatal	Total
Metal mining	2,300	9	306	315	1,900	3	197	200
Mineral-fuel production	26,500	7	1,803	1,810	24,000	15	1,221	1,236
Nonmetallic mining and quarrying	7,300	9	377	386	7,700	9	399	408
Total	36,100	25	2,486	2,511	33,600	27	1,817	1,844

[1] Data from Division of Labor Statistics and Research, California Department of Industrial Relations, in cooperation with the Bureau of Labor Statistics, U.S. Department of Labor.
[2] California Department of Industrial Relations, Division of Labor Statistics and Research, California Work Injuries, 1958.
[3] Nonsupervisory personnel only.

Consumption, Trade and Markets.—California was third only to Texas in the total value of the 1958 mineral production and as a chief consumer of minerals was its own best market. Only in those commodities where the State was the only or principal United States producer did production exceed consumption. Diversity of production far exceeded that in any other State, with resources that yielded nearly twice as many metal and mineral commodities as the next two leading States. This diversity of mineral products and industry has resulted in a wide variety of marketing practices.

TABLE 3.—Principal custom mills, commercial grinding plants, and primary smelters in 1958

Name	County	Nearest city or town	Minerals processed	Remarks
Industrial Minerals & Chemical Co.	Alameda	Berkeley	Nonmetals	Contract grinding.
Metals Disintegrating Co., Inc.	do	Emeryville	do	Do.
American Smelting and Refining Co.	Contra Costa	Selby	Lead, zinc, silver, gold.	Smelter, refinery, and fuming plant.
Fresno Agricultural Chemical Co.	Fresno	Fresno	Nonmetals	Custom mill.
Union Carbide Nuclear Co.	Inyo	Bishop	Tungsten ore and concentrates.	1,000-ton-a-day flotation and chemical plant.
Butte Lode Mining Co.	Kern	Randsburg	Gold, silver, and tungsten.	36-ton-a-day gravity concentrator.
American Minerals Co.	Los Angeles	Los Angeles	Nonmetals	Commercial grinding.
Kennedy Minerals Co.	do	do	do	Do.
Western Talc Co.	do	do	do	Contract grinding.
Kaiser Co., Inc.	San Bernardino	Fontana	Iron ore	Blast furnaces, steel plants, fabricating plants.
Commercial Minerals Co.	San Francisco	San Francisco	Nonmetals	Contract grinding.
Wildberg Bros. Smelting & Refining Co.	do	do	Gold, silver, and platinum.	Smelting, refining, manufacturing.

TABLE 4.—Sand and gravel, crushed stone, and portland cement sold or used in 1958, by method of transportation

Material	Quantity transported, by method (thousand short tons)				
	Railroad	Motortruck	Waterway	Not stated [1]	Total
Sand and gravel (commercial)	3,462	64,627	103		68,192
Crushed stone (commercial)	1,441	22,421	1,766	64	25,692
Portland cement	1,798	5,313	326	5	7,442

[1] Includes interplant transfers to batching units, etc.

Some metals and minerals were sold directly to the Government. Integrated industries converted raw minerals into finished products. Although most mineral commodities received some processing before sale or use, some crude minerals were shipped to mills, smelters, and consumers in other States or exported. As in the instance of most mineral-fuel production, producers of many nonmetals mined, processed, and retailed a finished product. Others contracted for the processing before sales or sold directly to the processor or refiner. A number of nonmetal processing plants custom-ground the mineral, purchased the material and processed it for resale, or purchased for resale without processing. Many buyers and brokers purchased metal and nonmetal minerals for resale or acted as agents for domestic and foreign consumers. The State had only one smelter that treated primary domestic nonferrous ores and concentrates, and its operation was dependent chiefly upon foreign materials.

Trends and Developments.—Increased population, accelerated construction, and industrial expansion have made nearly impossible the California producers' long-term ability to meet the State's mineral requirements satisfactorily at prices and grades competitive with other domestic and foreign sources. This has applied particularly to mineral fuels and metals, and, to a smaller extent, to some nonmetals. Although six new oilfields and four new gasfields were

discovered in 1958, exploration was inconsiderable, and increasing dependence was placed on sources of these fuels outside the State. The producers of metals and metal ores were affected most seriously by competition from foreign production in prices and grade. Foreign and out-of-State domestic sources of supply were relied on for a number of mineral products required by the construction, chemical, ceramic, and fertilizer industries, either because California resources were too low grade to be profitably worked or substitute materials did not give satisfactory results.

Several developments were designed to offset the trend toward reliance on out-of-State mineral resources. Five offshore oil leases of 3,840 acres each were auctioned by the State as compared with one lease of 5,500 acres in 1957. Expansion of facilities at the Kaiser Steel Corp. integrated steel plant near Fontana, San Bernardino County, completed or nearing completion by yearend included a fourth blast furnace, three new oxygen furnaces, a new slabbing mill, 10 soaking pits, installation of a 126-inch plate mill and an 86-inch hot strip mill, expansion of the tinplate mill and construction of a continuous annealer, and 90 new coke ovens.

At Niles, Alameda County, Pacific States Steel Corp. was assembling a used blast furnace purchased in Tennessee. Soule Steel Co. announced plans to build a steel rolling mill in Los Angeles to be in operation late in 1959.

Morris P. Kirk & Sons, Inc., at Los Angeles developed a new high-strength zinc-base alloy with a superior grain size that resulted in easier and higher quality machining with a minimum of grinding and finishing. Kaiser Aluminum & Chemical Corp. introduced a heat-treatable aluminum-magnesium-silicon alloy for electrical transmission which has about the same strength and electrical conductivity as aluminum wire with a steel core. The company's chemical division introduced a new basic refractory material made from high-purity periclase manufactured especially for protecting floor surfaces of marine and stationary boilers.

An on-site expansion was begun by the Linde Co. at Fontana to supply oxygen for oxygen-steelmaking facilities of Kaiser Steel Corp. The company also broke ground in September for constructing a new liquid-oxygen and nitrogen plant at Pittsburg, Contra Costa County.

Construction was completed on a glass-fiber-manufacturing plant at Corona, Riverside County, and initial operation was begun in September. In November construction started on a 200,000-square-foot plant at San Leandro, Alameda County, for manufacturing glass containers. In the Los Angeles area several cement-block producers formed the Shale-Lite Corp. to process expanded-shale aggregates. The first rotary kiln was in operation in November. A cement company in Riverside County announced plans for constructing a $5 million plant near Crestmore to produce white cement. A Santa Clara County cement company added new grinding facilities to provide increased production during peak demand periods.

A new mobile mining and milling unit was built and used in Kern County to mine, crush, and screen agricultural gypsite at the rate of 3,000 tons a day at scattered deposits in the Lost Hills area. A heavy-medium beneficiation section was installed in a sand-and-

gravel-preparation plant at Sisquoc, Santa Barbara County, for the production of aggregate from a marginal deposit.

Ionics, Inc., whose water-desalting devices have been used experimentally in the United States and as units to supply drinking water in Africa and the Middle East, arranged for its first domestic municipal installation. The company will lease, with option to buy, a plant to supply the city of Coalinga, Fresno County, with 28,000 gallons of drinking and cooking water a day. Pacific Gas & Electric Co. has planned to construct a $2 million, 12,500-kilowatt plant to generate electric power, using geyser steam in Sonoma County.

Legislation and Government Programs.—The Miller Bill, passed by the California State Legislature in July 1957, amended the Public Resources Code relating to offshore lands and eliminated any distinction between "wildcat" and "proved" oil lands. As a result, the State auctioned five leases in the offshore area bordering Santa Barbara County during 1958. The bill also provided the option of two bidding procedures.

Pacific Cement and Aggregates, Inc., won a decision for a 5-percent depletion allowance on its sand and gravel holdings near Fair Oaks, Sacramento County. The Bureau of Internal Revenue had contended that a depletion allowance could not be deducted, as the deposits involved worked-over mining land from which its minerals (gold and silver) had already been extracted.

Termination of the Government purchase programs for chromite and mercury on June 30, 1958, and December 31, 1958, respectively, resulted in complete cessation of chromite production in California, but had little effect on mercury output.

Exploration under the Defense Minerals Exploration Administration (DMEA) was continued under the newly created Office of Minerals Exploration, (OME), U.S. Department of the Interior. There were 18 projects in 12 counties active all or part of the year. Four new contracts were executed, one for copper-zinc, one for manganese, and two for mercury. Seven contracts were terminated before yearend, at which time 11 projects (5 for mercury, 3 for copper-zinc, 2 for tungsten, and 1 for manganese) were active.

In San Francisco the Bureau of Mines maintained the regional office for the area comprising California, Nevada, Hawaii, and the Pacific Islands and the Mineral Industries Office concerned with statistical and economic surveys on minerals and metals in the same Region and with the collection and dissemination of statistics on production, refining, transportation, and storage of petroleum and related products in PAD District Five (California, Oregon, Washington, Nevada, and Arizona). The new State of Alaska will be added to the latter coverage after January 1, 1959.

The Bureau's Pacific Petroleum Experiment Station, also at San Francisco, continued research on petroleum production, including secondary, largely in California.

At the Minerals Thermodynamics Experiment Station in Berkeley there was continuous research to supply the new mineral thermodynamic data so important in metallurgical, chemical, and ceramic technology.

TABLE 5.—Defense Minerals Exploration Administration contracts active during 1958

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation (percent)
HUMBOLDT					
Providence Tuolumne Gold Mines, Inc.	Copper Bluff	Copper-zinc	June 18, 1953	$58,820	50
INYO					
Albert P. Decker	Adamson	Tungsten	Oct. 24, 1957	32,100	75
Ralph E. Shupe	Round Valley & Tungsten Hill.	do	Sept. 9, 1957	70,680	75
LAKE					
COG Minerals Corp. (California Quicksilver Mines, Inc.)	Abbott	Mercury	Sept. 15, 1951	163,540	75
NAPA					
American Western Metals (Murray A. Schutz).	Harrison	do	May 2, 1956	28,540	75
H. L. M. Mining Co	Aetna Springs	do	Feb. 17, 1958	16,520	75
RIVERSIDE					
California Limestone Products	Arlington-Black Jack.	Manganese	Dec. 12, 1957	48,020	75
SAN BENITO					
New Idria Mining and Chemical Co.	New Idria	Mercury	July 18, 1952	365,126	75
Do	Molina Tunnel	do	Apr. 4, 1955	129,331	75
Do	New Idria	do	Nov. 12, 1957	96,980	75
SAN DIEGO					
Julian Nickel Mines (MacAfee & Co.).	Friday	Copper-nickel-cobalt.	Mar. 12, 1956	28,600	75
SANTA CLARA					
Palo Alto Mining Corp	Guadalupe	Mercury	July 31, 1957	20,020	75
SHASTA					
Shasta Copper & Uranium Co., Inc	Shasta King	Copper-zinc	May 24, 1955	104,572	50
Shasta-Phelps Dodge Joint Venture.	Balaklala	do	Aug. 3, 1956	109,820	50
SONOMA					
Sonoma Quicksilver Mines, Inc	Mount Jackson	Mercury	June 8, 1956	77,900	75
TRINITY					
Archibald Trucking Co. (also Humboldt County).	Grizzly	Copper-zinc	Apr. 28, 1958	9,860	50
The Castella Corp. (Smith & Austin).	Altoona	Mercury	June 27, 1955	95,260	75
YOLO					
Trans-Pacific Metals, Inc	Reed	do	June 16, 1958	102,316	50

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Lignite).—California commercial coal mining continued to be limited to one lignite strip mine near Ione, Amador County. This deposit has the highest montan-wax content of all United States

lignites and was operated solely for extraction of the wax and its byproducts. The output and value from this pit were virtually unchanged from 1957.

Natural Gas.—The marketed domestic production of natural gas dropped 5 percent below 1957. Of this, 29 percent was from dry-gas fields (largely in the north central valleys) and 71 percent from oil zones. Because of the continually rising demand for gas and the relatively low drilling and production expense for gas wells, there was intensive search for new gas pools. This exploration activity yielded only four new gasfields—two in Santa Barbara County and one each in Contra Costa and Tehama Counties. The new discoveries, together with extensions and revisions of existing gasfields, barely compensated for the gas production. The increase in the reserve during the year (as calculated by the American Gas Association) was only 0.15 percent. For the third successive year the Beehive Bend-Willows area in Glenn County led the State in completions of new dry-gas wells, with 13.

TABLE 6.—Natural gas, natural-gas liquids, and petroleum produced in 1958, by counties

County	Natural gas (million cubic feet)	Natural-gas liquids		Petroleum (thousand 42-gallon barrels)
		Natural gasoline and cycle products (thousand gallons)	LP-gases from plants (thousand gallons)	
Butte	7,892			
Colusa	5,203			
Contra Costa	1,391			
Fresno	30,916	24,972	22,409	31,328
Glenn	21,309			
Humboldt	1,877			
Kern	84,875	209,539	113,619	84,699
Kings	7,485	[1]	[1]	1,900
Los Angeles	66,977	274,108	42,390	74,411
Madera	2,747			
Monterey	3,315			10,865
Orange	30,389	95,249	22,370	36,948
Riverside				[1]
Sacramento	36,801			
San Benito	571			698
San Bernardino	50			[1]
San Joaquin	5,313			
San Luis Obispo	1,377	[1]	[1]	1,937
San Mateo	29			124
Santa Barbara	20,305	38,058	38,858	24,760
Santa Clara				[1]
Solano	31,650			
Sonoma	82			[1]
Sutter	2,531			
Tehama	865			
Tulare	5,699			[1]
Ventura	95,748	163,289	71,386	46,570
Yolo	1,352			
Undistributed		47,830	31,960	189
Total natural gas	[2] 465,582			
Total value (thousands)	$108,481	$68,485	$18,678	$911,844

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Less natural gas vented and wasted.

The quantity of natural gas received daily from the Paradox, San Juan, and Permian basins of Arizona, Colorado, New Mexico, Utah, and Texas was up only 1 percent—to 1.78 billion cubic feet—over the 1957 average but was rising rapidly at the beginning of 1959.

Demand, both from domestic and industrial customers, continued to rise and to exceed pipeline capacity.

During 1958 several applications were filed with State and Federal regulatory commissions for authority to increase deliveries of gas into California. Three El Paso Natural Gas Co. applications on file total 675 million cubic feet daily. A new company, Transwestern Pipeline Co., sought permission to deliver 300 million cubic feet a day to Pacific Lighting Gas Supply Co. in southern California.

Pacific Gas & Electric Co. continued its efforts of the past several years to complete arrangements to import Canadian natural gas into northern California. Plans include 1,300 miles of pipeline from southern Alberta to the San Francisco Bay region, estimated to cost $333 million. The line in California would be 36 inches in diameter and initially to deliver 420 million cubic feet of gas daily. For leveling periods of high and low gas demands, five large underground storage reservoirs have been in use for some time in southern California at Brea Olinda, Montebello, Whittier, and Playa del Rey in Los Angeles County and La Goleta in Santa Barbara County. In 1958 plans were underway by Pacific Gas & Electric Co. to provide two similar projects in northern California to store imported gas and assure a plentiful supply during periods of peak demand. The partly depleted, 23-year old McDonald Island field in San Joaquin County, 50 miles from San Francisco Bay, was acquired and was being equipped with additional wells and compressors. Plans were under way for a similar but much smaller storage project at the Pleasant Creek gasfield in Yolo County.

Natural-Gas Liquids.—As for a number of years, the production of natural-gas liquids decreased. The volume of gas processed dropped 5 percent, and the yield of liquid products was 3 percent below 1957; however, price deterioration in the petroleum industry reduced the dollar value of natural-gas liquids 14 percent. Natural gasoline constituted 64 percent and cycle condensate 7 percent of the total production of liquids, the balance being propane and butane products. Of the 73 natural gasoline and cycling plants, 5 were closed permanently during the year; 4 of them were in Los Angeles County. Sales of liquefied petroleum gases to California consumers rose 2 percent over the 1957 volume, compared with a 3-percent drop in the preceding year.

Peat.—Production of peat for soil conditioning dropped 20 percent under 1957. The greatest production came from the San Joaquin River Delta region of Contra Costa County and a slightly smaller tonnage from Jess Valley, southern Modoc County. A small quantity was reported from the Huntington Beach area of Orange County. Statewide, the unit value increased 10 percent over 1957.

Petroleum.—For the fifth successive year crude-oil production dropped, this year to 7 percent below 1957. The decrease resulted from excessive inventories of crude oil and refined products early in the year, aided by a lower than expected demand. As a result of the voluntary import-control program, imports of crude oil and products from foreign countries into the West Coast area were 22 percent less than in 1957. During April the Four Corners Pipeline commenced operation, bringing crude oil from Utah and New Mexico. At the end of the year it was transporting 57,000

barrels a day and was scheduled to reach the designed capacity of 70,000 barrels soon.

Domestic crude-oil demand was hampered by the steady proportionate rise in heavy oil production (as a percentage of the total). Because of the predominance of low-gravity domestic crude, West coast refineries made much more residual fuel oil from 1 barrel of crude (28 percent versus 13 percent for the entire United States) and less motor fuel (40 versus 45 percent). California refineries were steadily increasing coking capacity and other facilities to lower residual fuel yield (from 30 percent in January to 27 percent in December) and to increase motor-gasoline, jet-fuel, and other distillate production.

The problem of imbalance in heavy fuel stocks was accentuated by the continued inroads by out-of-State natural gas and by restrictions by metropolitan air-pollution-control regulatory agencies. Residual fuel stocks on the West coast, which had almost doubled during 1957 to 27 million barrels, continued to rise steadily to an unwieldy high of 34 million barrels in November 1958. Distress cargo shipments to Atlantic ports and foreign points, such as Caribbean bunkering stations, reduced stocks by the end of the year to 32 million barrels.

Total stocks of all petroleum products in the West Coast States decreased 3 percent, despite the fact that the total demand gained only 2 percent.

As a result of excess inventories and lower prices, fewer exploratory wells were drilled than in any year since 1947. Of the 476 wildcat wells drilled (down 18 percent from 1957), 59 were completed as oil producers and 14 as gas producers. This success ratio of 15 percent was slightly less than 1957 results (16 percent) and, as usual, lagged behind the national average of 20 percent. Four new gasfields and six new oilfields were discovered. Believed to be the most significant of the six new discoveries were the San Emidio Nose in Kern County and the Summerland offshore field in Santa Barbara County. The Standard-Humble-Summerland-State No. 1 was drilled from a stationary platform in 100 feet of water, 2.2 miles offshore. The platform was designed to permit the directional drilling of two holes at a time up to a total of 25.

The new fields and new pools discovered were estimated to have increased the proved crude-oil reserve by 16 million barrels. Extensions to old fields and revisions during 1958 after the year's production added 107 million barrels or 2.8 percent to the proved reserve.

At the end of 1958 there was relatively greater interest among wildcatters in drilling for gas than for oil. Increasing demand and rising prices for gas, along with lower drilling and completion costs, promise a higher return on the risk capital involved. Oil-well costs continue to climb. Moreover, for each of the past 5 years roughly half of all oil wells completed have produced heavy oil (below 20° API gravity), which is becoming less desirable for refining, as the demand for residual fuel continues to drop, along with increased gasoline requirements. In 1958 this shift in market demand caused a greater relative deterioration in prices paid for heavy crude-oil grades.

No major changes occurred in crude-oil refining facilities. Although some small refineries operated intermittently, none were shut down except the 19,000 barrel-a-day plant of Hancock Oil Co. near Long Beach, which was closed by fire. The trend toward larger companies via mergers continued, with absorption of Hancock Oil Co. into the Signal Oil and Gas Co. Signal had no refineries but was a sizable crude-oil and natural gasoline producer. The merger moved the company from seventh place in 1957 to fourth among California crude-oil producers. Merger negotiations were under way between Signal and one other small refining company.

Although no new plants were added to the 41 existing, crude-oil refining capacity increased 63,500 barrels daily. Of this, 35,500 barrels resulted from new equipment in one southern California refinery and a 20,000-barrel increase resulted from revision or re-evaluation of existing equipment by another refiner. The trend in West coast refining is toward geographical decentralization; a 45,000-barrel plant was completed in Washington-State, and ground was broken in Hawaii for one of 32,000 barrel-a-day capacity. Expansion of the refining companies into petrochemicals continued. Richfield Oil Corp. completed a new benzene-toluene plant at its Watson refinery. The same company and Stauffer Chemical Co. announced plans to build, through American Chemical Corp., a wholly-owned affiliate—a $7.5 million petrochemical plant near Watson to produce chlorinated hydrocarbons.

NONMETALS

Asbestos.—Only two asbestos properties were active. Amphibole shorts, produced in the Tin Mountain area of Inyo County, were shipped for use as filler in various manufactured products. Chrysotile asbestos was mined a few miles north of Napa. Shipments consisted of Group 7 shorts and refuse utilized in manufacturing floor tile and roofing. Although the tonnage mined and shipped was appreciably above that in 1957, the average unit value was somewhat less.

Barite.—Three mines (one each in Nevada, San Bernardino, and Tulare Counties) produced crude barite. Beginning stocks at mines were high, and although production was down 66 percent, shipments of crude barite to California grinding plants increased 45 percent compared with 1957. One company utilized part of its out-of-State crude production in manufacturing barium chemicals. Several producers ground their own barite, some purchased it for grinding, and others ground the material on a custom basis. The percentage of total ground used as a constituent in well-drilling fluids was the same as in 1957, but the quantity decreased 13 percent. Although the glass industry consumed most of the remaining ground output, small tonnages were used as filler in paint and asphalt emulsions.

Boron Minerals and Compounds.—The United States supply and much of the world supply of boron minerals were obtained from bedded deposits in Kern and Inyo Counties and the brines of Searles Lake, San Bernardino County. Finished boron compounds were produced from the minerals of the bedded deposits in refineries at Boron, Kern County, and Wilmington, Los Angeles County. Recovery

plants at Trona and West End on Searles Lake treated the brines that yielded boron compounds. A San Francisco chemical plant produced commercial and high-purity boron compounds from crude borates mined in Kern County. The total value of the boron-compound (finished product) output was slightly higher than in 1957, despite a lower tonnage, owing to the relative quantities of products produced to meet consumer demands and to increased unit prices made by producers on technical grade borax, anhydrous borax, and boric acid.

Bromine and Bromine Compounds.—At Searles Lake, San Bernardino County, elemental bromine was recovered from dry-lake brines. The liquid bromine was shipped to chemical plants and used in manufacturing various bromine compounds. Small quantities were consumed in compounding space and soil fumigants, pharmaceuticals, and chemicals used in photography, but most was converted to ethylene dibromide, which was added to tetraethyl lead for use in antiknock gasolines. At Newark, Alameda County, ethylene dibromide was compounded from bromides recovered in processing salt-works bitterns. Five percent less bromine and bromine compounds were produced than in 1957, but the unit price remained unchanged.

Calcium Chloride.—The output of calcium chloride was limited to two producers who recovered the crude liquid from Bristol Lake brines, San Bernardino County, in plants near Saltus and Amboy. A third plant (near Amboy) purchased the crude liquid and prepared flake and refined liquid products. The volume and value of production declined below 1957. Much of the output was consumed in Arizona, Nevada, and southern California for dust and ice control on roads; however, small quantities were used in processing seaweed and metal ores, as an accelerator in cement, and in "freezeproofing" materials bulk-shipped in open railroad cars or stockpiled in the open.

Cement.—Production of portland cement increased 2 percent, and shipments (including one-half million barrels from stocks) rose 5 percent compared with 1957. Of the total shipped, southern California cement plants in Kern, Los Angeles, Riverside, and San Bernardino Counties supplied 56 percent, and northern California plants in Calaveras, San Benito, San Mateo, Santa Clara, and Santa Cruz Counties supplied 44 percent. Bulk shipments increased 7

TABLE 7.—Finished portland cement produced, shipped, and in stock, and estimated consumption

Year	Active plants	Estimated capacity (thousand barrels)	Production (thousand barrels)	Shipments from mills			Estimated consumption (thousand barrels)	Stocks at mills Dec. 31 (thousand barrels)
				Thousand barrels	Value			
					Total (thousands)	Average per barrel		
1949–53 (average)	11	32,740	28,229	28,126	$74,162	$2.64	24,348	1,404
1954	11	35,845	32,599	32,762	98,251	3.00	28,761	1,563
1955	11	37,173	35,450	35,084	103,794	2.96	31,643	1,929
1956	12	42,882	39,547	39,290	120,511	3.07	35,872	2,180
1957	13	50,150	38,371	37,731	117,852	3.12	33,388	[1] 2,956
1958	13	49,505	39,056	39,583	124,367	3.14	34,232	2,426

[1] Revised figure.

percent from 1957, but bagged shipments declined 3 percent. Demand for Types I and II portland cement accounted for 97 percent of the total shipments. Six new storage silos were added at the Cushenbury plant in San Bernardino County, and the production of white cement was planned for the Crestmore plant in Riverside County. The Davenport plant in Santa Cruz County completed its conversion from oil to natural gas to reduce fuel cost.

Clays.—Production of clays declined 12 percent in quantity and 13 percent in value, compared with 1957. Clays in six major classifications were produced from open-pit mines, of which only ball clay (San Bernardino County) and fuller's earth (Inyo County) had increased outputs. Consumption in heavy clay products represented 50 percent of the production and cement 28 percent; 14 percent was thermally expanded for lightweight aggregate. The remaining 8 percent was used in other industrial processes, principally the manufacture of refractories. The demand for china clay and miscellaneous clay was notably below that in 1957. The production of fire and stoneware clays dropped to 372,000 tons from 662,000 tons in 1957. Los Angeles, Riverside, Ventura, San Mateo, and Solano Counties produced 62 percent of the nearly 2 million tons of miscellaneous clay mined. Amador, Placer, and Riverside Counties were the chief sources of fire and stoneware clay. Mono and Orange Counties supplied the china-clay output, while bentonite was obtained from Inyo, San Benito, and San Bernardino Counties.

TABLE 8.—Clays produced, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Inyo	(1)	(1)	13,336	$66,678
Kern	102,575	$341,281	63,651	226,927
Los Angeles	518,657	650,225	316,701	389,775
Madera			3,881	4,851
Mono			1,954	5,567
Orange	[2] 42,465	[2] 108,121	40,179	231,085
Riverside	423,406	1,185,557	372,608	913,290
San Bernardino	[2] 36,087	[2] 197,613	103,645	294,025
San Diego	42,072	42,072	38,324	38,699
San Joaquin	(1)	(1)	9,100	26,852
San Luis Obispo	9,200	11,500	8,120	10,150
Santa Barbara	6,844	6,844	7,538	7,538
Santa Clara	(1)	(1)	63,516	60,853
Sonoma	(1)	(1)	44,939	14,904
Stanislaus	1,143	4,000	(1)	(1)
Tulare	6,750	5,000	5,400	4,000
Undistributed [1]	1,538,981	3,211,787	1,301,098	2,717,181
Total	[2] 2,728,180	[2] 5,764,000	2,393,990	5,012,375

[1] Alameda, Amador, Calaveras, Contra Costa, Fresno, Inyo (1957), Marin, Placer, Sacramento, San Benito, San Joaquin (1957), San Mateo, Santa Clara (1957), Santa Cruz, Solano, Sonoma (1957), Stanislaus (1958), Sutter, Ventura, and Yuba Counties included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Excludes kaolin that cannot be revealed.

Diatomite.—Much of the diatomite production was obtained from open pits and an underground quarry in Santa Barbara County; however, substantial quantities were mined at open pits in Los Angeles and Napa Counties. The Napa County output was burned and ground for use in pozzolanic cement. Although more than half of the diatomite was consumed in preparing filter aids, large quantities were utilized as filler in paper and rubber products, as

lightweight aggregate, for insulation, as an extender in paints and fumigants, and in desiccants. Despite a slightly lower output compared with 1957, the average unit value was higher due to the relatively larger quantity of filter-grade material produced.

Feldspar.—The quantities of feldspathic sand and feldspar concentrate from dune sands in Monterey County that were sold and used for the feldspar content increased 5 percent above 1957. However, the output of crude feldspar at an open pit in San Bernardino County, custom-ground in Los Angeles County for ceramic and refractory use, dropped appreciably. The feldspathic sand and concentrate, some of which was ground to consumer specifications, was sold or used for manufacturing glass, sanitary ware, and various ceramic products.

Fluorspar.—Production was limited to a few tons of Acid-grade fluorspar produced from crude material mined near Nipton, San Bernardino County, and sold to the glass and chemical industries. Over 1,000 tons of low-grade fluorspar from this deposit was trucked to a nearby plant for beneficiation tests, but attempts to upgrade to commercial specifications were unsuccessful. Metallurgical-grade fluorspar used by industry was obtained from Nevada and Mexico.

Gem Stones.—Inspired by the activities of the many gem clubs and societies and the gem and mineral exhibitions, more field trips were made by gem collectors than in 1957. San Bernardino County continued to yield an abundance of gem material. Collectors gathered mostly agate and jasper in Calaveras, Kern, and Santa Clara Counties, tourmaline in San Diego County, obsidian in Modoc County, onyx in Napa County, and nephrite in Monterey County. Two nephrite boulders, weighing several thousand pounds but of inferior quality, were found by abalone divers in about 35 feet of water off northern San Luis Obispo County. Noteworthy quantities of other gem material reported collected included vesuvianite in Siskiyou County, thulite in Tulare County, and marcasite in San Luis Obispo County.

Gypsum.—Mine production of crude gypsum and gypsite increased 12 percent in quantity and 6 percent in value above that in 1957. The output was highest in the Nation and surpassed California's alltime high of 1956. The production of agricultural gypsum from Kern County deposits surpassed the output (tonnagewise) in Imperial County for the first time. A mobile unit [3] was used by one producer to mine and mill crude gypsum from its scattered deposits in Kern County. Twelve mines were active, five in Kern County and one each in Imperial, Kings, Merced, Riverside, San Luis Obispo, Santa Barbara, and Ventura Counties. A magnesia plant at Newark, Alameda County, recovered manufactured gypsum as a byproduct in treating salt-works bitterns. One major producer of gypsum products imported large tonnages of the crude mineral from Mexico. Over 50 percent of the total crude produced was sold uncalcined, of which about 85 percent went for agricultural use and the remainder was utilized as a cement retarder. Three companies operated two calcining plants each and produced plasters, wallboard, sheathing and lath. A comparatively small tonnage of calcined gypsum was consumed as brewer's fixe and as filler.

[3] Engineering and Mining Journal, vol. 160, No. 1, January 1959, p. 98.

Iodine.—Waste oil-well brines of the Los Angeles Basin were the source of crude iodine recovered in a chemical plant at Seal Beach, Orange County, and of various iodine compounds produced at a plant near Compton, Los Angeles County. The slight decline in quantity of equivalent crude iodine produced and the lower unit value, compared with 1957, were due primarily to competition from Chilean and Japanese production.

Iron Oxide Pigments.—In Alameda County California's only manufacturer of iron oxide pigments produced synthetic pigments by treating steel scrap with sulfuric acid and caustic soda, and a relatively small quantity of natural pigment from limonite from the company mine in Oregon. Although the tonnage of products sold was greater than in 1957, the average was less, due to a demand for lower quality pigments.

Lime.—Lime production declined 20 percent compared with 1957, owing almost entirely to decreased demand for lime by manufacturers of refractories, magnesia, and steel. The total output of building lime was over 20,000 tons, and agricultural lime was nearly 1,400 tons, virtually the same as in 1957. Monterey County was the leading lime-producing area. Kilns and hydrators were also operated in El Dorado, Tuolumne, and San Bernardino Counties.

Lithium Compounds.—Crude dilithium-sodium phosphate was recovered from Searles Lake brines, San Bernardino County. The crude mineral was refined to finished lithium carbonate and marketed as such. The company reduced the price of this product 6 cents a pound in carload lots effective January 1, 1958.

Magnesite and Magnesium Compounds.—A small tonnage of magnesite was mined near Livermore, Santa Clara County, and sold to two Alameda County manufacturers of magnesium carbonate and hydrous magnesium sulfate. Additional quantities of magnesite and some brucite were obtained from Nevada mines. California producers of magnesium compounds (from sea water and sea-water bitterns) supplied nearly 36 percent of the Nation's output, second only to production from Michigan. Plants in Monterey and San Mateo Counties extracted magnesium compounds from sea water, using limestone and dolomite. One company used dolomite to recover magnesium compounds from sea-water bittern, purchased from a salt producer, at its Alameda County plant and produced magnesium chloride directly from sea water at another plant in San Diego County. The total output of all compounds was virtually unchanged from 1957, but the average unit price was slightly lower. Magnesium chloride, magnesium trisilicate, and refractory magnesia had sales increases above 1957. All other compounds showed slight to moderate declines.

Mica.—Sericite schist was mined near Ogilby, Imperial County, by a producer who ground the mineral for use in roofing materials. At a plant in Los Nietos, Los Angeles County, imported scrap mica from India was ground and sold to paint manufacturers, and similar crude material from South Dakota was prepared for a shingle and roofing-paper producer.

Perlite.—The tonnages of crude perlite produced were virtually the same as in 1957 at the three deposits actively mined—one each in Inyo, Napa, and San Bernardino Counties. Inyo County crude was

expanded by the producer, sold to other California expanding plants, and shipped to consumers in Canada, Illinois, and Nevada. Perlite produced in Napa County was expanded by the producer at the quarry site. Crude perlite mined in San Bernardino County was shipped to various expanding plants in California. Expanded tonnages exceeded the quantities of crude produced, and consumer requirements were augmented by shipments of the crude mineral from Nevada and Arizona. Approximately 59 percent of the expanded production was consumed in building plaster, 15 percent in filter aid, 8 percent in soil conditioning, and 5 percent in concrete aggregate; the remaining 13 percent was sold for insulation, filler, and other uses.

Potassium Salts.—In comparison with 1957, the production of potassium compounds declined 10 percent, yet sales rose 12 percent and year-end stocks were reduced several thousand tons. However, the total value of sales was lower than in 1957, due to a general price reduction in July to meet competition from New Mexico and Utah producers. Except for a relatively minor quantity of cement-plant flue-dust accumulations from Santa Cruz County (sold to the fruit industry for soil improvement because of its potassium sulfate content) the total output of potassium compounds was made by one producer, who recovered muriate of potash from Searles Lake brines (San Bernardino County). The company also produced potassium sulfate from the muriate (potassium chloride).

Pumice, Pumicite, and Volcanic Cinder.—The lower yield of volcanic cinder in San Bernardino and Siskiyou Counties for use as railroad ballast and the suspension of a cinder aggregate operation in Inyo County resulted in a decreased total output of pumice, pumicite, and volcanic cinder compared with 1957. In 1958, 57 percent of the total was used for railroad ballast; 27 percent for concrete aggregate; 9 percent for scouring blocks, pesticides, insulation, and acoustic and patching plaster; 5 percent for road paving and fill; and 2 percent as an ingredient in various products. Some volcanic cinder from Lake County and pumice from Mono County were marketed for use as decorative stone in buildings and landscaping. Pumice from the Calsilco Claims in Kern County was prepared for use as abrasives, oil and grease absorbents, and in paint.

TABLE 9.—Pumice [1] sold or used in 1958, by counties

County	Crude		Prepared		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Fresno	431	$3,080			431	$3,080
Inyo	(2)	(2)	40,123	$189,950	(2)	(2)
Kern			925	38,541	925	38,541
Madera	(2)	(2)	7,641	104,295	(2)	(2)
Mono	(2)	(2)	19,269	391,307	(2)	(2)
San Bernardino	(2)	(2)	533	6,396	(2)	(2)
Shasta	4,547	8,367	(2)	(2)	(2)	(2)
Siskiyou	189,505	375,178	31,531	115,954	221,036	491,132
Other counties [3]	46,542	188,251	35,742	248,851	154,397	1,137,417
Total	241,025	574,876	135,764	1,095,294	376,789	1,670,170

[1] Includes pumicite and volcanic cinder.
[2] Imperial, Lake, Lassen, Modoc Counties and parts of Inyo, Madera, Mono, and San Bernardino Counties are included with "Other counties" to avoid disclosing individual company confidential data.

Pyrite.—The Hornet Mine, Shasta County, was the only pyrite producer. Production was slightly below that in 1957, but shipments dropped appreciably. Consumption was principally at two Contra Costa County sulfuric acid plants, although a few cars of pyrite were shipped to a Nevada copper-leaching plant, where the sulfur content was used to make sulfuric acid. The pyrite cinder produced at the California acid plants was sold to cement manufacturers for use as an additive in quick-setting cements.

Salt.—The quantity and value of California salt production declined, compared with 1957. More salt was produced by solar evaporation than in 1957, but a lower output of rock salt and that produced by other evaporative methods more than offset the increase. Approximately 78 percent of the output was obtained from sea water by solar evaporation; more than half was extracted at plants in the San Francisco Bay area. The major producer operated a plant at Newark, Alameda County, on crude salt from ponds in Alameda and San Mateo Counties and supplied crude salt to an adjacent plant operated by another salt company. The resulting bitterns were sold to a magnesia producer. The company expects to have a salt plant in operation in Napa County late in 1959. Crude salt was to be obtained from nearby ponds and others in Solano County. Producers in Kern and San Bernardino Counties recovered salt from dry-lake brines. Open pits in San Bernardino County near Saltus yielded the State's only rock-salt (halite) production, sold to consumers in California, Arizona, and Nevada. Over half of the evaporated-salt production was consumed in California; however, shipments were made to six States (including Alaska), the Pacific Island possessions, and exported to 10 foreign countries.

Sand and Gravel.—The gain in the quantity and value of sand and gravel production over 1957 was attributable to the output of paving gravel, which rose from 24 million tons in 1957 to 32 million in 1958. This gain was possible through preparations by State and county highway agencies, who made immediate use of antirecession funds appropriated in April under the Federal Highway Act. As a result, many sections of freeways and access roads were put under actual construction as soon as the funds were available. Contributing to a smaller extent to the high sand and gravel output were the requirements for streets in new residential areas, com-

TABLE 10.—Sand and gravel sold or used by producers

Year	Sand		Gravel		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1949–53 (average)	18,860	$16,743	28,456	$24,034	47,316	$40,777
1954	25,095	25,656	45,430	42,483	70,525	68,139
1955	25,507	26,857	39,372	39,963	64,879	66,820
1956	30,564	35,492	55,883	61,034	86,447	96,526
1957	[1] 32,789	34,134	46,194	52,896	[1] 78,983	87,030
1958	30,810	34,710	53,327	60,630	84,137	95,340

[1] Revised figure.

mercial and residential construction, and flood control and military projects that made heavy demands on commercial pits, in addition to the production by crews and contractors of Government agencies. The output of specialty sands for the glass industry and for various filter uses, also increased above 1957, although requirements for molding, blast, and engine sands declined.

Sodium Compounds.—The quantity and value of sodium compounds produced declined 6 and 7 percent, respectively, from 1957, reflecting a decline in chemical industry activity. Lower soda-ash production was responsible for the drop, as the total sulfate output showed little or no change. A lower output of salt cake was offset by the yield of anhydrous sodium sulfate, which had not been produced in 1957. The sodium carbonates produced (soda ash and trona) were recovered from dry-lake brines of Inyo and San Bernardino Counties. The latter also yielded salt cake and Glauber's salt. Smaller quantities of salt cake and anhydrous sodium sulfate

TABLE 11.—Sand and gravel sold or used by producers, by commercial and Government-and-contractor operations and by uses

Use	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Glass	409	$1,694	453	$1,917
Molding	[1] 80	187	[2]	[2]
Building	15,394	17,585	15,602	18,061
Paving	6,573	6,666	7,622	7,448
Blast	201	700	187	564
Engine	101	209	85	166
Filter	62	58	164	76
Other	3,699	3,218	3,941	3,833
Total	[1] 26,519	30,317	28,054	32,065
Gravel:				
Building	16,062	20,607	17,641	24,144
Paving	14,236	16,956	18,705	20,875
Railroad ballast	[2]	[2]	224	223
Other	4,077	4,404	3,588	3,501
Total	34,375	41,967	40,158	48,743
Total sand and gravel	[1] 60,894	72,284	68,212	80,808
GOVERNMENT-AND-CONTRACTOR OPERATIONS [3]				
Sand:				
Building	1,114	759	9	15
Paving	5,156	3,059	2,747	2,630
Total	6,270	3,818	2,756	2,645
Gravel:				
Building	1,964	1,809	25	32
Paving	9,855	9,119	13,144	11,855
Total	11,819	10,928	13,169	11,887
Total sand and gravel	18,089	14,746	15,925	14,532
ALL OPERATIONS				
Sand	[1] 32,789	34,135	30,810	34,710
Gravel	46,194	52,895	53,327	60,630
Grand total	[1] 78,983	87,030	84,137	95,340

[1] Revised figure.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[3] Includes figures for States, counties, municipalities, and other Government agencies.

TABLE 12.—Production of sand and gravel in 1958, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Alameda	8,647	$12,246	Placer	734	$672
Alpine	28	42	Plumas	1,385	1,738
Amador	204	665	Riverside	1,573	2,152
Butte	1,016	947	Sacramento	5,126	7,104
Calaveras	117	452	San Benito	112	86
Colusa	102	77	San Bernardino	6,796	6,057
Contra Costa	241	493	San Diego	4,860	6,923
Del Norte	433	404	San Joaquin	2,084	2,830
El Dorado	228	217	San Luis Obispo	642	740
Fresno	923	1,332	San Mateo	91	58
Glenn	340	231	Santa Barbara	876	1,194
Humboldt	1,361	1,299	Santa Clara	2,052	1,807
Imperial	452	318	Santa Cruz	660	849
Inyo	337	277	Shasta	483	755
Kern	1,539	2,067	Sierra	34	20
Kings	245	123	Siskiyou	282	464
Lake	551	[415	Solano	176	186
Lassen	165	151	Sonoma	1,691	1,746
Los Angeles	20,235	19,848	Stanislaus	671	707
Madera	586	515	Sutter	126	76
Marin	169	143	Tehama	227	278
Mariposa	214	275	Trinity	[81	115
Mendocino	573	708	Tuolumne	[81	103
Merced	1,407	835	Ventura	2,168	2,789
Modoc	334	240	Yolo	1,807	1,928
Mono	114	113	Yuba	1,126	1,535
Monterey	412	1,104	Other counties [1]	541	689
Napa	135	129			
Nevada	962	917	Total	84,137	95,340
Orange	5,582	5,156			

[1] Includes San Francisco and Tulare Counties, combined to avoid disclosing individual company confidential data.

were produced from crude borates mined in Kern County and at refineries in Kern and Los Angeles Counties, respectively. The sodium sesquicarbonate section of facilities being expanded at Bartlett, Inyo County, was in capacity operation by yearend.

Stone.—The drop in stone production (from 41.3 million tons in 1957 to 32.4 million tons in 1958) marked completion of several major freeway links in areas near sources of granite, basalt, and sandstone. Another factor that contributed to the decline was completion of those segments of construction at hydroelectric projects in Fresno County that had required large tonnages of crushed and broken stone for fill. The output of stone used for riprap increased nearly 3 million tons over 1957 owing to requirements at the Trinity Dam, Trinity County, and Riverside County Levee project. The quantities of stone quarried and used for breakwater in coast counties accounted for the increased output of dimension stone, which more than offset a substantial drop in production of architectural stone for building construction. Dolomite produced for refractory use and limestone quarried for use in manufacturing cement and lime and in sugar refining declined below 1957; however, the limestone output marketed for metallurgical flux, glass manufacture, whiting, and asphalt filler increased somewhat. The combined quantity of natural and artificially colored roofing granules produced was greater than in 1957.

Slate.—Slate production increased substantially, following a decline in 1957 during which there was a change in ownership of the Chili Bar quarry and plant, El Dorado County. The plant produced roofing granules and slate flour, for which there was a good demand

throughout 1958. The only other active slate operation was the Agua Fria quarry, Mariposa County, where slate used for flagging and building stone was produced.

TABLE 13.—Stone sold or used by producers, by uses

Use	1957		1958	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble, short tons	42,212	$769,620	48,560	$628,481
Rough architectural, cubic feet	[1] 52,986	[1] 513,930	[2] 72,582	[2] 443,630
Approximate equivalent in short tons	4,655		6,078	
Monuments and mausoleums, cubic feet	66,394	612,019	[3]	[3]
Approximate equivalent in short tons	5,725		[3]	
Flagging, cubic feet	9,381	20,762	11,636	30,911
Approximate equivalent in short tons	796		1,160	
Total dimension stone (quantities approximate, in short tons)	53,388	1,916,331	55,798	1,103,022
Crushed and broken stone:				
Riprap, short tons	1,499,225	2,683,401	4,535,718	6,041,468
Metallurgical, do	298,294	898,458	[4]	[4]
Concrete and roadstone, do	15,467,253	17,786,122	10,248,237	12,871,300
Railroad ballast, do	172,409	184,870	105,802	115,327
Agricultural, do	1,301	6,638	[4]	[4]
Chemical, do	17,209	57,877	12,467	41,426
Miscellaneous [5], do	[6] 23,842,180	[6] 30,057,392	[7] 17,465,277	[7] 28,172,952
Total crushed and broken stone, do	41,297,871	51,674,758	32,367,501	47,242,473
Grand total (quantities approximate, in short tons)	41,351,259	53,591,089	32,423,299	48,345,495

[1] Includes dressed architectural stone.
[2] Includes dressed architectural, and rough and dressed monumental stone.
[3] Included with "Rough architectural" to avoid disclosing individual company confidential data.
[4] Included with "Miscellaneous" to avoid disclosing individual company confidential data.
[5] Includes whiting substitute, filler, mineral food, poultry grit, stucco, roofing granules, filter beds, terrazzo, metallurgical (1958), agricultural (1958), and miscellaneous uses.
[6] Includes 11,165,200 short tons of limestone and oystershell used in cement valued at $14,685,783 and 695,632 tons of limestone used in lime valued at $1,803,409.
[7] Includes 11,794,819 short tons of limestone and oystershell used in cement valued at $14,949,555 and 557,088 tons of limestone used in lime valued at $1,471,946.

TABLE 14.—Production of stone,[1] 1958, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Alameda	959	$680	Placer	12	[3]
Alpine	[2]	1	Plumas	569	$427
Amador	55	87	Riverside	1,331	3,996
Butte	[2]	[2]	San Bernardino	4,526	7,829
Contra Costa	1,949	2,685	San Diego	824	1,675
Del Norte	54	32	San Luis Obispo	242	736
El Dorado	425	1,081	San Mateo	2,525	3,042
Fresno	526	631	Santa Barbara	36	125
Humboldt	140	114	Santa Clara	3,911	4,469
Imperial	22	22	Santa Cruz	1,010	965
Inyo	459	639	Shasta	91	136
Lassen	[2]	2	Siskiyou	150	223
Los Angeles	1,965	3,280	Solano	188	233
Madera	54	156	Trinity	2,467	2,106
Marin	1,076	1,554	Tulare	20	39
Mariposa	16	110	Ventura	342	524
Mendocino	232	464	Yuba	16	26
Monterey	532	1,429	Other counties [3]	5,361	8,376
Orange	338	451	Total	32,423	48,345

[1] Includes stone used in cement and lime.
[2] Less than 1,000.
[3] Includes Calaveras, Kern, Napa, Nevada, San Benito, San Francisco, Sierra, Sonoma, Stanislaus, Tuolumne, and part of Placer County, combined to avoid disclosing individual confidential data.

TABLE 15.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value
1954	3,012,041	$3,480,586	2,129,545	$2,786,035	[2] 11,044,061	[2] $21,434,189
1955	2,724,342	3,420,057	1,923,351	2,547,821	[3] 12,472,285	[3] 21,075,656
1956	3,899,350	5,155,292	1,966,581	2,339,318	[4] 14,115,070	[4] 22,118,105
1957	12,744,413	10,564,922	1,952,417	2,431,926	[5] 14,102,264	[5] 22,511,933
1958	3,649,390	5,347,679	1,498,912	1,738,570	[6] 14,408,695	[6] 22,583,791

Year	Sandstone		Other stone [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1954	2,703,599	$3,723,255	4,414,510	$6,117,049	23,303,756	$37,541,114
1955	2,937,537	4,886,507	4,650,806	5,234,343	24,708,321	37,164,384
1956	2,917,916	4,833,877	9,684,453	11,662,060	32,583,370	46,108,652
1957	4,222,211	6,679,968	8,329,954	11,402,340	41,351,259	53,591,089
1958	3,933,245	5,687,984	8,933,057	12,987,471	32,423,299	48,345,495

[1] Includes light-color volcanics, schist, serpentine, river boulders, and such other stone as cannot properly be classed in any main group; also marble (1954–58) and slate (1958).
[2] Includes 9,567,191 tons of limestone and oystershell valued at $17,229,547 used in cement and lime.
[3] Includes 10,977,552 tons of limestone and oystershell valued at $16,431,434 used in cement and lime.
[4] Includes 12,259,540 tons of limestone and oystershell valued at $17,354,910 used in cement and lime.
[5] Includes 11,860,832 tons of limestone and oystershell valued at $16,489,192 used in cement and lime.
[6] Includes 12,351,907 tons of limestone and oystershell valued at $16,421,501 used in cement and lime.

Strontium Minerals.—Activity at celestite deposits was limited to development at a property near Ludlow, San Bernardino County.

Sulfur.—Byproduct industrial gases yielded a sulfur equivalent nearly 5 percent greater in quantity and approximately 8 percent higher in value than in 1957. Although the increase and a major portion of the output were derived from gases at 11 oil refineries in the State, a small part of the recovery was sulfur dioxide from stack gas at the Selby smelter, Contra Costa County, where the yield dropped slightly below 1957. Four of the oil refineries converted hydrogen sulfide to molten sulfur, while the others delivered the gas by pipeline to nearby chemical plants for manufacturing sulfuric acid or elemental sulfur. About two-thirds of the recovered sulfur came from refineries in the Los Angeles Basin.

The production rise of refinery byproduct sulfur, despite a 6-percent drop in refinery crude throughput, resulted from several factors, including: Improved sulfur-recovery efficiency through increased attention to sources of air pollution; greater utilization of high-sulfur crude oils, which constitute a large portion of the California oil reserves; and continued rise in reforming and catalytic desulfurization capacity created by the need for improved gasoline quality.

Most sulfur-ore shipments originated at the Leviathan mine, Alpine County. The crude ore was transported to Nevada for manufacturing sulfuric acid used in a copper-leaching operation. The total shipped was somewhat lower than in 1957. Small quantities of sulfur ore used as a soil aid were mined and shipped from the Crater deposit, Inyo County, and the Sulphur Bank mine, Lake County. Nearly four times more sulfur was shipped than in 1957.

Talc, Soapstone, and Pyrophyllite.—The total quantity of these minerals mined in 1958 increased over 1957, however, the value de-

creased. Direct shipments to consumers increased appreciably while those made to grinders declined slightly. Talc production was entirely from Inyo and San Bernardino Counties. Two mines, one each in El Dorado and Los Angeles Counties, produced soapstone. Pyrophyllite was obtained from one deposit in San Bernardino County, two in Mono County, and three in San Diego County. The total tonnages ground were only slightly under 1957. Demand increased for such uses as insecticides, paper, rice polishing, roofing, and textiles, but declined for other reported uses. Of the three minerals produced, only talc was exported, and the quantity of ground talc shipped for export was several times that in 1957.

Vermiculite.—A crude vermiculite prospect in San Diego County was abandoned, and activity at a property in Tulare County was confined to exploration and development. An Orange County plant exfoliated imported crude vermiculite and crude mineral mined in Montana was exfoliated at plants in Sacramento and Los Angeles Counties.

Wollastonite.—A new plant was constructed at Blythe for manufacturing spun fiber for rock-wool insulation, utilizing wollastonite from the Little Maria Mountains, Riverside County.[4] The wollastonite float gathered in the area during 1958 was sold primarily for use in decorative landscaping and as both interior and exterior building stone.

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Chromium.—As a result of cessation of the domestic purchase program for chromite on May 19, 1958, production and shipments of ore and concentrate declined 41 percent below 1957. Four mines supplied 81 percent of the output; three in San Luis Obispo County and one in Fresno County. Although some exploration and development were done during the latter half of the year, all activity at chromite mines had ceased by yearend, and a few producers still had stocks of ore and concentrate on hand, for which there was no market. The chromite output came from 63 mines and prospects in 19 counties compared with 120 properties and 23 counties in 1957. Mines that yielded ore in Alameda, Mendocino, Plumas, and Stanislaus Counties during 1957 were idle in 1958. Sixty-five percent of all shipments in 1958, compared with 56 percent in 1957, consisted of concentrate containing over 45 percent Cr_2O_3.

Copper.—Copper output dropped sharply from the 10-year high in 1957 owing principally to a lower average unit price. Most of the copper was a byproduct of tungsten ores mined in the Pine Creek area, Inyo County. The remaining copper output was obtained largely from copper ores mined in Humboldt, Calaveras, San Bernardino, Shasta, and Siskiyou Counties. Smaller quantities were recovered from lead, gold, and silver ores produced in Inyo, Mono, Nevada, and Yuba Counties.

Five exploration contracts for ores of copper were in effect during all or part of 1958 under the DMEA program. The contract for copper-nickel-cobalt ore, San Diego County, was terminated in April, and one contract for copper-zinc ore in Shasta County was terminated in June.

[4] Rock Products, vol. 61, No. 8, August 1958, pp. 80–81.

Gold.—Gold output increased 8 percent above 1957 owing to greater production at dredges. Seventy-five percent of the total output was produced at placers, compared with 71 percent in 1957, of which 98 percent was recovered by bucketline dredges in Sacramento, Trinity, and Yuba Counties. In addition to the 65 active placer mines worked in 16 counties, placer gold was recovered from numerous prospects, several reworked tailing piles and mine dumps, and at six sand and gravel preparation plants.

Only six lode mines (one of these a cleanup operation at a mine in Nevada County) produced more than 1,000 ounces of gold. Less than 141,000 tons of ore was mined from 107 lode mines in 22

TABLE 16.—Mine production of gold, silver, copper, lead, and zinc in 1958, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value	Troy ounces	Value
Amador	(2)	2	42	$1,470	11	$10
Butte		(2)	27	945	3	3
Calaveras	6	5	124	4,340	80	73
Del Norte		2	6	210		
El Dorado	2	2	6,681	233,835	2,858	2,587
Inyo	13		227	7,945	(3)	(3)
Los Angeles	1	(2)	88	3,080	14	13
Madera	(2)	1	14	490	3	3
Mariposa	11	(2)	586	20,510	172	156
Mono	4		(3)	(3)	3,420	3,095
Placer	1	12	326	11,410	30	27
Plumas	2	3	73	2,555	(3)	(3)
Riverside	1		7	245	2	2
San Bernardino	11	(2)	102	3,570	5,485	4,965
Shasta	6	2	512	17,920	116	105
Sierra	9	5	17,395	608,825	3,425	3,100
Siskiyou	6	5	12,323	431,305	33,778	30,570
Trinity	2	10	1,485	51,975	170	153
Undistributed [4]	32	16	145,367	5,087,845	138,693	125,523
Total	107	65	185,385	6,488,475	188,260	170,385

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Amador							$1,480
Butte							948
Calaveras	(3)	(3)	(3)	(3)	100	$10	4,423
Del Norte							210
El Dorado			29,800	$3,487	13,900	1,418	241,327
Inyo	(3)	(3)	(3)	(3)	(3)	(3)	7,945
Los Angeles							3,093
Madera							493
Mariposa							20,666
Mono	100	$26	(3)	(3)	(3)	(3)	3,121
Placer							11,437
Plumas			(3)	(3)	(3)	(3)	2,555
Riverside							247
San Bernardino	21,700	5,707	(3)	(3)	(3)	(3)	14,242
Shasta	(3)	(3)					18,025
Sierra					1,100	112	612,037
Siskiyou	(3)	(3)					461,875
Trinity							52,128
Undistributed [4]	1,476,200	388,241	250,200	29,273	86,900	8,864	5,639,746
Total	1,498,000	393,974	280,000	32,760	102,000	10,404	7,095,998

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] From property not classed as a mine.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Includes Fresno, Humboldt, Imperial, Kern, Nevada, Sacramento, San Diego, Stanislaus, Tuolumne, and Yuba Counties combined to avoid disclosing individual company confidential data.

counties, yielding a little over 47,000 ounces of gold. Classified by ore type, 84 were gold mines, 6 silver, 7 copper, 9 lead, and 1 tungsten. Gold recovered as bullion from amalgamation and cyanidation comprised 57 and 26 percent, respectively, of the total yield, and gold from smelting concentrates and ores 16 and 1 percent. The United States Mint in San Francisco was the principal depository for gold and silver production; however, a gold refinery operated in conjunction with the lead smelter at Selby, Contra Costa County, received shipments of bullion, as did several banks and various bullion buyers.

TABLE 17.—Gold production at placer mines, by classes of mines and methods of recovery [1]

Class and method	Mines producing [2]	Washing plants (dredges)	Material treated (thousand cubic yards)	Gold recovered, troy ounces
Surface placers:				
Gravel mechanically handled:				
Dredges:				
1949–53 (average)	37	46	68,104	185,038
1954	15	27	45,094	135,615
1955	15	23	40,944	143,183
1956	12	19	36,709	131,529
1957	7	13	31,304	118,591
1958	11	15	27,598	136,021
Nonfloating washing plants: [3 4]				
1949–53 (average)	23	23	65	2,312
1954	24	24	9	2,298
1955	18	18	80	1,865
1956	18	22	2	1,624
1957	4	21	12	1,549
1958	4	15	1	872
Gravel hydraulically handled:				
1949–53 (average)	19	----------	231	875
1954	8	----------	44	235
1955	7	----------	116	230
1956	6	----------	9	101
1957	6	----------	11	85
1958	6	----------	7	166
Small-scale hand method: [5]				
1949–53 (average)	54	----------	104	1,997
1954	46	----------	120	1,802
1955	28	----------	94	1,182
1956	26	----------	79	1,029
1957	32	----------	36	1,283
1958 [6]	39	----------	49	1,177
Underground placers:				
Drift:				
1949–53 (average)	13	----------	4	211
1954	17	----------	6	247
1955	14	----------	5	153
1956	11	----------	4	164
1957	6	----------	3	109
1958	5	----------	(7)	27
Grand total placers:				
1949–53 (average)	146	----------	68,508	190,433
1954	110	----------	45,273	140,197
1955	82	----------	41,239	146,613
1956	73	----------	36,803	134,447
1957	55	----------	31,366	121,617
1958	65	----------	27,655	138,263
1848–1958	----------	----------	(8)	67,764,189

[1] For historical 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 commercial rock plants and tungsten mines that produced byproduct gold from gravels; byproduct gold is included with gold recovered.
[4] Includes all placer operations using power excavator and washing plants both on dry land; when the washing plant is a movable outfit, it 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] Includes gold recovered by electrostatic separation; combined to avoid disclosing individual company confidential data.
[7] Less than a thousand cubic yards.
[8] Complete data not available.

TABLE 18.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing [2]		Material sold or treated [3] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
1949–53 (average)	190	146	471	332,370	$11,633	1,027,409	$930
1954	131	110	232	237,886	8,326	309,575	280
1955	130	82	305	251,737	8,811	954,181	863
1956	116	73	281	193,816	6,784	938,139	849
1957	118	55	204	170,885	5,981	522,288	472
1958	107	65	139	185,385	6,489	188,260	170
1848–1958			[4]	105,435,664	2,392,352	118,571,790	96,528

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1949–53 (average)	680	$315	11,996	$3,649	7,828	$2,357	$18,884
1954	362	213	2,671	732	1,415	306	9,857
1955	613	457	8,265	2,463	6,836	1,682	14,276
1956	859	730	9,296	2,919	8,049	2,205	13,487
1957	945	569	3,458	989	2,969	689	8,700
1958	749	394	140	33	51	10	7,096
848–1958	635,638	206,454	262,651	52,186	149,406	35,264	2,782,784

[1] Includes recoverable metal content of gravel washed (placer operations); ore milled; old tailings or slimes retreated; tungsten ore; and ore, old tailings, slag, flue dust, and pyritic ore residue shipped to smelters during calendar year indicated.
[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[3] Does not include gravel washed.
[4] Figure not available.

TABLE 19.—Mine production of gold, silver, copper, lead, and zinc in 1958, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed, and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation:					
Ore	[1] 26,778	4,505	----	----	----
Old tailings	40	7	----	----	----
Total	26,818	4,512	----	----	----
Cyanidation: Ore	12,057	35,012	----	----	----
Total	12,057	35,012	----	----	----
Total recoverable in bullion	38,875	39,524	----	----	----
Concentration and smelting of concentrates:					
Ore [2] [3]	7,698	124,411	1,402,100	43,500	15,100
Old tailings	23	5	----	----	----
Total	7,721	124,416	1,402,100	43,500	15,100
Direct smelting:					
Ore and copper precipitates [3]	503	17,023	95,900	236,500	86,900
Old tailings	23	17	----	----	----
Total	526	17,040	95,900	236,500	86,900
Placer	138,263	7,280	----	----	----
Grand total	185,385	188,260	1,498,000	280,000	102,000

[1] Includes gold recovered as "natural gold."
[2] Includes tungsten-ore concentrate.
[3] Combined to avoid disclosing individual company confidential data.

TABLE 20.—Mine production of gold, silver, copper, lead, and zinc in 1958, by classes of ore or other source materials in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Gold	84	132,548	46,497	46,098	1,000	30,100	15,200
Silver	6	322	46	5,515	300	8,400	9,000
Copper and tungsten ore and copper precipitates [2]	8	[3] 4,332	463	119,017	1,480,800	32,700	----------
Lead	9	1,643	30	10,321	15,900	208,800	77,800
Total	107	138,845	47,036	180,951	1,498,000	280,000	102,000
Other "lode" material: Old tailings	([4])	2,105	86	29	----------	----------	----------
Total	----------	2,105	86	29	----------	----------	----------
Total "lode" material	107	140,950	47,122	180,980	1,498,000	280,000	102,000
Gravel (placer operations)	65	([5])	138,263	7,280	----------	----------	----------
Total all sources	172	----------	185,385	188,260	1,498,000	280,000	102,000

[1] Detail will not necessarily add to total, because some mines produce more than 1 class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Tungsten-ore tonnage not included.
[4] From property not classed as a mine.
[5] 27,654,940 cubic yards. Does not include material washed at commercial gravel plants to produce 860 ounces of byproduct gold and 99 ounces of byproduct silver included in placer totals.

Iron Ore.—The output of usable iron ore declined 26 percent below 1957 figures. Production of direct-shipping ore dropped to 11 percent of the 1957 tonnage, while shipments of concentrate increased 73 percent. Only two iron mines were active. The Eagle Mountain open-pit mine, Riverside County, yielded direct-shipping ore, but a high percentage of the mine output was beneficiated by magnetic separation, jigging, and heavy-media concentration. All ore mined at the Iron Age open-pit and underground operations, San Bernardino County, was upgraded using magnetic separators and hand sorting. Although shipments were consigned principally to the blast furnaces at Fontana, San Bernardino County, some usable iron ore was sold for use as a cement additive and for export. Exports were appreciably lower than in 1957. The port of Stockton received 433,444 tons of iron ore and concentrate from Nevada mines for export in 1958 as compared with 728,455 tons in 1957.

Iron and Steel.—Late in 1958 the western steel market began to show a sharp increase in demand that followed a year of appreciable decline. The primary reason for the decline had been a national business recession that decreased consumption. As a result, pig-iron production dropped 14 percent. Production of steel ingots and steel used for castings decreased 17 percent (from 3,059,638 tons in 1957 to 2,535,686 tons in 1958). Three blast furnaces at Fontana supplied all the pig iron produced. A fourth furnace was completed but not fired. Some pig iron was received from Geneva, Utah, for open-hearth furnaces at Pittsburg, Contra Costa County, and Torrance, Los Angeles County. Fontana and Geneva pig iron also was sold to numerous foundries throughout the State. Steel production was supplied by 39 furnaces at nine plants. The 29 open-hearth furnaces

were at Fontana (9), Pittsburg (5), South San Francisco (5), Torrance (4), Emeryville (3), and Niles (3). Los Angeles had four electric furnaces and Torrence three. At Fontana three new oxygen furnaces were completed and had limited production before the yearend.

TABLE 21.—Consumption of ferrous scrap and pig iron in thousand short tons

Year	Total scrap used	Pig iron used	Year	Total scrap used	Pig iron used
1949–53 (average)	2,345	1,081	1956	2,789	1,431
1954	2,185	1,001	1957	2,656	1,437
1955	2,778	1,223	1958	2,127	1,280

TABLE 22.—Consumption of ferrous scrap and pig iron, by types of furnaces and miscellaneous uses, in thousand short tons

Ferrous scrap and pig iron charged to—	1957	1958	Ferrous scrap and pig iron charged to—	1957	1958
Steel furnaces: [1]			Miscellaneous uses: [3]		
Scrap	2,259	1,763	Scrap	38	39
Pig iron	1,268	1,119	Total scrap	2,656	2,127
Total	3,527	2,882	Total pig iron	1,437	1,280
Iron furnaces: [2]			Grand total	4,093	3,407
Scrap	359	325			
Pig iron	169	161			
Total	528	486			

[1] Includes open-hearth, electric furnaces, and basic oxygen process.
[2] Includes cupola, air, and blast furnaces; also direct castings.
[3] Includes rerolling, copper precipitation, nonferrous, and chemical uses.

Iron and Steel Scrap.—Ferrous scrap consumption dropped 20 percent from 1957, approximating the 17-percent decrease in production of steel ingots and steel used for castings by the State's nine steel plants. Consumer stocks rose 40 percent, and scrap purchases were only 61 percent of consumption. California's iron and steel foundries used only 21 percent of the total scrap consumption. Although small in comparison to scrap needs, rail shipments into the State were 78 percent of those to out-of-State markets, an indication that California was self-sufficient in ferrous scrap in a year when iron and steel plants operated below capacity.

Lead.—Mine production of lead dropped 96 percent from 1957 to the lowest quantity reported since 1905. The primary reason for the decline was the drastically curtailed activity at lead and lead-zinc mines begun early in 1957 as a result of lower prices. Nearly 75 percent of the lead production was derived from ores produced at nine lead mines, principally the Santa Rosa mine, Inyo County.

California's only primary lead smelter, at Selby, Contra Costa County, reduced lead ores and concentrates from foreign and domestic sources. Also in the same county a tetraethyl lead plant at Pittsburg was completed and produced during the latter half of 1958.

Manganese.—Shipments of Metallurgical-grade manganese ore and concentrates increased 163 percent and decreased 23 percent, re-

spectively, compared with 1957. Ores comprised 86 percent of total shipments. Nearly 91 percent of all manganese ores and concentrates produced and shipped was from deposits in Imperial and Riverside Counties. Humboldt, Lake, Plumas, and Sonoma Counties each had only one active property from which one or more shipments of manganese ore were made. The State's entire output was shipped out of the State under the Government carlot program. One new exploratory contract for manganese ore, in Riverside County, was executed in January under the DMEA program and was in effect throughout the year.

Mercury.—California supplied 59 percent of the U.S. mercury output. The yield was the highest since 1944, despite a lower average open-market price, but probably was stimulated by the impending expiration on December 31, 1958, of the domestic purchase program under the Defense Production Act. The quantity and value of the total output increased 35 and 26 percent, respectively, over 1957. Mercury shipments were 44 percent higher and end stocks 42 percent lower than in the preceding year. Mines and prospects in 16 counties contributed to output, but 86 percent of the mercury produced and shipped was derived from four mines—one each in Lake, San Benito, San Luis Obispo, and Sonoma Counties—the only properties with yields exceeding 1,000 flasks each.

TABLE 23.—Mercury produced, by methods of recovery

Year	Furnaced [1]		Retorted		Unclassified [2]	Total		Operating mines
	Ore (short tons)	76-pound flasks	Ore (short tons)	76-pound flasks	76-pound flasks	76-pound flasks	Value [3]	
1949–53 (average)	60,479	5,406	994	285	141	5,831	$960,915	22
1954	110,445	10,525	10,100	724	13	11,262	2,977,560	35
1955	122,937	8,671	5,982	1,077	127	9,875	2,867,206	49
1956	76,801	6,991	9,312	1,971	55	9,017	2,343,699	71
1957	115,134	13,722	10,806	2,228	561	16,511	4,077,887	57
1958	130,560	20,307	10,471	1,594	464	22,365	5,122,927	48

[1] Includes ore and mercury from dumps not separable.
[2] Includes mercury recovered from miscellaneous dump material, placer, and cleanup operations.
[3] Value calculated at average price at New York.

Molybdenum.—Molybdenum sulfide and oxide concentrates were recovered in treating tungsten ores mined in the Pine Creek area, Inyo County. The ores were selectively mined for high molybdenum content. The concentrates were exported.

Nonferrous Metal Scrap.—About 300 million pounds of nonferrous metal scrap was consumed, roughly 6 percent of the 1958 quantity. Of the total, 40 percent by weight was lead scrap, 27 percent copper, 18 percent aluminum, 13 percent zinc, and 2 percent magnesium, nickel, and tin. Plants in the Los Angeles area used about 80 percent of the lead and copper, 98 percent of the aluminum, and 88 percent of the zinc. Approximately 90,000 tons of nonferrous scrap was moved out of State by rail, and 7,500 tons came into the State.

Platinum.—A relatively small quantity of platinum was recovered as a byproduct of gold dredging from the Yuba River area, Yuba County. The quantity and value of the recovered metal were 26 and 46 percent lower than in 1957.

Rare-Earth Minerals.—A fluocarbonate concentrate of the cerium-group metals was recovered from barite-carbonate ore mined at Mountain Pass in the Mescal Range, San Bernardino County, by flotation, leaching, and roasting to produce a concentrate containing 68 percent rare-earth oxides. Although the tonnage shipped to an eastern plant for further treatment and extraction of the rare-earth elements was appreciably greater than in 1957, the value was much less owing to the lower average grade.

Silver.—Silver output, recovered primarily as a byproduct of other metals, dropped 64 percent below 1957. The principal reason for the decline was drastically curtailed activity at lead-zinc mines. Over half the silver output was produced in Inyo County, mostly from tungsten ores mined in the Bishop area. Gold ores supplied about 25 percent, lead ores 6 percent, and silver and copper ores the remainder of the total lode silver recovered. Approximately 96 percent of the total silver recovered was derived from ores of lode mines and 4 percent from placer mines.

Tungsten.—Production and shipments of tungsten concentrate were limited to the Pine Creek mine and mill operations, Inyo County, the only major domestic tungsten producer still active at yearend. Despite production inactivity, two exploration contracts for tungsten ore under the DMEA program were active throughout the year, both in Inyo County.

Uranium.—Uranium ore was shipped from five properties, two in Riverside County and one each in Kern, San Bernardino, and Sierra Counties. Two producers shipped to a processing plant in Salt Lake City, Utah, and two to a plant in Tuba City, Ariz. The other producer shipped to a Grants, N. Mex., processor but received no payment, as the ore was too low grade. The total tonnage shipped was more than three times the 1957 figure and had a slightly higher average U_3O_8 content. Values were also higher in 1958 by $1.70 a ton f.o.b. mine.

Zinc.—Recoverable zinc output (the lowest since 1939) declined 98 percent compared with 1957. The greatly curtailed activity at mines yielding recoverable zinc began early in 1957. Most of the major producers had closed down their operations before January 1958. Lower prices for zinc metal caused these mines to remain closed and drastically reduced production at others. Over 83 percent of the recoverable zinc output came from ores mined in Inyo County—principally the Santa Rosa mine. A high percentage of the remaining zinc production was recovered from the gold ore of the Hazel Creek mine, El Dorado County.

Other Metals.—Work at cobalt-nickel prospects included the following: A small-scale churn-drilling program was conducted at a property in the Smith River area, Del Norte County; roads to two mine sites in Plaster City area, Imperial County, were improved and ore samples taken for assay; and exploration was done at the Friday mine near Julian, San Diego County.

In Placer County testing and drilling at a prospect near Lincoln yielded some zircon concentrate which was not sold; at an underground placer-gold operation near Rocklin the zircon fraction of the sand was stockpiled.

REVIEW BY COUNTIES

Alameda.—Sand and gravel production, chiefly from pits in the Pleasanton, Niles, and Fremont areas, increased 1 million tons above 1957; it was used principally to meet aggregate requirements for the Nimitz Freeway in southern Alameda County. Smaller tonnages were produced for building construction and railroad ballast. Quarries in the Oakland, San Leandro, Niles, and Hayward areas yielded stone crushed for macadam and fill. A basalt quarry near Oakland was the source of stone used for riprap and railroad ballast. Miscellaneous clay was dug from pits near Niles and used in manufacturing building brick and other heavy clay products. Fire clay was mined underground near Livermore for foundry use.

Crude salt was recovered from sea water by solar evaporation from more than 20,000 acres of ponds at three plants in the county. The State's major producer refined the crude salt at Newark and sold the crude to a refining plant on adjacent property. Nearly 50 percent of the salt sold was used in making chlorine. A former producer at Mount Eden closed his plant and reported no production for 1958. Salt-work bitterns from the Newark plants were sold to a nearby chemical plant and processed, yielding magnesia, synthetic gypsum, and byproduct ethylene dibromide.

Open-hearth steel furnaces were in production at Emeryville and Niles, using iron and steel scrap as a source of metal. At the latter site a used blast furnace was being installed and was expected to be in operation in 1959. An Emeryville plant was California's only manufacturer of iron oxide pigments. Although most of the product was synthetic iron oxide (produced from sulfuric acid, caustic soda, and steel scrap) some natural oxide pigment was made by calcining iron ore mined in Oregon. Two grinding plants in Emeryville and one in Berkeley ground crude barite, and the latter also processed, on a custom basis, clays, soapstones, and other nonmetallic minerals received from mines outside the county.

Alpine.—The Leviathan mine near Markleeville was the principal California sulfur-ore mine. The crude ore was shipped to the producer's copper-leaching plant in Nevada and used in making sulfuric acid. Shipments were lower than in 1957 due to curtailed copper output.

Crews and contractors for the California Division of Highways dug 28,000 tons of sand and gravel and quarried and crushed a few hundred tons of granite, used in highway construction and maintenance.

Amador.—Much of the county's mineral production value was derived from the Ione area. Sand produced in the area was used in the manufacturing of glass and firebrick, and clay deposits yielded fire clay used in cement and in manufacturing refractories and heavy clay products. One company prepared and sold clay for consumption in pottery, stoneware, and tile and as a filler in linoleum and paint. County, State, and Federal Government-and-contractor paving projects utilized sand and gravel from pits in the same area, and crushed stone obtained near Pioneer. A stone quarry near

Lancha Plana was active part of the year, producing roofing granules.

One drift mine near Sutter Creek and several small stream-gravel washing operations in the county yielded a few ounces of gold. A few ounces of gold and silver was recovered near Jackson from a cleanup operation at the Central Eureka mine, and from retreated tailings at the Zeila property.

The State's only active lignite mine (near Ione) yielded substantially the same tonnage as in 1957. The entire output was processed at Buena Vista for its montan-wax content.

Butte.—The production of dry natural gas from Butte County field dropped 12 percent below 1957, yet continued to be the most important mineral product. The Wild Goose field ranked fourth (up from fifth in 1957) among the State's dry-gas fields, despite a 5-percent drop in volume output. The Perkins Lake, Llano Seco, Durham, and Chico fields also yielded less gas in 1958.

The construction of roads and road structures in the county required nearly twice the sand and gravel as in 1957. The principal pit locations were the Chico, Gridley, and Oroville areas. Granite boulders were utilized by the California Division of Highways in a road-repair project.

TABLE 24.—Value of mineral production in California, by counties

County	1957 [1]	1958	Minerals produced in 1958 in order of value
Alameda	[2] $16,874,306	$19,060,749	Sand and gravel, salt, magnesium compounds, stone, bromine, clays.
Alpine	(3)	(3)	Sulfur ore, sand and gravel, stone.
Amador	1,209,898	969,733	Sand and gravel, clays, coal (lignite), stone, gold, gem stones, silver.
Butte	3,393,284	2,819,647	Natural gas, sand and gravel, chromite, gold, stone, silver.
Calaveras	12,065,210	12,902,098	Cement, stone, sand and gravel, clays, copper, gold, lead, mercury, silver, gem stones, zinc.
Colusa	373,226	1,287,214	Natural gas, sand and gravel, chromite, gem stones.
Contra Costa	[2] 3,802,353	3,714,637	Stone, sand and gravel, natural gas, peat, clays.
Del Norte	929,262	571,803	Sand and gravel, chromite, stone, gold.
El Dorado	2,390,198	2,206,428	Stone, lime, gold, sand and gravel, soapstone, lead, silver, zinc, chromite.
Fresno	134,767,707	110,711,093	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone, chromite, clays, gold, pumice, gem stones, mercury, silver.
Glenn	4,929,056	5,228,404	Natural gas, sand and gravel, chromite.
Humboldt	2,565,261	1,949,399	Sand and gravel, natural gas, stone, manganese ore, gold, silver, copper, lead.
Imperial	2,379,174	2,800,689	Gypsum, manganese ore, sand and gravel, pumice, mica (scrap), stone, gold, gem stones, lead, zinc, silver.
Inyo	7,848,408	6,957,054	Molybdenum, tungsten, sodium carbonate, talc and pyrophyllite, stone, copper, sand and gravel, pumice and volcanic cinder, boron minerals, silver, perlite, clays, lead, zinc, sulfur ore, gold, gem stones, asbestos.
Kern	[2] 366,203,441	333,300,306	Petroleum, boron minerals, natural-gas liquids, cement, natural gas, stone, sand and gravel, gypsum, sodium sulfate, clays, salt, pumice, gold, uranium, gem stones, silver, lead, zinc.
Kings	11,825,970	14,007,533	Petroleum, natural-gas liquids, natural gas, sand and gravel, gypsum, mercury.
Lake	[4] 892,832	1,168,849	Mercury, sand and gravel, pumicite and volcanic cinder, manganese ore, sulfur ore, gem stones.
Lassen	129,593	(3)	Sand and gravel, volcanic cinder, stone.
Los Angeles	[2] 324,086,387	288,666,777	Petroleum, natural-gas liquids, sand and gravel, natural gas, stone, cement, iodine, diatomite, clays, soapstone, gem stones, gold, silver.
Madera	1,801,286	1,421,103	Natural gas, sand and gravel, stone, pumice and volcanic cinder, clays, gold, gem stones, silver.
Marin	2,174,090	1,817,869	Stone, sand and gravel, clays, mercury, gem stones.
Mariposa	144,545	406,035	Sand and gravel, stone, gold, silver, gem stones.
Mendocino	1,799,082	1,172,143	Sand and gravel, stone, gem stones.

See footnotes at end of table.

TABLE 24.—Value of mineral production in California, by counties—Continued

County	1957 [1]	1958	Minerals produced in 1958 in order of value
Merced	$1,120,195	$840,220	Sand and gravel, gypsum, mercury.
Modoc	748,629	710,372	Peat, sand and gravel, pumice and volcanic cinder, gem stones.
Mono	1,531,991	656,323	Pumice, sand and gravel, pyrophyllite, clays, gold, silver, lead, gem stones, copper, zinc.
Monterey	[2] 32,868,074	27,533,946	Petroleum, lime, magnesium compounds, stone, sand and gravel, natural gas, feldspar, salt, chromite, mercury, gem stones.
Napa	1,231,909	856,768	Stone, sand and gravel, mercury, asbestos, diatomite, perlite, chromite, gem stones.
Nevada	198,944	1,256,093	Sand and gravel, gold, barite, stone, silver, copper, lead, zinc.
Orange	142,041,235	132,425,593	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone, clays, salt, iodine, peat.
Placer	896,256	1,071,768	Sand and gravel, clays, stone, chromite, gold, silver.
Plumas	538,919	2,184,969	Sand and gravel, stone, manganese ore, gold, silver, lead, zinc.
Riverside	39,461,951	34,715,893	Iron ore, cement, stone, sand and gravel, clays, manganese ore, gypsum, wollastonite, petroleum, uranium, gem stones, gold, silver.
Sacramento	16,546,767	17,080,005	Natural gas, sand and gravel, gold, clays, silver.
San Benito	7,801,824	8,257,884	Petroleum, cement, mercury, stone, natural gas, sand and gravel, clays, chromite, gem stones.
San Bernardino	[4] 77,360,987	76,201,449	Cement, boron minerals, stone, sodium carbonate, sand and gravel, sodium sulfate, potassium salts, salt, talc and pyrophyllite, iron ore, calcium chloride, petroleum, lithium minerals, lime, clays, bromine, rare earths, manganese ore, barite, perlite, natural gas, pumice and volcanic cinder, gem stones, copper, silver, gold, feldspar, lead, fluorspar, zinc, uranium.
San Diego	7,562,239	9,212,941	Sand and gravel, stone, magnesium compounds, salt, clays, pyrophyllite, gem stones, gold, silver.
San Francisco	194,890	[3]	Stone, sand and gravel.
San Joaquin	5,364,243	4,091,912	Sand and gravel, natural gas, clays.
San Luis Obispo	[2] 11,242,490	10,729,526	Petroleum, natural-gas liquids, chromite, mercury, sand and gravel, stone, natural gas, gypsum, clays, gem stones, manganese ore.
San Mateo	11,660,381	11,452,612	Cement, stone, salt, magnesium compounds, petroleum, clays, sand and gravel, mercury, natural gas, gem stones.
Santa Barbara	[2] 111,971,553	98,830,858	Petroleum, diatomite, natural-gas liquids, natural gas, sand and gravel, stone, mercury, gypsum, clays, chromite.
Santa Clara	27,501,823	28,419,631	Cement, stone, sand and gravel, mercury, clays, magnesite, masonry cement, petroleum, gem stones.
Santa Cruz	7,548,198	8,988,120	Cement, stone, sand and gravel, clays, potassium salts, gem stones.
Shasta	2,098,480	1,676,197	Sand and gravel, pyrites, stone, gold, volcanic cinder, copper, chromite, silver.
Sierra	665,761	648,498	Gold, sand and gravel, stone, silver, uranium, zinc.
Siskiyou	1,965,302	1,699,383	Pumice and volcanic cinder, sand and gravel, gold, stone, chromite, silver, gem stones, copper.
Solano	10,352,104	8,752,846	Natural gas, clays, stone, sand and gravel.
Sonoma	4,309,538	3,097,232	Sand and gravel, mercury, stone, manganese ore, natural gas, clays, chromite, petroleum, gem stones.
Stanislaus	933,212	727,005	Sand and gravel, clays, gold, mercury, stone, silver.
Sutter	502,609	688,365	Natural gas, sand and gravel, clays.
Tehama	700,903	486,945	Sand and gravel, natural gas, chromite.
Trinity	1,649,368	2,354,765	Stone, sand and gravel, mercury, gold, chromite, silver.
Tulare	[2] 3,239,047	2,289,728	Natural gas, sand and gravel, petroleum, barite, stone, clays, gem stones.
Tuolumne	1,211,204	1,065,455	Stone, lime, sand and gravel, gold, chromite, silver, gem stones.
Ventura	202,605,322	181,137,209	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone, clays, gypsum.
Yolo	1,357,951	[3]	Sand and gravel, natural gas.
Yuba	4,131,995	5,239,854	Gold, sand and gravel, clays, stone, platinum, silver, copper.
Undistributed [5]	[2] 6,334,073	4,139,767	
Total [6]	[2] 1,650,035,000	1,502,660,000	

[1] Excludes lithium.
[2] Revised figure.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Excludes value of manganese and low-grade manganese ores sold and blended at Government low-grade stockpiles for future beneficiation.
[5] Includes gem stones, mercury, and value indicated by footnote 3.
[6] Total has been adjusted to eliminate value of gas vented and wasted and eliminate duplicating value of clays and stone.

The Lambert mine near Magalia was the only source of chromite ore and concentrate. Although some of the crude ore was shipped direct to the Government stockpile in Oregon, most was upgraded in the producer's mill in Shasta County before shipment to the stockpile. Stream gravel near Oroville yielded the few ounces of gold and silver produced in the county.

Calaveras.—Shipments of portland cement from Kentucky House by the county's only producer were slightly higher than in 1957. The company produced cement primarily for northern California consumption, although smaller tonnages were also shipped to southern California, Nevada, and Oregon and for export. Limestone quarried near San Andreas for use in cement comprised a substantial part of the stone produced. County quarries also yielded crushed granite and miscellaneous stone sold as roofing granules and for road paving. Much of the increased sand and gravel output was from pits near Comanche; however, structural and paving sand and gravel were produced from deposits at San Andreas. Clay used in cement was mined near San Andreas, and clay for heavy clay products was produced in the Valley Springs area.

Copper ore mined at the Calaveras Copper property near Milton yielded recoverable copper and silver. Copper precipitate was obtained by in-place leaching at the Penn mine near Campo Seco. Gold, silver, and some zinc were recovered from gold ore produced at the Blackstone mine near West Point. Relatively minor quantities of gold and silver were obtained from placer properties in the county—one hydraulic operation near Mountain Ranch, one nonfloating washing plant at Comanche, and several small-scale hand operations at various locations.

Colusa.—Natural gas production increased substantially over 1957 owing to the large volume increases from the Compton Landing and Arbuckle fields, discovered in 1955 and 1957, respectively. The older Princeton field yielded a smaller output than in 1957.

A lower demand for paving sand and gravel was responsible for the drop in output of these materials, most of which were obtained from pits near Colusa by commercial producers and crews of the county road agency.

Chromite mining was confined to one producer, who worked the Hi Noon No. 1 claim for a short time and shipped a few tons of ore to the Government stockpile in Oregon.

Contra Costa.—Stone, again the leading raw-mineral product in the county, was produced on virtually the same level as in 1957. Producers quarried basalt near Orinda, sandstone near Richmond and Concord, and miscellaneous stone near Clayton, used as riprap, concrete aggregate, and roadstone. Early completion of several major road projects was responsible for the drop in sand and gravel output compared with 1957. Sands from pits in the Antioch and Cowell areas were prepared for use in asphalt shingles and paving mix and mortar. Clays mined from deposits in the Port Costa and Richmond area were utilized in manufacturing building brick.

One of the State's four new gasfield discoveries in 1958 was made at Los Medanos near Port Costa. Only one well was completed at the field in the year, and its output added but slightly to the gas produced from the Rio Vista field (principally in Sacramento

County). The total natural gas production in the county dropped 17 percent below 1957. The county's four large, deep-water petroleum refineries constituted the second largest concentration in the State, representing 31 percent of the total refining capacity. The aggregate average daily crude-oil capacity dropped from 422,800 barrels to 415,800 because new installations had less capacity than the equipment retired. Elemental sulfur and sulfuric acid were obtained from hydrogen sulfide recovered from gases in refineries at Avon, Oleum, and Richmond or in nearby chemical plants. The yield in equivalent elemental sulfur rose 9 percent above 1957, but the unit value declined 3 percent. Liquid sulfur dioxide, some of which was converted to sulfuric acid, was recovered from waste stack gases in the lead smelter at Selby, treating primary nonferrous material consisting principally of imported lead ores and concentrates. Gold and silver were refined at the smelter, and zinc fume recovered in the slag plant was shipped outside the State for conversion to the metal and oxide. Peat-dredging operations in the San Joaquin River Delta, for use as a soil-conditioning agent, yielded a tonnage 20 percent under 1957.

Crude gypsum from San Marcos Island, Mexico, was calcined in the producer's Antioch plant and consumed in manufacturing gypsum plaster, lath, and wallboard. In the Pittsburg area a steel plant rolled structural shapes and tinplate, and refractories were produced in a plant that utilized clays mined outside the county. Sulfuric acid was made in plants near Richmond and Nichols from pyrites produced in Shasta County. The pyrite producer prepared copper salts, primarily from copper scrap, in a plant near Martinez.

Del Norte.—Sand and gravel was produced commercially in the Klamath and Smith River areas and by crews and contractors of State and county agencies at various locations. The quantities produced were 48,000 tons less than in 1957, and 93 percent of the output was used for paving; the remainder was consumed for structural purposes. Stone quarried near Crescent City and smaller quantities at other locations were used in constructing State and county roads.

Production and shipments of chromite ore dropped to less than half the 1957 figures, incident to termination of the domestic purchase program before midyear. Mining activity was limited to 15 chromite deposits worked by 14 producers in the first 5 months of 1958. A few ounces of placer gold was recovered at a dry-land washing plant near Gasquet and by small-scale hand methods at French Hill.

El Dorado.—Stone production rose from 313,000 tons in 1957 to 425,000 tons in 1958. The increase resulted from requirements for concrete aggregate and roadstone by the U.S. Forest Service and the Sacramento Municipal Utilities District. Limestone quarried near Diamond Springs, Shingle Springs, Auburn, and Cool was crushed and used in manufacturing lime and glass, in sugar refining, as metallurgical flux, as filler in asphalt and fertilizer, and for concrete and roadstone. Quick- and hydrated lime produced at Diamond Springs was sold for construction, agricultural, chemical, and other industrial uses. Shipments were made to nearby States and to Alaska and Canada. Near Placerville dimension stone was produced for building construction and rubble. A smaller tonnage was

crushed and sold for roofing granules. Slate quarried at Chili Bar was crushed for roofing granules or ground for rock flour. Pits in the Placerville and Lake Tahoe areas were the source of sand and gravel used in paving and general construction.

The Hazel Creek lode-gold mine yielded much of the county's recoverable gold and silver and all the lead and zinc produced. A few ounces of gold was recovered from gold ore mined at the Yellow Jacket property near Kelsey. Small-scale operations at various placer deposits produced a few ounces of gold and silver. Soapstone mined at the Shrub deposit near Shingle Springs was sold to grinders in the San Francisco Bay area; however, mine production ceased before the end of the year. A few tons of chromite ore was mined on the Wilson property near Georgetown and sold under the domestic purchase program.

Fresno.—Mineral-fuel output again dominated the county's mineral industries. Crude-oil production dropped 9 percent below 1957. Although the Coalinga East Extension and the Coalinga fields were among the 10 top producers in the State, the Kettleman Dome (also in Kings County), Guijarral Hills, and Raisin City fields each yielded 5,000 barrels or more a day. Natural gas output was 7 percent lower than in 1957. Wet gas was processed in the five natural gasoline plants in the county, and production of natural-gas liquids declined 6 percent because of the smaller volume of wet gas available. Exploration revealed no new oil or gas fields.

Pits in the Fresno, Friant, Sanger, and Coalinga areas were the chief sources of sand and gravel production, used principally for building, paving, and fill. Output was lower than in 1957. Early completion of base construction at the Wilson and Courtwright Dams resulted in a precipitous drop in stone output (from 7.9 million tons in 1957 to 0.5 million tons in 1958). Even at that, a substantial part of the 1958 production was used in the Courtwright Dam. Crushed granite was produced and used by highway crews and contractors. Dimension stone for building construction and monuments was quarried near Clovis, and a quarry near Sanger supplied miscellaneous stone for railroad ballast. Miscellaneous clay was mined from deposits near Fresno and used in manufacturing common brick. Over 400 tons of pumice quarried near Friant was prepared for concrete aggregate.

Chromite production was limited to the tonnage mined on the Butler estate, some of which was upgraded at a mill near Coalinga. The ore and concentrate were shipped to the Government stockpile in Oregon. The mill was shut down following conclusion of the domestic purchase program. The relatively small gold and silver output was from a placer operation near Auberry and as byproduct recovery at a sand-and-gravel-preparation plant on the San Joaquin River near Friant. Cinnabar ore mined by open pit at the Little Mercy claims near Mendota yielded a minor quantity of mercury.

One plant at Fresno custom-ground crude barite for producers and processors outside the county; another expanded crude perlite mined in San Bernardino County.

Glenn.—The Beehive Bend-Willows field was the most active natural gas area in the State, with 13 new wells completed. This area pro-

duced 15 percent of California's total gas yield from dry-gas fields and was second only to the Rio Vista field of Sacramento-Solano-Contra Costa Counties in both production and reserves. Smaller active fields in the county were the Bounde Creek, Ord Bend, and Afton. Total natural gas production in the county rose 19 percent above 1957.

The Orland and Willows areas were the principal location of pits that yielded a somewhat lower tonnage of sand and gravel (compared with 1957) produced for commercial sale and for paving use by State and county agencies.

Chromite ore and concentrate were shipped to the Government stockpile in Oregon from the Burrows mine near Newville. A few tons of ore mined at the Chrome Creek deposit near Stonyford was also shipped to the stockpile.

Humboldt.—Production of natural gas, limited to the 20-year-old Eureka field, continued its slow decline and was 10 percent under 1957.

The output of sand, gravel, and stone dropped below 1957. Pits in the Arcata and Fortuna areas supplied most of the sand and gravel production, over 65 percent of which was used in paving projects by city, county, and State agencies, and by the Federal Bureau of Indian Affairs. Quarries near Arcata and Eureka were worked to produce basalt, sandstone, and miscellaneous stone used as riprap, fill, and railroad ballast and in paving.

Sintered carbonate ore produced at the Queen's Peak deposit near Garberville was shipped to a Government stockpile. Ore from the Copper Bluff mine near Hoopa was the source of the recoverable copper and lead and all but a few ounces of gold and silver credited to producers in the county. Chromite-ore production and shipments were limited to a few tons mined from the White Cedar deposit near Martin's Ferry and sold to GSA under the domestic purchase program.

Imperial.—The quantity of crude gypsum quarried at the Fish Creek Mountains deposit and processed at Plaster City was slightly below 1957. The calcined product was used in manufacturing plaster and wallboard, while some of the crude mineral was prepared for use as a soil conditioner and cement retarder. Pits in the Brawley, El Centro, and Holtville areas were the principal sources of sand and gravel used for paving and building. Also near Brawley a portable plant was used to prepare sand for filter use. Granite was quarried near Calexico, Plaster City, and Winterhaven and used for riprap by the Imperial Irrigation District. Some granite from the Plaster City area was used in road construction. Lightweight aggregate material was prepared from pumice quarried near Calipatra. The entire 1958 State output of mica (sericite schist) was obtained from the Mica Schist mine near Ogilby. The crude mineral was ground by the producer and used in manufacturing shingles and roofing paper.

Over 50 percent of the manganese ore and concentrate produced in California in 1958 was obtained from nine deposits in the Palo Verde area. Except for one mine that yielded sintered carbonate ore, the output was oxide ore. The entire production was Metallurgical-grade shipped to an out-of-State Government stockpile. A few

ounces of gold and silver was recovered from ore mined at the La Colorado property near Ogilby and silver ore from the Annex claims near Glamis yielded small quantities of silver, lead, and zinc.

Inyo.—Lode mines in the county yielded all the molybdenum (oxide and sulfide) and tungsten concentrates produced and shipped in the State during 1958 and a high percentage of the recoverable gold, silver, copper, lead, and zinc. Tungsten ore from the Pine Creek mine near Bishop was the source of the molybdenum and tungsten and most of the gold, silver, and copper. Silver ore from the Ella mine and lead ore from the Santa Rosa mine, both near Keeler, added appreciably to the total silver, copper, lead, and zinc credited to the county. Lead ores mined from the Christmas Gift mine near Darwin and the Silver Spoon mine near Lone Pine contributed notable quantities of silver, lead, and zinc.

Sodium compounds (soda ash and trona) were recovered from Owens Lake brines at Bartlett, where construction of expanded facilities for recovering these compounds was partly completed before the end of the year. More than 50 percent of the State output of talc came from Inyo County, chiefly from the Shoshone, Tecopa, Big Pine, and Keeler areas. Although most of the crude mineral was shipped to grinders in southern California, grinding plants were operated at Laws and Keeler (one each) by two producers. Underground mines near Death Valley Junction and Shoshone produced colemanite (natural calcium borate) and crude sodium-calcium borate, respectively, mined and shipped to the producer's mill and refinery in Kern County.

Limestone was quarried in the Argus Range and calcined at the producer's Kern County plant for carbon dioxide used in making sodium carbonate. Near Lone Pine marble was quarried for terrazzo and roofing granules and quartzite for ganister. Dimension stone used in building construction and for rubble was quarried near Death Valley Junction and at a location near Argus Peak. Sand and gravel from pits near Bishop was prepared for building and paving use. County, State, and Federal agencies—crews and contractors—produced paving sand and gravel at various localities. Bentonite was mined from a pit near Death Valley and used in pharmaceuticals and ceramics. Fuller's earth from a deposit in the Olancha area was prepared for consumption in insecticides, filter aids, and concrete admixtures.

Pumice and volcanic cinder from deposits in the Little Lake and Bishop areas were used principally (92 percent) as concrete aggregate. The remaining output was processed for pozzolan, insulation, and patching plaster. Crude perlite mined at the Fish Spring quarry near Big Pine was sold to southern California expanding plants. Sulfur ore from the Crater deposit near Big Pine was sold for agricultural use. A few tons of asbestos (amphibole) shorts mined at the Tin Mountain-Lawrence claim was processed and used in making steam-pipe insulation.

Kern.—Kern County again led all others as a source of minerals and as an oil producer and was second only to Ventura in natural gas output. This position was maintained, despite a decline of nearly $33 million in total mineral-production value compared with 1957 and a volume drop of 7 and 1 percent, respectively, in oil and

gas output. The San Emido Nose oilfield discovery was reported to be the most significant discovery in the State, with the possible exception of the Summerland offshore field in Santa Barbara County. Other exploration resulted in nine new pools in previously discovered fields. There were eight oil refineries in the Bakersfield area, one of which operated intermittently. These units are small, and the combined refining capacity was only 6 percent of the State total. Wet gas from the oilfields was processed in 15 natural gasoline plants and 2 cycling plants. Production of natural-gas liquids from these plants was 6 percent lower than 1957 yields, yet the combined output was 27 percent of the 1958 State total. The county's and the State's two cycling plants at Paloma and South Coles Levee, and the natural gasoline plant at North Coles Levee rank among California's five largest in production of natural-gas liquids.

The Nation's leading producer of boron compounds mined crude borate from a large open-pit operation near Boron and processed these minerals and borates from company mines in Inyo County at a nearby mill and refinery. Sodium sulfate was produced as a byproduct during the processing. Appreciable quantities of partly refined borates were shipped to the company refinery in Los Angeles County, sold to various chemical companies, and exported. Small tonnages of crude calcium borate and sodium borate were prepared, respectively, for use as an aid in extinguishing fires and an additive in weed-killing agents. However, most of the crude borates was processed to refined boron compound sold domestically and exported. Crude salt was recovered by solar evaporation from brines of Koehm dry lake at Saltdale and sold to various consumers for a wide variety of uses.

Production and shipments of portland cement at two plants, one each at Monolith and Mojave, were above 1957 figures. The Monolith Co. mined limestone and clays locally and obtained gypsum and fluorspar from its deposits in Ventura County and Nevada State, respectively. The Mojave producer quarried limestone but purchased all other raw materials. Basalt, granite, and miscellaneous stone was quarried by crews and contractors of the California Division of Highways for road structures and paving. Dimension sandstone and miscellaneous stone were produced near Rosamond and Tehachapi and used for rubble, architectural purposes, and roofing granules. Some limestone from the Monolith-Mojave area was also crushed for roofing granules. Sand and gravel production in the county rose nearly 72 percent above 1957. Approximately 63 percent of the total output was used in paving projects, both commercial and Government. Large stationary and portable preparation plants were operated near Bakersfield, Maricopa, and Lebec. Smaller preparation plants were operated throughout the year at Taft, Ridgecrest, and Inyokern. In addition to the clays mined near Monolith for cement, clays were dug at deposits in the Boron, McKittrick, Mojave, and Rosamond areas for use in compounding well-drilling muds, in manufacturing pottery and absorbents, and for various filler uses. Substantial tonnages of gypsite were produced for soil improvement in agriculture. Although the Lost Hills and McKittrick areas were the chief sources of the mineral, important quantities were mined near Maricopa and Wasco. Less

than 1,000 tons of pumice was quarried near Inyokern and used in cleaning compounds, abrasives, and paint and as an absorbent.

Lode-gold ores mined in the Randsburg area yielded nearly all the recoverable gold produced in the county and much of the silver. The major producer was the Yellow Aster mine. About 2 tons of lead ore from an old mine dump in the area yielded the county's entire lead and zinc output and nearly 42 percent of its total silver. A few ounces of placer gold was reported by itinerant prospectors in the Kern River area. Uranium-ore shipments from the Little Sparkler mine near Miracle Hot Springs were higher in U_3O_8 (grade and content) than all other shipments in the State combined.

Kings.—Oil and natural gas were the leading mineral products, despite yields below 1957. Petroleum production from three fields—Pyramid Hills, Kettleman Middle Dome, and Kettleman North Dome (which extends into Fresno County)—declined 10 percent. The combined natural gas output, wet gas from the oilfields, and dry gas from the Dudley Ridge, Trico Northwest, and Trico (most of which lies in Kern and Tulare Counties) fields was down 19 percent. The wet gases were processed in three natural gasoline plants near Avenal, and reported production of natural-gas liquids was 10 percent below 1957 figures. Improved facilities were installed at the county's only oil refinery near Hanford, which included a catalytic reforming unit and a polymerization plant.

Most of the sand and gravel produced was used in constructing and maintaining county roads. The total output was less than half the tonnage in 1957. Near Avenal approximately 80,000 tons of gypsite was mined for agricultural use as a soil conditioner.

Cinnabar ore from the Little King (Fredanna) claims near Parkfield was furnaced, yielding more than 100 flasks of mercury, and 14 flasks of the metal was recovered in retorting ore from the Dawson pit south of Avenal.

Lake.—The Abbott mine near Wilber Springs, Colusa County, one of California's four major mercury mines, produced and shipped over 3,000 flasks of mercury. Ore mined at the Big Injun group near Middletown also yielded a few flasks of the metal. A few tons of manganese ore mined at the Toy Young open-pit mine near Ukiah was shipped to an out-of-State government stockpile.

Commercial producers in the Clear Lake area and crews and contractors for State and county agencies produced nearly four times the quantity of sand and gravel credited to the county in 1957. Approximately 78 percent of the production was used in road construction and maintenance; the remainder was consumed in concrete structures and for fill material. Volcanic cinder and ash were quarried in the Clearlake Highlands area for use as decorative rock, roofing granules, and concrete aggregate and in acoustic plaster and road surfacing. The Sulphur Bank mine a few miles south of Clearlake Oaks, a former mercury producer, was the source of a relatively small tonnage of sulfur ore, used as a soil aid.

Lassen.—Virtually all the sand and gravel produced, nearly three times the tonnage of 1957, was used for road construction and maintenance by crews and contractors of the California Division of Highways and the Lassen County Road Commission. A somewhat larger tonnage of volcanic cinder than in 1957 was quarried near

Susanville for concrete aggregate. Stone production dropped sharply from 1957 and was limited to the granite obtained from the Susanville Quarry for use as curbing.

Los Angeles.—The county played a dominant role in the oil and gas industry, ranking first in refining, with half of the State's refineries and over 60 percent of the total capacity. Crude-oil production was second only to Kern County, despite a 9-percent drop from 1957. There was a net gain of 5 percent in crude capacity at the 17 active refineries that resulted chiefly from additional facilities placed in operation at one of the larger plants. Three plants were inoperative at yearend, one of which planned reconstruction after a major fire, Natural gas production decreased 20 percent, compared with 1957; and, although 4 of the 26 natural gasoline plants closed during the year, the volume of wet gas processed declined only 9 percent, and the natural-gas liquids output was only 5 percent lower.

Exploration resulted in two oilfield discoveries at Bouquet Canyon and Cheviot Hills. Three new pools were reported in this period—one each in the Beverly Hills, Whittier, and Wilmington fields. Hydrogen sulfide was recovered from refinery byproduct gases at seven refineries in the Los Angeles-Long Beach area. Waste oil-well brines from the Los Angeles Basin (largely from Los Angeles County) were the source of the State's iodine and iodine compounds output. Various iodine compounds were produced in processing the brines at a Compton plant. Most of the brines were piped to Seal Beach, Orange County, for iodine recovery. Two of the plants converted hydrogen sulfide directly to molten sulfur, while the others piped the gas to nearby chemical plants for conversion to elemental sulfur and/or sulfuric acid.

Sand and gravel production rose 7 percent in quantity and 10 percent in value above 1957 figures. The county supplied more than one-fourth the California output. The increase was due to the increased tonnages required for paving projects, which more than offset the decline in specialty sands produced in the El Segundo, Torrance, and Walteria areas for molding, blast, and engine sand. Preparation plants were operated at Arcadia, Azusa, El Monte, Irwindale, and Sun Valley, each of which washed and screened over 1 million tons of sand and gravel. Stone quarries in the county yielded nearly 2 million tons—25 percent less than in 1957. The output was used for building construction, rubble, flagging, revetments and jetties, breakwater fill, paving, and roofing granules. The stone used in harbor improvements was quarried on Santa Catalina Island and barged to the mainland.

A cement plant at Los Angeles produced portland cement from purchased clinker and gypsum from the company deposit in Nevada. A Southgate lath and wallboard plant also utilized crude gypsum from Nevada, and a plant at Long Beach calcined crude gypsum (mined by the company in Mexico) in manufacturing plaster, wallboard, and other gypsum products. Deposits in the Torrance, Santa Monica, Los Angeles, Compton, and Van Nuys areas were the principal sources of miscellaneous clay used to manufacture common brick and other heavy clay products. Clay mined near San Fernando was sold for use as a carrier in insecticides.

Near Walteria diatomite was mined, milled, and sold for filter aid, insulation, and filler. Soapstone was mined from a deposit near San Fernando and prepared in a Los Angeles grinding plant for use as asphalt filler. Several other grinding plants in the Los Angeles area prepared talc, soapstone, and pyrophyllite mined in California and out-of-State. One Los Angeles exfoliating plant expanded crude vermiculite mined in Montana. Seven other plants in the county expanded crude perlite from mines in California and Nevada. A sand and gravel preparation plant near Montebello recovered relatively small quantities of placer gold and silver as byproducts in its operation.

Four steel companies in the Torrance-Los Angeles area produced ingots and finished steel products. One Torrance plant operated open-hearth furnaces utilizing iron and steel scrap and Utah iron ore; the other operated electric furnaces on scrap alone, as did the two Los Angeles plants.

Madera.—Natural gas production from the Chowchilla, Gill Ranch, and Moffat Ranch fields was 5 percent below 1957. One new well, completed during the year at the Gill Ranch field, yielded more than 80 percent of the total 1958 volume.

Sand and gravel production was only 50 percent of the 1957 output, due primarily to early completion of several major highway projects. The principal producers operated preparation plants on the San Joaquin River. Near Chowchilla several thousand tons of sand was produced and prepared for manufacturing concrete pipe. Lower requirements for highway construction were also responsible for the decreased output of crushed granite; however, production of dimension granite near Raymond for architectural and monumental stone increased. Appreciable quantities of pumice and pumicite were quarried near the Friant Dam for building block and as a carrier in pesticides. Clay was mined south of Trigo and used in the manufacture of brick. One company recovered a few ounces of gold and silver during dredging operations on the San Joaquin River near the Friant Dam.

Marin.—Stone production increased slightly. Although the tonnage of basalt quarried near Novato was under 1957, this decline was offset by an increased output of sandstone from quarries near San Rafael used for riprap, concrete aggregate, and roadstone. Stone from the McNear quarry was barged up the Sacramento River to flood-controlled projects. Sand and gravel production rose substantially above 1957 owing chiefly to the greatly increased building and paving requirements at housing projects in the county. Although most of these materials came from pits near Novato, Nicasio, and Point Reyes Station, some sand and gravel was dredged from San Francisco Bay bordering the county. Shale was quarried near San Rafael; some of it was bloated at the Haydite plant for lightweight aggregate. The remainder was used by the producer of common brick.

Cinnabar ore from the Edwards mine on the Bently Ranch was furnaced and a number of flasks of mercury recovered. Ore from the Gambonini property near Marshall also yielded mercury.

Mariposa.—The output of sand and gravel increased nearly fourfold over 1957. The demand for these materials in the maintenance

and repair of county roads and at building and paving projects in Yosemite National Park was primarily responsible for the sharp increase. Commercial requirements, however, were less than in 1957. An appreciable quantity of dimension mariposite was quarried near Coulterville for building and garden uses. Some slate was quarried near Mariposa and used for flagging and in building construction. Government crews and contractors in Yosemite National Park utilized crushed miscellaneous stone for fill and concrete aggregate.

The principal gold and silver output was recovered from gold ore of the Red Banks mine near Bagby and another small lode operation in the same area. Several mines in the East Belt area contributed a few ounces of lode gold and silver. Placer mining was limited to a few small-scale operations by prospectors and to the byproduct recovery of gold and silver at a sand and gravel preparation plant near Mariposa.

Mendocino.—Sand and gravel production declined nearly 50 percent from 1957 owing primarily to the drop in requirements of the filter plant at the nearly completed Coyote Dam. Approximately 73 percent of the sand and gravel output was used in roads, bridges, and culverts. Much of the remaining production was consumed in general construction, as fill, and for filter purposes. Major commercial production came from pits in the Ukiah area. Stone output was used by Government crews and contractors for fill and roadstone.

Merced.—Consistent with 1957, sand and gravel output supplied 99 percent of the value of all mineral materials produced. The 1958 tonnage was only slightly below 1957. Government contracts utilized most of the output, particularly at the Castle Air Force Base building and paving projects. The Le Grand, Los Banos, Merced, and Snelling areas produced most of these materials, and preparation plants were operated in the last two. Bentonite mined in San Bernardino County was processed in a Merced plant for special cement and chemical uses and prepared with barite as constituents in well-drilling muds. Considerably more gypsite was mined at a deposit near Los Banos than in 1957 and used as a soil-conditioning agent. The Stayton mine east of Hollister was the source of a small tonnage of cinnabar ore retorted, which yielded a few flasks of mercury.

Modoc.—There was a 22-percent increase, compared with 1957, in the quantity of peat moss recovered from a bog in Jess Valley. The peat was hauled to Likely, where the producer contracted its processing for sale as a soil conditioner. The tonnage of sand and gravel produced in the county declined 34 percent from 1957. A high percentage of the output was used in paving projects by county, State, and Federal agencies. The principal source of these materials was the pits and preparation plant near Alturas. Volcanic cinder was mined near Ainshea Butte and used in widening a railroad bed. Pumice quarried near Tionesta was consumed as concrete aggregate. Pumice obtained from a Siskiyou quarry was cut for scouring blocks at a Tulelake mill.

Mono.—Closing down of all tungsten mines in 1957 made pumice the most valuable mineral commodity produced in the county, although the tonnage produced was virtually the same as in 1957. Pumice

deposits were quarried in the Bishop, Benton, and Mono Crater areas and used for acoustic plaster, lightweight aggregate, and scouring blocks, respectively. The scouring-block material came from the Frank Sam mine and was cut and trimmed at the Lee Vining mill. Virtually all sand and gravel production was used by Government crews and contractors and was obtained at various locations. Nearly 2,000 tons of kaolinitic clay was mined near Casa Diablo and processed for use in whiteware and as a filler in paper and plaster. Pyrophyllite from the Pacific Pyrophyllite and Colton mines in the White Mountain area was processed in the Laws plant of one of the producers. The chief use of the plant product was as a carrier in insecticides.

The major gold and silver producer was the Sierra-Washington group near Mammoth Lake. Gold ore mined at the Chemung property near Bridgeport and lead ore from the Topaz lead-silver mine near Topaz Lake also contained recoverable gold and silver. Some high-grade ore obtained from the Betty Anne prospect in the White Mountain area yielded silver and small quantities of lead and zinc.

Monterey.—The Parris Valley oilfield discovery was made at less than 800 feet, yielding an oil of 12° API; however, initial daily production was only 5 barrels. Production from the two wells drilled was less than 300 barrels during a 3-month period. The only other field in the county (the San Ardo) was the State's seventh largest producer despite an 8-percent drop from 1957; natural gas production from this field declined 22 percent.

Quick- and hydrated lime was produced in a plant at Natividad from limestone and dolomite from a nearby quarry. Although the lime was prepared for chemical and industrial uses, the manufacture of refractories, and the building trades, most of the plant product was used in the producer's sea-water processing plant at Moss Landing to recover magnesia. The magnesia, and chromite from the Philippine Islands, was consumed chiefly in manufacturing refractories. Another plant at Moss Landing recovered salt from sea water by solar evaporation; most of it was sold for use in icing refrigerator cars.

Stone production increased slightly over 1957 owing to the demand for the crushed material used as road base by State and county agencies. Decomposed granite was quarried in the Salinas and Pebble Beach areas for road construction. Rough stone and rubble were produced at a Carmel quarry for fireplace, patio, and other building uses. Sand and gravel output declined to less than half the quantity produced in 1957, as Government-and-contractor paving projects required only one-tenth the tonnage used in 1957. Production of specialty sands (molding, blast, engine, filter, and other industrial uses) from the Castroville and Pacific Grove areas increased 5 percent over the preceding year; most of the gain was credited to molding use.

The quantity and value of feldspathic sand, recovered from dunes near Pacific Grove for its feldspar content, were higher than in 1957 by 5 and 7 percent, respectively. The feldspathic sand and feldspar concentrate produced (some of which was ground to consumer specifications) were used chiefly in manufacturing glass, pottery, and sanitary ware.

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Chromite ore mined at the Lilly group and the Mee Ranch, near San Simeon, was shipped to the Government stockpile in Oregon. Cinnabar ore mined at the Patriquin open-pit deposit near Parkfield was retorted, yielding a few flasks of mercury. Ore from the Old Murry No. 1 claim northwest of San Simeon also yielded a small quantity of the metal.

Napa.—Stone production declined sharply from 1957, particularly the tonnages required for riprap, concrete, and road construction. Much of the crushed and broken stone for construction and paving projects by Government agencies was obtained near Napa, at one of the State's largest basalt quarries. Sand and gravel production in the county was more than twice the 1957 figure, due to requirements in the Napa, Rutherford, and St. Helena areas for these materials, used as fill and in local paving projects.

The largest active asbestos deposit (the Phoenix mine near Napa) was the only California source of chrysotile asbestos, yielding Group 7 refuse and shorts. Diatomaceous silica was quarried near Napa and prepared for use in pozzolanic cement at a Napa Junction plant that also bloated shale from Solano County for lightweight aggregate. Crude perlite was quarried and expanded at St. Helana for use in plaster and concrete, and a relatively small tonnage of the crude mineral was sold to a manufacturer of gypsum products.

Most mercury production was retorted from ores of the Oat Hill and Oat Hill Extension mines near Middletown. A few flasks was recovered from James Creek stream gravels. All mercury produced was sold to a buyer in the San Francisco Bay area. Small tonnages of chromite ore mined at the Grub Stake No. 1 claim near Middletown, and the Reeve property near Rutherford, were shipped to the Government stockpile in Oregon.

Nevada.—The output of sand and gravel was more than 15 times that in 1957. The sharp rise was due primarily to the increased requirement for structural and paving materials in a new section of highway 40 leading to Floriston. Although the major source of sand and gravel for this project was pits in the Truckee area, an appreciable quantity was obtained near Grass Valley. The latter area was also the source of the limited stone output, most of which was used by the State in road construction and maintenance.

Except for the gold ore mined near French Corral, the output of recoverable gold, silver, copper, lead, and zinc came from mines in the Grass Valley-Nevada City area. A large percentage of the output was the result of cleanup operations, and recovery from mine-dump ore, at the Empire Star group, and the Brunswick and Lava Cap mines. Two dragline operations in the French Corral area and one suction dredge in the Grass Valley area worked placer gravels; however, most of the placer gold and silver produced was credited to a prospector who used small-scale hand equipment to recover the metals.

Although only a relatively small quantity of crude barite was produced at the Spanish mine near Nevada City by two operators during the year, one producer shipped a large tonnage from the mine stockpile to its Merced plant. The other operator shipped the newly mined barite to its grinding plant near Sacramento.

Orange.—Petroleum production dropped 7 percent from 1957, yet the output ranked fourth in the State. No new fields were discovered, but a new, deeper pool was found in the northern area of the Huntington Beach field. The natural gas yield also declined 9 percent, and production of natural-gas liquids from six natural-gasoline plants was 9 percent less than in 1957. Peat mined from pits at two operations near Huntington Beach was prepared and sold as a soil-conditioning agent.

Sand and gravel production was more than 500,000 tons greater than in 1957. Over half the output was used in paving projects, nearly 2.5 million tons was consumed in building construction, and the remainder included pit-run material for fill and sand prepared for molding and blast use. Plants in the Anaheim and Orange areas were credited with a substantial part of the prepared sand and gravel produced. Decomposed granite was quarried near Costa Mesa and used as road base. Several quarries supplied miscellaneous stone for jetties and riprap at coastal out-fall projects of the Orange County Flood Control District. Kaolin was mined at deposits in the El Toro area and used in whiteware and for furnace linings. Fire clay produced near Sierra Peak was consumed in manufacturing firebrick. Pits near Olive and Huntington Beach supplied miscellaneous clay for use in sewer pipe and drain tile.

A Santa Ana salt company recovered salt from sea water by solar evaporation near Corona del Mar, which was sold locally. Crude iodine was recovered from waste oil-well brines of the Los Angeles Basin in a Seal Beach plant. Only a small percentage of the brines came from wells in the county. Some of the crude iodine was converted to potassium iodide, but most of the output was sold crude. An Anaheim plant expanded imported crude vermiculite for use in plaster.

Placer.—The nearly threefold increase in sand and gravel production resulted from demand for these materials in completing sections of Highway 40 and for building and paving requirements at Squaw Valley, site of the 1960 Winter Olympics. Much of the stone quarried was used for fill and road construction. Decomposed granite was quarried near Auburn for fill use. Dimension stone for rough and dressed monumental use and crushed stone used for roofing granules and prepared as filler in poultry feed were obtained from quarries near Rocklin. Two producers in the Lincoln area mined fire clay used and sold for manufacturing sewer pipe and other heavy clay products.

Four chromite deposits in the Foresthill area and one near Bear River were the sources of comparatively small tonnages of chromite ore shipped to the Government stockpile in Oregon. Except for a few ounces of lode gold from a prospect near Foresthill, the gold and silver output came from placers. Drift mines near Iowa Hill and Rocklin, a dragline operation near Monte Vista, and a nonfloat washing plant in the Iowa Hill area worked ancient riverbed gravels. In these and other areas of the county stream and bench gravels were worked by a small number of miners and prospectors, who used small-scale hand equipment.

Plumas.—The demand for sand and gravel to meet requirements in county and road projects and for building construction resulted in

a higher output of these materials compared with 1957. In addition to the production by crews and contractors for the California Division of Highways, appreciable tonnages of sand and gravel were produced at fixed and portable plants, especially a portable plant near Belden. Stone production consisted primarily of fill material produced by contractors for use in constructing the Caribou Afterbay Dam. Near Tobin about 17,000 tons of stone for riprap was quarried and used on a railroad right-of-way.

The Mount Hough underground mine near Quincy was the source of manganese ore and concentrate shipped to an out-of-State Government stockpile. Gold and silver output was confined principally to small-scale placer operations near Belden, Nelson Creek, and Greenville. A sand-and-gravel-preparation plant near Belden recovered byproduct gold and silver. Gold ore from a mine dump near Blairsden yielded small quantities of gold and silver, and some silver ore from the Silver Tip claim in the Lights Creek area contained recoverable silver, lead, and zinc.

Riverside.—The Eagle Mountain open-pit iron mine was the State's major metal mine and one of two active iron mines in 1958. Production and shipments of ore were lower than in 1957, but appreciably more concentrate was produced at the adjacent beneficiation plant and shipped to the producer's blast furnaces at Fontana, San Bernardino County. Ore and concentrate were also exported.

Production and shipments of portland cement from the Crestmore plant were higher than in 1957. A new cement cooler was installed and major alterations were made on dust-control equipment. Stone production rose above 1957, owing to increased requirements in road construction and facing stone for levees. The tonnage of roofing granules produced at Temescal Canyon near Corona also increased. Stone for building construction was quarried near Whitewater. Limestone used in cement and for filler in asphalt and fertilizer was obtained from quarries near Crestmore. Limestone quarried near Riverside and Nightingale was used to produce roofing granules. Sand and gravel output was less than in 1957 due in part to reduced structural and paving requirements by the California Division of Highways. Completion of the Palo Verde diversion dam in 1957 was indirectly responsible for a lower production of these materials as concrete aggregate. More glass sand was produced near Corona than in 1957. Deposits in the Alberhill, Corona, and Elsinore areas were major sources of fire and miscellaneous clays used in pottery, pipe, and other clay products. Clay used in cement was obtained from pits near Alberhill and Riverside. Crude gypsum mined in the Little Maria Mountains was calcined at Midland and used in manufacturing gypsum products. Wollastonite float was gathered in this area and sold for decorative stone in landscaping and buildings.

The Arlington, Langdon, and Kyle groups (near Blythe) supplied manganese ore and concentrate shipped to an out-of-State Government stockpile. For the first time there was a small shipment of marketable uranium ore from claims in the McCoy Mountains to a processing plant at Tuba City, Ariz. Another operator in the same area did considerable development during the year but shipped no ore. A test shipment of uranium ore was also made from the

Lucky Three property in the Eagle Mountain area. A few ounces of gold and silver was recovered from gold ore of the Mission mine near La Cresenta that had been mined in 1957.

The single well of the Prado Dam area of the Mahala field, discovered in 1956, yielded crude oil at virtually the same rate as in 1957.

Sacramento.—Natural gas production in the Rio Vista field (which lies partly in Contra Costa and Solano Counties) declined 10 percent below 1957 but still yielded 2.5 times as much gas as the second largest producing field. Production from two of the county's smaller gasfields (the Thornton and Freeport), dropped 33 and 38 percent, respectively. Late in the year a new productive gas sand was discovered in the River Island field, and production was 13 percent above the 1957 figure. Despite the overall decline, natural gas production was exceeded by only three counties, all of which obtained large volumes of gas from crude-oil zones.

Sand and gravel production exceeded that in 1957 by 1.5 million tons, owing chiefly to increased requirements for these materials in structural and paving projects by county, State, and Federal agencies. Virtually every operator produced larger quantities of sand and gravel than in 1957, particularly in the Fair Oaks, Perkins, and Sacramento areas, where preparation plants were operated. Pits near Sacramento and Michigan Bar were the source of fire and miscellaneous clays mined for use in stoneware, firebrick, and heavy clay products.

Most of the county placer gold and silver output, second only to that in Yuba County, came from bucketline dredging on the American River. Four sand and gravel preparation plants recovered by-product gold and silver. Gold ore from the Little White Rock lode mine near Folsom yielded a few ounces of gold and silver.

Barite, soapstone, and talc mined outside the county were ground to consumer specifications in a Florin plant. Crude vermiculite from a Montana deposit was expanded for insulation and plaster in the producer's Sacramento plant.

San Benito.—Petroleum and natural gas production increased one-third over 1957, largely because of six new wells completed in the Franco pool of the Vallecitos field (southwest area). The older and much smaller Bitterwater field produced at the 1957 rate. At least two producing wells (principally gas) in the Vallecitos field were shut in awaiting a proposed pipeline connection to a utility-company gasline.

Production and shipments of portland cement from the San Juan Batista plant were appreciably lower than in 1957. Shipments were by truck, in bulk and bags, to consumers in northern and southern California. Limestone used in the cement was quarried near the plant, while shale was obtained from a quarry in San Mateo County. A Hollister quarry was the source of dolomite used by a magnesia producer in Alameda County and in manufacturing rock wool in Santa Clara County. Crushed and broken stone used for riprap, roadstone, and railroad ballast was produced at the State's largest granite quarry near Logan. The lower demand for sand and gravel by State Highway projects resulted in much of the decline in output of these materials from 1957; however, production

by crews of the San Benito County Road Department was slightly higher. Bentonite mined near Idria was used as a constituent in well-drilling muds, and a pit near Tres Pinos yielded the mineral for use as a filler in paint.

The county had 10 producing mercury mines. The Idria area was the location of the New Idria underground mine, the State's leading producer. The San Carlos open-pit operation in the same area was the only other mine producing more than 100 flasks. Concentrate from the Margaret open-pit chromite mine near Clear Creek was shipped to the Government stockpile in Oregon.

San Bernardino.—The value of mineral production was seventh highest in the State, yet 31 mineral and metal commodities were produced, nearly twice the number in the next two leading counties. Shipments of portland cement from the county's four plants was nearly 30 percent of the State total. Production and shipments at these plants—at Colton, Cushenbury, Oro Grande, and Victorville—declined 5 and 3 percent, respectively, compared with 1957. During the year new crushing and storage facilities were under construction at Oro Grande, and dust control improved. Two new 310-foot rotary kilns were installed at this plant, one of which was to replace five 125-foot kilns.

Stone production declined nearly 200,000 tons owing principally to less limestone being quarried by cement producers. Limestone from the Cushenbury quarry supplies flux for the Fontana iron and steel plant, and increased quantities of limestone for roofing granules were produced near Adelanto, San Bernardino, and Wrightwood. Miscellaneous stone quarries near Barstow were also sources of roofing granules. Marble was quarried near Victorville and used for building stone and terrazzo. Decomposed granite obtained in the Colton area was used for road base and fill. Quartz from quarries at Oro Grande and Lucerne Valley was consumed in the manufacture of cement. Sand and gravel pits in the southwest corner of the county and those in the Victorville-Barstow area were worked by operators actively engaged in producing structural and paving materials for freeway construction. Projects of the California Division of Highways used over 1 million tons of aggregate. More than half the total sand and gravel output (exceeding 6 million tons) was used in Government and commercial paving projects. Quick- and hydrated lime produced in plants at Colton and West End was sold to the building trades, used for agricultural purposes, and consumed in various chemical and industrial processes. Ball clay was dug from pits in the Ivanpah area and used in making whiteware and tile. Bentonitic clays were mined at deposits in the Yermo, Vidal, Newberry, and Daggett areas and sold for use in furnace linings, decolorizing agents, high-magnesia cement, and chemicals. Miscellaneous clay was obtained near Colton and Cushenbury for use in cement and near Chino and Highgrove for manufacturing common brick. Shale for lightweight aggregate was quarried and bloated near Chino.

Two chemical plants at opposite ends of Searles Lake recovered various compounds from the lake brines. The Trona plant extracted sodium borates, boric acid, potassium chloride and sulfate, soda ash, salt cake, elemental bromine, and crude dilithium-sodium

phosphate. The plant at West End recovered sodium borate, soda ash, salt cake, and Glauber's salt. The liquid bromine was shipped to the Los Angeles area for use in preparing bromine compounds. The crude lithium phosphate was converted by the producer to lithium carbonate. The State's entire output of calcium chloride was obtained from the brines of Bristol Lake. Two plants recovered the compound in liquid form; a third plant purchased the crude liquid chloride and produced refined liquid and flake products. Halite was mined by open-pit methods near Amboy. Much of the output was sold for use in making chlorine. At plants near Trona and Rice, salt was produced from dry-lake brines by solar evaporation. The output from the Rice plant was used in a water-softening plant.

County talc deposits yielded approximately one-third of the State output. Although 10 deposits were actively worked, 4 in the Tecopa area were the source of more than 50 percent of the production. All the crude talc produced was shipped to grinders in the Los Angeles area. The Victor mine near Oro Grande was the only producing pyrophyllite property. The Leviathan mine near Barstow was the source of crude barite. The mineral was shipped to the producer's processing plant at Compton, Los Angeles County, and used in compounding well-drilling muds. Crude perlite from the Klondike quarry was expanded in California plants outside the county for use by the building trades. Volcanic cinder produced near Ludlow was used for railroad ballast, and pumice quarried near Hinkley was prepared for use as a soil-conditioning agent.

Although the county played a minor role in crude-oil and natural gas production, there were 19 operating wells in the Mahala and Chino-Soquel fields. The volume output of petroleum and natural gas at these fields dropped 23 and 27 percent, respectively, below 1957.

The only active iron-ore property was the Iron Age. Ore from the mine was upgraded by hand sorting and magnetic separators. Although some iron concentrate was sold to the cement industry, most of the production was consigned to steel producers. The Fontana integrated operation was California's major steel plant and the only pig-iron producer. Developments at this plant, either completed or near completion by yearend, included a fourth blast furnace, increased coking capacity, oxygen-steel furnaces, and added steel rolling facilities. Utah coal supplied the coking plant. During the year manganese (oxide) ores were shipped from deposits near Pisgah and in the Owlshead Mountains area. Ore and concentrate were shipped from the Riley J. mine in the latter area. One shipment of manganese ore was made from the Monarch mine near Earp. All shipments were made to an out-of-State Government stockpile. Rare-earth concentrates, largely cerium, were produced from a barite-fluocarbonate ore mined at Mountain Pass and shipped to eastern plants. Although 11 lode mines were active, nearly all of the recoverable gold, silver, copper, lead, and zinc came from 7 mines. Only two of the properties were producers in 1958—the New Trail mine (copper ore) near Nipton and the Kelly mine (silver ore) in the Randsburg area. Several small-scale operations in the Randsburg area recovered a few ounces of placer gold and silver from stream

gravels. A small test shipment of uranium ore was made to an Arizona mill from the Este No. 2 claim in the Big Bear Lake area. Three other uranium properties were inactive.

A small tonnage of Acid-grade fluorspar produced from ore mined in the Clark Mountain area was sold to the chemical and glass industries. Feldspar mined at the Beck property near Kramer Junction was custom-ground in Los Angeles and used by the producer in manufacturing pottery and refractory brick.

San Diego.—Structural and paving projects in the San Diego, El Cajon, and Oceanside areas created a heavy demand for sand and gravel. As a result, the output of these materials was 1.5 million tons greater than in 1957. Each of several plants near San Diego prepared over one-half million tons. Specialty sands were produced and prepared near Oceanside for glass, molding, blast, and filter use. Stone production also increased, owing to the tonnages required for riprap along the sea coast and crushed for roadstone. Much of the output was quarried in the San Diego area. Small quantities of dimension and crushed granite were quarried near Escondido, Vista, and El Cajon than in 1957. Roofing granules were prepared from stone quarried near Jacumba.

Crude salt was recovered near Chula Vista from sea water by solar evaporation. Most of the output was sold to food processors in the immediate area. Magnesium chloride was recovered from the salt-works bitterns at a nearby chemical plant. Three prophyllite deposits (two in the Escondido-Rancho Sante Fe area and one near Chula Vista) were the source of nearly one-third of the State output of this mineral. However, shipments to grinders and consumers were appreciably below production figures, and year-end stocks at one deposit were high. Grinders at Escondido and Chula Vista and in Los Angeles ground the crude mineral for use as a carrier in insecticides. The Chula Vista plant also expanded crude perlite mined in California and Texas.

Gold ore mined from the Eagle Nest group of claims near Pine Valley yielded a few ounces of gold and silver.

San Francisco.—Stone quarried at Candlestick Point was used in macadam at the new Candlestick baseball stadium, the International Airport in San Mateo County, and several paving projects of the California Division of Highways. A cleanup of the 7th Street quarry, to make way for residential construction, yielded considerable stone used as fill. Sand dredged from San Francisco Bay, obtained from ocean-beach dune deposits and removed from the Sunset Reservoir, was sold and used for fill and in paving.

A San Francisco chemical plant purchased crude borates mined in Kern County and produced boric acid and sodium sulfate. At another plant talc from Inyo County deposits and soapstone mined in El Dorado County were ground and prepared for use in insecticides, paint, rice polishing, and ceramics.

San Joaquin.—Over 50 percent of the more than 2 million tons of sand and gravel produced was consumed in paving projects and road structures. The increase in output over 1957 was due primarily to requirements for paving materials by State and county agencies. The major producers operated preparation plants near Tracy and Clements and also supplied sand and gravel for building construc-

tion. Clays mined at three pits in the Stockton area were used in manufacturing sewer pipe, common brick, and mortar.

Despite considerable exploration activity, production of natural gas dropped nearly 60 percent below 1957. The sharp decline resulted principally from the rapid drop in formation pressure at the 23-year-old McDonald Island field, which had been the largest producer. This 11-well field was shut-in in March, after pressure dropped to 450 pounds. The field was subsequently acquired by a utility company for conversion to a storage facility for 30 billion cubic feet of gas (largely from out-of-State) to assure supply under peak conditions. The seven new wells in the Roberts Island-Whiskey Slough fields tripled production there. A new well was added in the Thornton & Thornton West area, yet the yield was down one-third. Four new wells were completed at the one-well Vernalis field, extending the productive area. It has been estimated that this field may soon produce 50 million cubic feet a day and could eventually rank with the Rio Vista and Beehive Bend-Willows areas.

San Luis Obispo.—Petroleum and natural gas production from five oilfields dropped 17 and 31 percent, respectively, from 1957. The Russell Ranch field, which extends into Santa Barbara County, was the largest producer, followed by the Guadalupe, Arroyo Grande, Morales Canyon, and Taylor Canyon. The heavy crudes produced were processed at the Arroyo Grande coking plant for further refining outside the county. Byproduct elemental sulfur was obtained in processing these high-sulfur crudes by separation and conversion of hydrogen sulfide in the cracked gases. The natural gas liquid yield at the Russell Ranch natural gasoline plant was only slightly lower than in 1957.

Over 50 percent of the State's chromite ore and concentrate came from four mines in the Santa Lucia Range. Approximately 1,600 tons of crude ore and 8,500 of concentrate were produced and shipped to a Government stockpile in Oregon. The yield in mercury from mines in the county was the third largest in the State. All but a few flasks were obtained from deposits in the Paso Robles area, location of the Buena Vista mine, the State's fourth largest producer. A shipment of manganese ore was made from the Fitzhugh property near Paso Robles to an out-of-State Government stockpile.

The value of the sand and gravel production was virtually the same as in 1957. Over 85 percent of the output was used in paving and road structures, chiefly at State highway projects. A portable sand and gravel plant near Santa Margarita supplied 100,000 tons of paving aggregate. Pits near Oceano were the source of sands sold as molding and engine sands. Limestone quarried near Lime Mountain was sold to sugar refineries and used for riprap and roadstone. The Santa Maria project of the Federal Bureau of Reclamation used sandstone for riprap that was quarried in the county. Nearly 68,000 tons of crushed granite was used in State and county roads during 1958. Gypsite mined near Simmler was shipped to consumers for agricultural use. Clays were mined from deposits near San Luis Obispo and used in manufacturing common brick.

San Mateo.—Production and shipments of portland cement from the Redwood City plant exceeded those in 1957. Oystershell and clay

dredged from San Francisco Bay were used in manufacturing this cement. Much of the bulk cement output was barged to a company facility in Yolo County for distribution to central and northern California points; however, shipments were also made from the plant to consumers in southern California, Nevada, and Utah. Some of the dredged oystershell was utilized in preparing poultry grit and animal foods. Stone quarried near Woodside was used as rough building stone, riprap, and drain rock and in macadam. Quarries in the Brisbane, Belmont, San Mateo, and Rockaway Beach areas were the source of crushed stone used in paving and general construction. A sand deposit at Edgemar yielded appreciable quantities of sand for paving and building construction.

A salt company at Redwood City, with major operations extending into Alameda County, recovered a large quantity of crude salt from the sea water of San Francisco Bay by solar evaporation. Nearly all of the output was exported. A South San Francisco chemical plant produced magnesium compounds from raw sea water, utilizing a calcined limestone-dolomite mixture in the process.

Although some wildcat drilling was done production of petroleum and natural gas was limited to six wells in the La Honda field and one well in the Oil Creek field. The yields in crude oil and natural gas were by 34 and 17 percent, respectively lower than in 1957.

Cinnabar ore from the Farm Hills open-pit mine near Redwood City was retorted, yielding 95 flasks of mercury.

Santa Barbara.—Petroleum production was 11 percent below 1957; however, the Standard-Humble-Summerland discovery well, completed late in the year on a State lease about 2 miles offshore near Carpinteria, may prove to be the most significant oil find of the year. As a result, much attention was given to exploration on five other offshore State leases of 3,840 acres, each of which was sold at auction in June 1958. Some leases were near onshore fields west of Santa Barbara. Natural gas yield declined 21 percent from 1957, despite two new gasfield discoveries (at Glen Anne Canyon and Refugio Cove). The output of natural gas liquids was virtually unchanged from 1957, although one of six plants in the county was abandoned during the year. Two small refineries near Santa Maria, with a combined daily capacity of 8,700 barrels, operated principally for asphalts.

Open-pit and underground quarries of the Lompoc area supplied nearly one-third of the world diatomite production. Nearby processing plants prepared the crude material for a wide variety of uses, chiefly filter aids, fillers and extenders, and insulation. Near Casmalia oil-saturated diatomaceous shale was mined and burned. The product was then prepared for sale chiefly as lightweight aggregate, although about 20 percent of the output was used by manufacturers of pozzolan cement.

Sand and gravel production increased above 1957 owing to the demand for paving materials, much of which was used in State highway construction. The major sources of these materials were pits and preparation plants near Goleta and Santa Maria. The output of sand and gravel for building construction increased 14 percent, compared with 1957. Stone production was less than in 1957, due primarily to decreased demand for riprap from quarries near

Carpinteria. Architectural stone was obtained from a sandstone quarry near San Marcos Pass. Stone quarries near Tepusquet Canyon, east of Sisquoc, supplied building stone, flagstone, and rubble. Over 4,000 tons of agricultural gypsum was mined south of Ventucopa in the Cuyama Valley. Clay mined from pits near Santa Barbara was used in the manufacture of common brick.

Mercury recovery in the county was limited to the quantities produced by furnace and retort at the Gibraltor group of claims northeast of Santa Barbara. In the Santa Ynez area, concentrate produced from ore of the Davis chromite mine and chromite ore mined on the Mesa Chrome No. 1 and No. 2 claims were shipped to the Government stockpile in Oregon.

Santa Clara.—The wet-process cement plant at Permanente operated at near capacity and shipped portland cement to consumers in California, Oregon, Washington, Nevada, Alaska, and Hawaii. A limited quantity of masonry cement was also produced. The producer installed a new swing-hammer mill for raw or finish grinding. Less limestone was quarried at Permanente, conforming with a lower cement production. The output of stone from quarries in the San Jose, Milpitas, Los Altos, and Monte Vista areas, used in building and paving, also dropped below 1957. Major sources of stone were the quarries at Permanente and near Los Altos. Some oystershell was dredged from San Francisco Bay and prepared for poultry grit. Paving projects and fill requirements required nearly 700,000 tons more sand and gravel than in 1957, and building construction in the county consumed 100,000 more tons. Pits at San Jose, Cupertino, Campbell, and Coyote were the major sources of these materials. Deposits near San Jose were mined for clays used in brick and flue linings. Magnesite quarried near Livermore was sold to Alameda County magnesia plants.

Nearly 1,300 flasks of mercury was retorted by independent producers from mine and dump ore at the New Almaden mine and from ore produced at the Guadalupe mine.

The 79-year-old Mood Gulch oilfield has not been credited with petroleum production for several years; however, two wells in the field were estimated to have yielded a few hundred barrels of crude oil in 1958.

Santa Cruz.—A dry-process cement plant at Davenport operated at capacity to supply the demand for portland cement. Limestone and sandstone used in the cement were quarried locally, and shale was obtained from the Chittenden quarry, which also supplied a cement plant in San Benito County. A relatively small tonnage of flue-dust accumulations from the Davenport plant was sold for soil improvement because of its potash content.

Limestone quarried near Portola Valley for rubble and road base also increased, compared with 1957. A quarry near Felton supplied stone used as aggregate. The combined output of sand and gravel from pits near Felton, Santa Cruz, and Scotts Valley and used for paving in the immediate areas was less than in 1957. However, the quantities of these materials shipped out of the county was substantially the same, and the output used for building construction exceeded them in 1957.

Shasta.—The lower demand for paving materials was responsible for the sharp drop (over 50 percent) in sand and gravel production, although the quantities sold and used for building construction increased several thousand tons above 1957. The principal sources of these materials were pits and plants in the Redding area, with small quantities from plants near Anderson and in the Burney, Hat Creek, and Fall River Mills areas. Crews and contractors of the Shasta County Road Department quarried virtually all the stone produced, which was used for riprap and roadstone. Volcanic cinder mined near Glenburn and McArthur was used in road construction and in manufacturing septic tanks.

The Hornet open-pit mine was the State's only pyrite producer. Although most of the ore was shipped to Contra Costa County sulfuric acid plants, some of the mineral was sold to a Nevada copper-leaching plant for the same use. The pyrite cinder from the acid plants was sold as a quick-set-cement additive.

Gold ores from mines in the Shasta, French Gulch, and Redding areas were the source of all the lode gold and most of the lode silver recovered. Copper ore mined at the Wallis property near Redding yielded recoverable copper and some silver. Much of the placer gold and silver output was from a dragline operation on the Davis property near Redding. The remaining recoveries were by miners and prospectors who used small-scale hand methods.

The concentrator at Castella upgraded chromite ore mined by the company in Butte County. A small tonnage of chromite ore mined at the Cadillac group near Platina was shipped to the Government stockpile in Oregon.

Sierra.—Lode-gold mines in the Downieville and Alleghany areas supplied most of the mineral production. Much of the gold and silver output was derived from ores of the Brush Creek mine near Downieville and the Original 16 to 1 mine near Alleghany. Ore of the former also contained recoverable zinc. The small placer gold and silver production came from one hydraulic operation near Gold Lake, one drift mine at Poker Flat, and numerous miners and prospectors who worked stream gravels by small-scale hand methods.

Sand and gravel production was limited to the output by maintenance crews of State and county agencies to meet paving requirements. Virtually all commercial demands for these materials were met by producers in adjoining counties. Quartz quarried in the Crystal Peak area was shipped to a silicon plant at Springfield, Oreg.

One shipment of uranium ore was made from the Silver Streak mine in Dog Valley to a processing plant in Utah.

Siskiyou.—Over 180,000 tons of volcanic cinder was mined at the Kegg cinder pit and used for railroad ballast. Most of the sand and gravel output was used in roads by county, State, and Federal agencies. The quantities produced were lower than in 1957, in view of the substitution of crushed stone available at sources near project sites. The tonnages sold and used for building construction by preparation plants near Yreka and Mount Shasta were also lower. Approximately 150,000 tons of stone was quarried near road-construction projects and used for riprap, roadstone, and fill.

Virtually all the lode gold and silver output was recovered by cyanidation from ore of the Siskon mine near Happy Camp. The quantities recovered at other mines and prospects were minor. Except for a few ounces reported by itinerant prospectors and miners, placer gold and silver production originated at one hydraulic operation near Etna and two dragline dredges—one at Scott River and one near Seiad Valley.

Fourteen chromite properties were active during the first half of the year, yet only 202 tons of ore and 361 tons of concentrate were produced and shipped. All shipments were made to the Government stockpile in Oregon.

Solano.—Natural gas production declined 3 percent from 1957, continuing the trend of the past several years. Approximately 30 percent of the Rio Vista field lies in Solano County, and the yield therefrom maintained it in second place among California's dry-gas-producing counties. This field supplied about two-thirds of the county total; smaller volumes were produced at the Maine Prairie, Suisun Bay, Kirby Hill, Winters, and Cache Slough fields.

Shale was quarried at the Chabot pit near Vallejo and thermally expanded for lightweight aggregate at the producer's Napa County plant. Stone quarried and crushed near Benicia, Vallejo, Suisun, and Thomasson was used principally in local paving projects. The quantities produced were less than in 1957. Lower demands for paving materials were also responsible for the decline in sand and gravel production. The output was sold and used chiefly for municipal street repair and maintenance and was supplied by preparation plants in the Rio Vista, Denverton, and Winters areas.

Sonoma.—Sand and gravel production surpassed that in 1957 by 200,000 tons. Preparation plants near Healdsburg and Windsor supplied a substantial part of the building and paving requirements, much of which was trucked to the Santa Rosa area. Stone output dropped below 1957, in view of completion of major freeway projects late in 1957. Stone quarried in the Petaluma, Cotati, and Occidental areas was sold and used for local building and paving needs. The quantities of dimension stone produced near Glen Ellen and Kenwood were virtually unchanged from 1957. Shale was quarried near Forestville and Santa Rosa and used for road fill.

The Mount Jackson mine near Guerneville was the State's second largest mercury producer. Smaller quantities of the metal were recovered from cinnabar ore at the Amazon underground mine near Cloverdale and the Mercury Bank open-pit deposit near Healdsburg. An operator near Cazadero worked the Aho manganese deposit and the Mohart No. 1 claim and shipped manganese ore to an out-of-State Government stockpile. Chromite concentrate produced from ore of the Laton mine near Cazadero and a few tons of chromite ore mined at the Meadowlark deposit near Healdsburg were shipped to the Government stockpile in Oregon.

Production from the county's one oil well and three dry-gas wells in the Petaluma area declined below 1957.

Stanislaus.—The sand and gravel output was consumed principally in building construction and in City, County, and airport paving projects. The tonnage sold and used for paving declined nearly 50

percent from 1957. Fire clay from deposits near Knight's Ferry and La Grange was used in manufacturing stoneware and heavy clay products. Stone production was limited to dimension sandstone quarried for rubble near La Grange.

Byproduct gold and silver was recovered at a sand and gravel preparation plant near Oakdale on the Stanislaus River. Cinnabar ore from the Adobe underground mine near Patterson was hand-sorted and retorted to yield a few flasks of mercury.

Sutter.—Natural gas output nearly doubled the 1957 yield. One new well was completed in the Marysville Butte field, the source of all of the county's natural gas production.

Sand and gravel production was limited to local paving requirements. A substantial part of the output was from pits in the Feather River area and was used by crews and contractors of the Sutter County Road Department. Clay was mined near Nicolaus for use outside the county in manufacturing sewer pipe.

Tehama.—Sand and gravel production came chiefly from deposits along the Sacramento River in the Red Bluff and Richfield areas. Nearly 70 percent was used for commercial paving projects or the construction and maintenance of State and county roads.

The natural gas yield (from the Corning and South Corning fields) was slightly above the 1957 output despite the fact that more than half the wells were shut in at year end. Late in December a new well was completed in the Kirkwood area, one of the four new gasfield discoveries in the State.

Chromite ores and concentrates from the Grau and Kleinsorge manganese deposits near Red Bluff, chromite concentrate produced from ore of the Pine Tree mine near Beegum, and a few tons of ore mined on the S.P. lease near Platina were purchased by GSA.

Trinity.—Virtually all the stone quarried was produced near and used in the Trinity River Dam and reservoir projects of the Federal Bureau of Reclamation. These projects and requirements of the California Division of Highways for road maintenance and construction consumed most of the sand and gravel output. Commercial production of sand and gravel was limited to local building demands in the Weaverville area.

The Altoona underground mine in the Castle Creek area was the only producing mercury mine. The Fairview Placers on the Trinity River were the source of most of the gold and silver recovered. This dredging operation terminated in April owing to construction work at Trinity Dam, and cleanup operations also yielded a small quantity of mercury. Two hydraulic operations in the Trinity River area and one on Crow Creek near Redding produced gold and silver, as did numerous small-scale placer operations at various localities in the county. Ore from two lode-gold prospects in the Trinity River and Hayfork areas yielded a few ounces of recoverable gold. Chromite concentrate produced at the Charlene Sue and Costa deposits near Castella and chromite ore mined at the Starr-Bee property near Hayfork were shipped to the Government stockpile in Oregon.

Tulare.—The Trico field, which extends into Kern and Kings Counties, was third in production among the State's dry-gas fields, despite a 22-percent drop below 1957. The total natural gas yield

(including wet gas) declined 17 percent. Crude petroleum production from the county's only oilfield—the Deer Park—was 8 percent below the 1957 volume.

Completion of major freeways in Tulare County by the California Division of Highways resulted in an appreciable decline in sand and gravel output compared with 1957. Virtually all production came from commercial preparation plants in the Lemon Cove and Porterville areas. The demand for sand and gravel in building construction was substantially the same as in 1957. Stone production was limited to the tonnages quarried and crushed by highway maintenance crews of State and Federal agencies. Miscellaneous clay mined from deposits near Exeter was used in manufacturing common brick.

Crude barite from the Barite King mine in the Nine Mile Canyon area was trucked to a crushing and jigging plant at Linnie Station, Inyo County, where the product was transshipped to the producers' grinding plant at Rosamond, Kern County. A comparatively small tonnage of the crude mineral mined from another deposit in the same area was shipped to the same grinding plant and to a Long Beach plant for compounding in well-drilling muds.

Tuolumne.—Stone production was confined to quarries in the Sonora, Columbia, and Twain Harte areas. A lime plant at Sonora operated on limestone quarried by the producer near Sonora and Columbia. The quick- and hydrated-lime products were sold to the building trades and to agricultural, chemical, and other industrial consumers. Some limestone was also sold to the glass industry and to producers of mineral foods and used as rough building stone. A quarry near Sonora supplied marble for terrazzo. Several quarries in the Twain Harte area were worked by crews and contractors of State and county road agencies. Sand and gravel output was more than twice that in 1957. Approximately 65 percent of the total was used in paving projects of county, State, and Federal agencies.

Several lode-gold prospects produced small quantities of recoverable gold and silver. A few ounces of gold was recovered from stream gravels by prospectors using small-scale hand methods. A few tons of chromite concentrate produced from ore of the Mum mine near Moccasin was purchased by GSA.

Ventura.—Ventura led all counties of the State in natural gas production, despite a 3-percent drop from 1957, and ranked third in petroleum output. In contrast to other leading oil-producing counties, where production losses ranged from 7 to 11 percent, the petroleum yield was slightly above that in 1957. There was one oil discovery at El Rio, north of Oxnard, and a new pool was also discovered in the 28-year-old San Miguelito field. The Ventura field was credited with nearly 50 percent of the petroleum yield. Production was also reported from the South Mountain, Rincon, Oxnard, Saticoy, and 16 smaller fields. The most significant development was the completion, late in the year, of the first two wells on Rincon Island. This artificial island had been under construction in 45 feet of water about one-half mile offshore on a State lease comprising 1,170 acres. Daily refining capacity in the county totaled 11,000 barrels and consisted of three small plants near Oxnard and one at Ventura. One of the former was inoperative. The county's nine

natural gasoline plants processed about 4 percent more wet gas than in 1957 and yielded 5 percent more products.

Over 2 million tons of sand and gravel was produced. Nearly 1.5 million tons of this total was used in paving, in county road construction and maintenance, for road and runways at military establishments, and in commercial paving projects. Molding and filter sands were produced and prepared near Ventura, and blast sand was obtained near Santa Paula. The tonnage of sandstone quarried at Rincon Point for riprap was credited with much of the increased stone output, compared with 1957. A quarry near Oxnard was the source of rubble used in building construction. Limestone quarried near Santa Susana was prepared for use as poultry grit, in mineral foods, and as filler in fertilizers. Quarries northwest of Stauffer and in the Ventura area supplied shale, which was expanded for lightweight aggregate. Gypsum quarried in Cuyama Valley was shipped to a Kern County cement plant for use as a retarder in portland cement.

Yolo.—Over 1 million tons more of sand and gravel was produced than in 1957. The major sources of these materials were preparation plants on Cache Creek and Putah Creek and in the Madison and Yolo areas. The output was sold and used for paving projects (65 percent) and building construction. A very substantial part of the total output was used at projects in Sacramento County.

The volume of natural gas produced dropped 42 percent from 1957. Although most of the production came from the Winters field, which extends into Solano County, smaller quantities were contributed by the Dunnigan Hills and Sycamore Slough fields. The 10-year old partly depleted Pleasant Creek field has not produced for several years; however, a utility company was considering this field for conversion to underground storage. This would be the first storage project of its kind in northern California.

Yuba.—The State's major placer-gold operation was in the Yuba River Basin near Hammonton, where a fleet of bucketline dredges treated stream gravels. A very high percentage of the placer gold and silver and all the platinum credited to the county and State were recovered at this operation. Minor quantities of gold and silver were recovered at small-scale operations by numerous prospectors. Virtually all the lode gold, silver, and copper produced was recovered from gold ore mined at the Browns Valley group of claims near Browns Valley.

Over 50 percent of the more than 1 million tons of sand and gravel produced was utilized by the U.S. Army Corps of Engineers in flood-control projects. Blast, engine, and filter sands were produced at a preparation plant near Marysville. Clay from deposits near Wheatland was used in the manufacture, outside the county, of heavy clay products. Stone production was limited to a relatively small tonnage quarried for riprap and used in Federal flood-control projects.

The Mineral Industry of Colorado

By Alfred L. Ransome,[1] Frank J. Kelly,[2] William H. Kerns,[2] and D. H. Mullen[2]

A LOWER output of petroleum—Colorado's major mineral product—resulted in a reversal of the overall mineral-value trend for the State, which until 1958 had been continuously upward for 12 years. Minerals produced in Colorado in 1958 were valued at $305.3 million, 10 percent below the 1957 record of $338.5 million. Molybdenum and uranium again were the principal commodities in the metals group, and cement and sand and gravel were the primary nonmetals.

Mineral fuels represented 59 percent of the value of mineral production—1 percent less than in 1957. Petroleum, which alone accounted for nearly one-half of the total value, decreased 12 percent in quantity and 13 percent in value of production, partly because of gradual depletion of the older fields in the Colorado section of the Denver-Julesburg basin but primarily because of a lower output from the Rangely field inherent to the start of unitizing operations. Coal production was less than in 1957 by 17 percent, largely because of a lower demand for coking coal, and the $19.3 million value represented 6 percent of the value of the State's mineral production.

Metals accounted for 27 percent of the value of all minerals produced—2 percent less than in 1957—and as a group declined in value from $99.6 million in 1957 to $81.8 million in 1958. A reduced demand for molybdenum resulting from a drop in iron and steel production and a 3-month strike were direct causes of the substantial decline in output of this most important Colorado metal commodity. Uranium, second to molybdenum in significance to the mineral economy in Colorado, showed a marked advance in both production and value in 1958 and represented 18 percent of the total domestic output. However, the rise was insufficient to offset decreases for other metal-group commodities. Prices of copper, lead, and zinc continued to decline, and total value of a lower output for each of these base metals and also gold and silver was only $17.7 million—a 31-percent drop from 1957.

Among the 14 nonmetals produced, the most significant advances (both in quantity and value of production) were made by those in the construction industry—cement, sand and gravel, and stones.

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Nonmetal production, as a group, was 22 percent above 1957 in terms of value, and accounted for 14 percent of the value of all minerals produced.

TABLE 1.—Mineral production in Colorado [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate [2]—gross weight	182	$91	134	$58
Clays—thousand short tons	403	978	449	1,111
Coal—do	3,594	21,831	2,974	19,305
Columbium-tantalum concentrate—pounds	103	(3)	2,280	7
Copper (recoverable content of ores, etc.)	5,115	3,079	4,193	2,206
Feldspar—long tons	43,818	307	34,648	237
Gem stones	(4)	35	(4)	38
Gold (recoverable content of ores, etc.)—troy ounces	87,928	3,077	79,539	2,784
Gypsum—thousand short tons	(3)	(3)	103	341
Lead (recoverable content of ores, etc.)	21.003	6.007	14,112	3,302
Lime—thousand short tons	2	45	(3)	(3)
Manganese ore and concentrate (35 percent or more Mn)—gross weight	175	14	210	17
Mica:				
Scrap	312	6	387	6
Sheet—pounds	14	(3)		
Natural gas—million cubic feet	[5] 95,259	[5] 9,526	82,464	8,659
Natural-gas liquids:				
Natural gas—thousand gallons	(3)	(3)	[6] 49,505	[6] 3,410
LP-gases—do	(3)	(3)	[6] 68,027	[6] 3,343
Peat	3,559	(3)	7,143	41
Petroleum (crude)—thousand 42-gallon barrels	[5] 54,982	[5] 166,046	[6] 48,309	[6] 144,444
Pumice—thousand short tons	25	53	34	65
Pyrites—thousand long tons	62	(3)	67	359
Rare-earth metals ore and concentrates	[5] 749	[5] 24	650	35
Sand and gravel—thousand short tons	16,400	13,994	20,626	17,842
Silver (recoverable content of ores, etc.) thousand troy ounces	2,788	2,523	2,056	1,860
Stone—thousand short tons	2,438	4,168	2,930	4,943
Tungsten concentrate—60-percent WO_3 basis	45	55	(3)	(3)
Uranium ore	740,055	15,605	939,706	22,486
Vanadium—thousand pounds	6,264	(3)	4,791	(3)
Zinc (recoverable content of ores, etc.)	47,000	10,904	37,132	7,575
Value of items that cannot be disclosed: Carbon dioxide, cement, fluorspar, iron ore, molybdenum, perlite, salt, and values indicated by footnote 3		[5] 81,907		62,855
Total Colorado [7]		[5] 338,504		305,284

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Colorado also shipped 42 tons low-grade beryl (2.84 percent BeO) valued at $5,000 in 1958.
[3] Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."
[4] Weight not recorded.
[5] Revised figure.
[6] Preliminary figure.
[7] Total has been adjusted to eliminate duplicating the value of raw material used in manufacturing cement and lime.

Union Carbide Nuclear Co. began operation of its new 1,000-ton-per-day uranium mill at Rifle in January; Cotter Corp. started operating its 100-ton-a-day uranium pilot mill at Canon City in July; and the Vanadium Corp. of America closed its Naturita uranium mill January 31 and expanded facilities at Durango. American Metal Climax, Inc., in early spring completed its new byproducts-unit of its molybdenum plant at Climax for the recovery of tungsten, tin, and pyrite.

Experiments on retorting oil shale were continued during the year by two private firms, but operation of the experimental plant at Grand Valley was suspended in July.

Of particular significance to the nonmetal mineral industry in 1958 was the closing of the feldspar grinding plant at Denver and mica grinding mill at Pueblo by International Minerals & Chemical Corp., and the shutdown by Ozark-Mahoning Co. of its Jamestown fluorspar operation December 31.

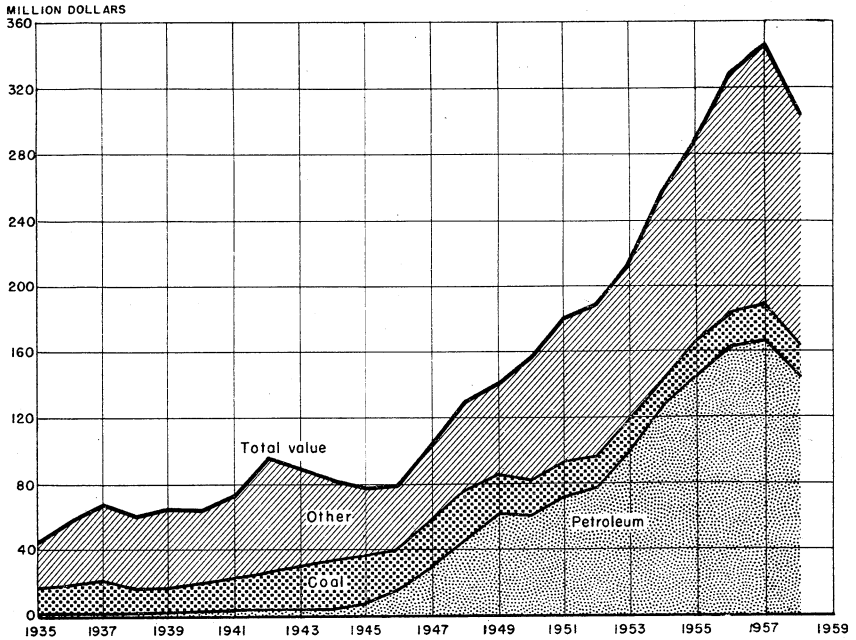

FIGURE 1.—Value of petroleum, coal and total value of all minerals produced in Colorado, 1935–58 (excludes uranium 1941–55).

Employment and Injuries.—The annual average employment in the mining industry in Colorado in 1958 declined 5 percent and that of metal mining alone 9 percent. Detailed data on employment and earnings presented in the accompanying table were supplied by the Bureau of Labor Statistics.

During 1958 there were 13 fatal accidents in the mineral industries, including 2 in coal mining, compared with 6 and none, respectively, in 1957. Preliminary figures indicate a total of 611 injuries (including 574 temporary) in the mineral industry in 1958 compared with 702 (676 temporary) in 1957. The greatest proportion was in metal mining.

Legislation and Government Programs.—Government participation in strategic minerals search continued in 1958 but at a considerably lower rate than in 1957. Ten Defense Minerals Exploration Administration (DMEA) contracts were executed during the year for a total of $492,200 (14 totaling $808,500 in 1957). Contracts during 1958 covered exploration principally for uranium, but also for lead, zinc, and copper, in nine counties; details are given in the Review by Counties section. DMEA expired June 30 and was superseded later in the year by the Office of Minerals Exploration (OME) within the U.S. Department of the Interior.

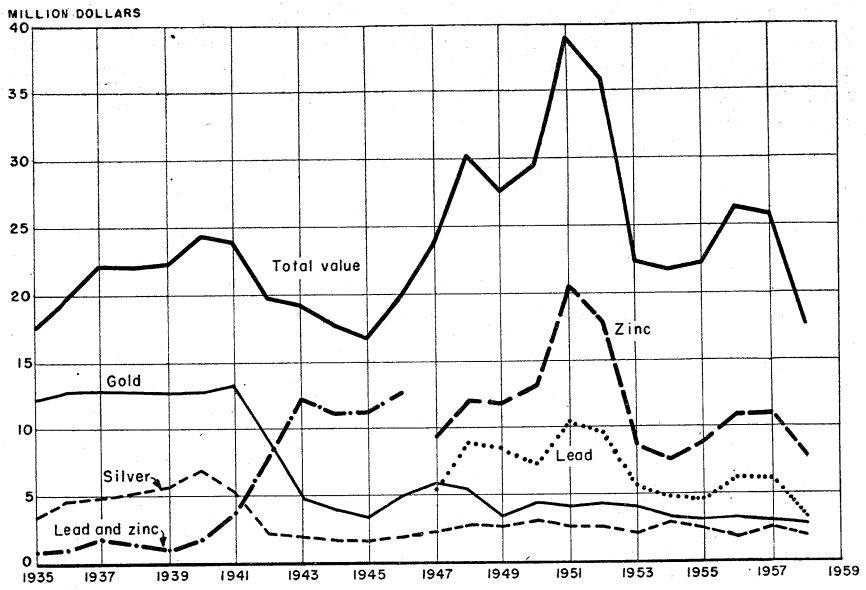

FIGURE 2.—Value of mine production of gold, silver, lead, and zinc and total value of these minerals (including copper) in Colorado, 1935–58.

TABLE 2.—Average employment, average hourly earnings, average weekly hours, and average weekly earnings in the nonagricultural and mining industries of Colorado [1]

[U.S. Department of Labor, Bureau of Labor Statistics]

Industry	Average employment		Average hourly earnings [2]		Average weekly hours [2]		Average weekly earnings [2]	
	1957	1958	1957	1958	1957	1958	1957	1958
Total nonagricultural	465,100	457,700						
Total mining	15,800	15,000	$2.46	$2.48	41.1	39.2	$101.11	$97.22
Metal mining	6,500	5,900	2.34	2.30	43.7	41.2	101.32	94.76
Coal mining	2,400	2,000	2.94	3.00	33.1	29.8	97.31	89.40
Petroleum and natural gas	6,000	6,300	2.43	2.49	43.3	41.7	105.22	103.83
Other mining and quarrying	900	800						

[1] Average employment includes all full- and part-time workers below administrative. Average earnings are gross earnings and include overtime pay, night differential, and special pay before deductions and taxes; such earnings are not wage rates or take-home pay. In contract construction work some employees are commonly engaged in mining construction materials. These men are not included in the table totals, as industry itself does not make the distinction in its employment records.

[2] Production workers; excludes administrative and nonworking supervisory personnel.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Asphalt and Related Bitumens.—The processing plant of the American Gilsonite Co. near Fruita in Mesa County completed a full year of operation in April with highly successful results, and all units operated in excess of design rates. Plans for a $400,000 expansion that would increase capacity of the plant from 700 to 850 tons a day were announced. Completion of the program was scheduled for mid-1959.

Shale Oil.—Union Oil Co. continued research mining and retorting of oil shale at its Grand Valley plant. The company reported that oil could be produced from oil shale at a cost competitive with domestic petroleum. Some shale oil was used for various purposes by mining companies in western Colorado—the first time shale oil has been used by industry. Because of abundant supplies of petroleum from foreign sources at Pacific coast refineries during the first half of the year, operations at the Grand Valley plant were suspended in July.

The Denver Research Institute continued its investigations and operation of a pilot plant in Denver designed for research and development of the Swedish Aspeco process for the Oil Shale Corp. Major changes and improvements in the equipment have been made. Operation of the plant provided engineering data from which construction and operating costs of a commercial plant could be estimated. The corporation announced plans to build a 1,200- to 2,400-ton-a-day plant in western Colorado, which would be 1 unit of a full-scale commercial plant consisting of 8 to 16 such units having a total capacity of 9,000 to 38,000 tons of raw shale daily when completed.

Considerable interest was shown in a proposal to detonate a nuclear device at a depth of approximately 900 feet in an oil-shale deposit to determine the extent and type of fracturing. The test would be a joint operation of the Federal Bureau of Mines, Atomic Energy Commission, and participating representatives of fuel and chemical industries. The proposed experiment is part of the search for a low-cost method of utilizing the oil-shale resource.

Carbon Dioxide.—Production of carbon dioxide for the manufacture of dry ice and liquid carbon dioxide from wells in Las Animas and Montezuma Counties increased 25 percent over that of 1957. Output of processing plants in Bent and Montezuma Counties was marketed in the Four Corners area of Colorado, New Mexico, Arizona, and Utah; shipments also were made to consumers in Montana and Texas. Carbon dioxide from oil wells in Jackson County was vented.

Coal.—Production of coal declined 17 percent below that in 1957. Reduced demand for steel in the early part of the year forced curtailment at some mines that produced coking coal used exclusively for the manufacture of coke at steel plants in Colorado, Utah, and California. Two mines, both in Routt County, were closed early in the year. The Harris mine was abandoned on January 31 after 44 years of operation, and the Keystone mine was closed on February 28 after 32 years of operation. The latter was partly reopened near the end of the year. Production in excess of 1,000 tons each was from 108 mines (101 underground, 7 strip) in 16 counties.

The Federal Bureau of Mines, at Denver, continued its coal research. Reports [3] describing results of work were published.

A certificate of honor from the Joseph A. Holmes Safety Association was presented to the State of Colorado by Marling J. Ankeny,

[3] Goodman, J. B., Gomez, M., and Parry, V. F., Laboratory Carbonization Assay of Low-Rank Coals at Low, Medium, and High Temperatures: Bureau of Mines Rept. of Investigations 5383, 1958, 49 pp.
Gomez, M., Goodman, J. B., and Parry, V. F., General Properties of Low-Temperature Tar: Bureau of Mines Bull. 569, 1958, 31 pp.
Lammers, G. C., Allen, R. R., Donaven, D. J., Wagner, E. O., and Parry, V. F., A Study of the Feasibility of Hydraulic Transport of a Texas Lignite: Bureau of Mines Rept. of Investigations 5404, 1958, 39 pp.

TABLE 3.—Production of coal, by counties
(Exclusive of mines producing less than 1,000 tons annually)

County	1957		1958	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Delta	61,674	$5.45	49,503	$5.67
El Paso	[2] 263,729	[2] 6.75	7,599	7.11
Fremont	224,503	3.71	250,634	3.76
Garfield	38,441	5.45	20,184	6.24
Gunnison	290,958	5.93	283,661	5.88
Huerfano	69,297	6.46	63,269	6.41
Jackson	1,448	5.37	31,133	2.32
La Plata	38,737	4.10	33,058	5.03
Las Animas	1,318,124	7.78	768,275	10.24
Mesa	76,617	6.95	84,388	5.57
Moffat	108,024	5.71	[3] 388,661	[3] 7.37
Montezuma	1,035	4.10		
Montrose	1,974	5.95	1,991	7.49
Pitkin	(2)	(2)	(3)	(3)
Rio Blanco	12,901	5.97	12,653	7.20
Routt	465,065	4.11	399,169	3.89
Weld	621,102	4.70	580,011	4.70
Total	3,593,629	6.08	2,974,189	6.49

[1] Value received or charged 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 as estimated by producer at average prices that might have been received if such coal had been sold commercially).
[2] Production of Pitkin County combined with El Paso County to avoid disclosing individual company confidential data.
[3] Production of Pitkin County combined with Moffat County to avoid disclosing individual company confidential data.

President of the association and Director of the Federal Bureau of Mines, in recognition of operating 139 coal mines from November 3, 1956, to February 2, 1958, without a fatal accident. An average of 2,650 men produced 4.5 million tons of coal during the period. The nonfatality period continued until August 1, 1958—22 consecutive months.

Data collected by the Federal Bureau of Mines from 132 underground and 7 strip mines show 2,284 men employed, with 2 fatal accidents and 169 temporary injuries in 1958 compared with data from 112 underground and 5 strip mines reporting in 1957 showing 2,527 men employed with no fatalities and 141 temporary injuries. The same data show productivity rates of 6.7 tons of coal mined per man-shift in 1957 and 7.4 tons in 1958.

Natural Gas.—Marketed natural gas decreased 13 percent under 1957 and accounted for 3 percent of the 1958 value of the State's mineral production. Major sources of dry gas were fields in Rio Blanco, Moffat, La Plata, and Logan Counties. Natural gas from oil wells was processed at plants in Logan, Moffat, Morgan, Rio Blanco, and Washington Counties. Residual gas from these plants was marketed through pipelines to consumers. Twenty new gas fields were discovered, 4 each in Garfield, Logan, and Mesa Counties, 2 in Baca and Moffat Counties, and 1 each in Montezuma, Morgan, Prowers, and Rio Blanco Counties. Sixty successful development wells were completed, most of which were in fields in La Plata (38), Moffat (6), and Morgan (5) Counties.

Natural-Gas Liquids.—Natural gasoline, propane, and butane were recovered from wet-petroleum gases at six plants in Logan, Moffat,

Morgan, Rio Blanco, and Washington Counties. Natural gasoline recovered was only slightly more than in 1957. Liquid-petroleum gases (propane and butane) recovered increased 27 percent over the previous year.

Peat.—Peat humus was mined in Boulder, Gilpin, and Teller Counties for use as an admixture in fertilizers and as a soil conditioner. Production doubled that of 1957.

Petroleum.—Production of petroleum from 242 fields in 17 counties dropped 12 percent. Declines were noted in all major producing counties in the Denver-Julesberg basin primarily because of gradual depletion of the older fields. The decline of production in Rio Blanco County of 5.4 million barrels was entirely at the Rangely field where repressuring and the beginning of waterflood operations under unit operation required altered production schedules.

TABLE 4.—Production of crude petroleum, by counties [1]

(Thousand barrels)

County	1957	1958 (preliminary)	Principal fields in 1958 in order of production
Adams	1,002	773	Badger Creek, Middlemist, Beacon.
Archuleta	137	117	Price Gramps.
Bent	6	1	Bent's Fort.
Boulder	3	3	Boulder.
Fremont	25	27	Florence-Canon City.
Jackson	888	925	McCallum, McCallum-S, Battleship.
Jefferson	1	2	Soda Lake.
Kiowa	7	----	
La Plata	12	18	Red Mesa, Barker Dome.
Larimer	226	206	Fort Collins, Wellington.
Logan	6,517	5,696	Yenter, Graylin-NW, Cliff, Atwood-E.
Moffat	1,375	1,159	Powder Wash, Iles.
Montezuma	5	4	Dove Creek.
Morgan	6,838	7,241	Adena, Bijou-W, Zorichak.
Rio Blanco	28,470	23,078	Rangely Weber, Wilson Creek, Rangely Mancos Shale.
Routt	94	161	Tow Creek.
Washington	7,028	6,793	Plum Bush Creek, Big Beaver, Little Beaver.
Weld	2,348	2,105	Pierce, Black Hollow, New Windsor.
Total	54,982	48,309	

[1] Distribution by county effected by use of Colorado Oil and Gas Conservation Commission data adjusted to Bureau of Mines total.

Total drilling declined from 855 completions and 4.5 million feet in 1957 to 836 completions and 4.3 million feet in 1958. There were 32 oil discoveries and 20 gas discoveries in 1958 compared with 34 oil discoveries and 18 gas discoveries in 1957. Drilling in the Colorado portion of the Denver-Julesburg basin increased considerably over 1957 with 621 completions, a gain of 87 wells. Much of the drilling was centered in Morgan County where discoveries in the Bijou area stimulated substantial exploration and development. Considerable drilling was done in the southwestern counties in the Colorado portion of the Paradox basin without marked success; one well in Montezuma County produced 38 barrels of oil from the Paradox formation at a depth of 6,055 feet, and a gas discovery in Montrose County produced 630,000 cubic feet from the Hermosa formation at a depth of 7,151 feet.

TABLE 5.—Wildcat- and development-well completions in 1958, by counties

[Oil and Gas Journal]

County	Crude	Condensate	Gas	Dry	Total	Footage	County	Crude	Condensate	Gas	Dry	Total	Footage
WILDCAT							WILDCAT—Con.						
Adams				12	12	68,700	San Miguel				2	2	7,500
Arapahoe				4	4	22,700	Washington	7			90	97	413,100
Archuleta				6	6	6,600	Weld	5			50	55	419,800
Baca	1		2	8	11	57,900	Yuma				3	3	19,300
Bent				7	7	37,400							
Boulder				2	2	7,100	Total wildcat	31	1	20	433	485	2,508,900
Crowley				1	1	7,200	DEVELOPMENT						
Delta				1	1	1,700							
Dolores				5	5	29,300	Adams	2			4	6	41,000
El Paso				1	1	1,700	Archuleta				1	1	1,200
Fremont				6	6	13,100	Fremont				4	4	12,200
Garfield			4	3	7	27,100	Garfield			3	3	6	23,600
Grand				5	5	8,900	Jackson	1	1		3	5	21,000
Jackson		1		4	5	19,200	Kiowa			1		1	4,900
Kiowa				2	2	11,100	Larimer	1				1	4,900
Kit Carson				3	3	18,300	La Plata	3		38	2	43	240,400
Las Animas				1	1	6,200	Logan	21		3	26	50	253,900
Larimer				4	4	19,100	Mesa			2		2	10,200
La Plata				4	4	9,700	Moffat	3		6	6	15	76,300
Lincoln				4	4	21,800	Montezuma	1			5	6	2,900
Logan	4		4	78	86	444,000	Morgan	46		5	38	89	520,400
Mesa			4	10	14	55,000	Rio Blanco	3		2	6	11	41,000
Moffat	2		2	9	13	70,600	Routt	4			3	7	25,800
Montezuma	1		1	9	11	65,400	Washington	23			49	72	350,600
Montrose				1	1	1,900	Weld	10			22	32	212,500
Morgan	8		1	73	82	456,300							
Ouray				1	1	3,800	Total development	118	1	60	172	351	1,842,800
Prowers			1	3	4	21,300							
Pueblo				1	1	2,900							
Rio Blanco	1		1	11	13	87,000	Total all drilling	149	2	80	605	836	4,351,700
Routt	2			9	11	46,200							

METALS

Beryllium.—There was a 26-percent decline in the quantity of beryllium concentrate sold and a 36-percent drop in the value of output. Only 11 mines were operated compared with 19 in 1957. The Colorado beryl production depended on the ability of mine operators to sell or market feldspar, mica, and other commercial pegmatite minerals in addition to beryl. In 1958 the outlet for feldspar and mica at Denver and Pueblo, respectively, was eliminated by the closing of both plants by International Minerals & Chemical Corp.

The Boomer lode near St. George, Park County, was the major producer in the United States. Ore from this property was sold mainly to the Government purchase depot at Custer, S. Dak., although some material was shipped to Antero Refining Co. near Poncha Springs. In addition, 42 tons of low-grade beryl (2.84 percent BeO) was sold to Mineral Concentrates & Chemical Co. at Loveland. Mile High Oil Co. took over operation of the Boomer lode on December 1, 1958.

The Beryl Ores Co. continued to process both domestic and foreign beryl at its plant at Arvada. Reportedly the Poncha Springs beryllium-oxide plant of Antero Refining Co. was shut down after several months of operation.

Cadmium, Indium, and Thallium.—The American Smelting and Re-

fining Co. recovered cadmium, indium, and thallium from flue dust, dross, and other byproduct material shipped from other company smelters to its Globe smelter at Denver.

Columbium-Tantalum.—Fremont County continued to be the principal source of columbium-tantalum, and output reached 2,280 pounds compared with 103 pounds in 1957. Three mines in Fremont County and one in Jefferson County accounted for the entire production; all but a small quantity was shipped to the Government purchase depot at Custer, S. Dak.

Copper.—Copper production decreased 18 percent, and value of copper output declined 28 percent compared with 1957. The principal copper producer was Idarado Mining Co. from its Treasury Tunnel-Black Bear-Smuggler Union group of mines in the Upper San Miguel district of San Miguel County. Copper was recovered from the ore as a coproduct of lead, zinc, gold, and silver. The New Jersey Zinc Co., operating the Eagle mine in the Red Cliff district of Eagle County, was second to Idarado.

Gold.—Output of gold decreased 10 percent below 1957. The Idarado Mining Co. operation in San Miguel County was the leading source of gold and was followed closely in gold output by the Golden Cycle Corp.'s Ajax mine in the Cripple Creek district of Teller County. These two, plus three other operations mining ore from underground workings and shipping ore from mine dumps in the Cripple Creek district, and one mine each in Eagle and Clear Creek Counties, made up the seven major gold producers that accounted for 92 percent of the gold output.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousand)	Value (thousands)
1949-53 (average)	188	23	1,393	118,665	$4,153	2,838	$2,568
1954	123	19	973	96,146	3,365	3,417	3,093
1955	120	14	908	88,577	3,100	2,772	2,509
1956	124	18	1,156	97,668	3,418	2,285	2,068
1957	115	16	1,111	87,928	3,078	2,788	2,523
1958	91	17	869	79,539	2,784	2,056	1,860
1858-1958	--------	--------	[3]	40,424,205	908,724	763,502	597,505

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1949-53 (average)	3,061	$1,448	27,203	$8,331	48,041	$14,294	$30,794
1954	4,523	2,669	17,823	4,883	35,150	7,592	21,602
1955	4,323	3,225	15,805	4,710	35,350	8,696	22,240
1956	4,228	3,594	19,856	6,235	40,246	11,027	26,342
1957	5,115	3,079	21,003	6,007	47,000	10,904	25,591
1958	4,193	2,206	14,112	3,302	37,132	7,575	17,727
1858-1958	292,844	90,199	2,730,336	320,089	1,858,190	341,915	2,258,432

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old slag, or tailings shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed.
[3] Figure not available.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1958, by counties, in terms of recoverable metals

County	Mines producing [1]		Lode material sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
Adams		6		1,053	$36,855	146	$132
Boulder	6	1	664	123	4,305	8,282	7,495
Chaffee	1		52	3	105	569	515
Clear Creek	9	1	8,603	1,401	49,035	27,051	24,483
Custer	1		40			357	323
Eagle	2		300,894	3,903	136,605	1,103,857	999,046
El Paso			(2)	13	455	2	2
Gilpin	6	2	8,372	238	8,330	714	646
Grand	1		45			4	4
Gunnison	3		36	1	35	1,638	1,482
Hinsdale	1		2			14	13
Jefferson		4		504	17,640	81	73
Lake	6		6,966	207	7,245	16,246	14,703
La Plata	1		2			898	813
Mineral	3		26,988	785	27,475	92,841	84,026
Montezuma	1		36	82	2,870	969	877
Montrose	1	1	238	3	105	5,302	4,799
Ouray	2		257	201	7,035	1,866	1,689
Park	5		3,781	58	2,030	37,886	34,289
Rio Grande	1		134	6	210	14	13
Routt	1		4			7	6
Saguache	6		11,169	34	1,190	16,866	15,265
San Juan	7		17,049	1,205	42,175	33,336	30,171
San Miguel	3		382,421	26,626	931,910	696,166	630,065
Summit	5	2	1,413	36	1,260	3,560	3,222
Teller	19		99,737	43,057	1,506,995	6,845	6,195
Total: 1958	91	17	868,903	79,539	2,783,865	2,055,517	1,860,347
1957	115	16	1,110,892	87,928	3,077,480	2,787,892	2,523,183

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Adams							$36,987
Boulder	(2)	$237	8	$1,872			13,909
Chaffee	1	631	13	3,136			4,387
Clear Creek	26	13,413	281	65,719			152,650
Custer			1	187			510
Eagle	1,585	833,631	4,091	957,341	24,885	$5,076,540	8,003,163
El Paso							457
Gilpin	1	526	2	374			9,876
Grand	2	999					1,003
Gunnison	(2)	79	5	1,158			2,754
Hinsdale	(2)	26					39
Jefferson							17,713
Lake	1	289	181	42,377			64,614
La Plata							813
Mineral	40	20,882	1,233	288,569	1,019	207,896	628,848
Montezuma	(2)	237	(2)	12			3,996
Montrose	8	4,234					9,138
Ouray	1	579	9	2,153			11,456
Park	6	3,235	677	158,313			197,867
Rio Grande	5	2,814					3,037
Routt			(2)	23	1	153	182
Saguache	20	10,494	261	61,203	231	47,124	135,276
San Juan	48	25,274	391	91,529	274	55,804	244,953
San Miguel	2,448	1,287,175	6,874	1,608,457	10,593	2,161,105	6,618,712
Summit	1	763	85	19,785	129	26,306	51,336
Teller							1,513,190
Total: 1958	4,193	2,205,518	14,112	3,302,208	37,132	7,574,928	17,726,866
1957	5,115	3,079,230	21,003	6,006,858	47,000	10,904,000	25,590,751

[1] Operations at slag dumps and old mill or miscellaneous cleanups not counted as producing mines.
[2] Less than 1 ton.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1958, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	33	108,160	43,489	8,175	2,200	2,900	----
Dry gold-silver	9	3,140	278	5,971	4,500	127,700	----
Dry silver	7	477	11	7,036	700	5,800	----
Total	47	111,777	43,778	21,182	7,400	136,400	----
Copper	7	37,611	3,194	803,748	2,746,000	290,900	----
Copper-lead and copper-lead-zinc [2]	3	384,959	26,932	714,468	4,923,000	13.911,200	21,223,700
Lead	25	16,326	1,477	77,040	74,100	2,251,400	15,500
Lead-zinc	12	313,418	2,253	426,410	630,700	11,397,600	52,987,500
Zinc	2	76	1	448	100	6,000	37,300
Total	45	752,390	33,857	2,022,114	8,373,900	27,857,100	74,264,000
Other "lode" material:							
Dry gold:							
Cleanings	(3)	(4)	5	2	----	----	----
Mill cleanings	(3)	(4)	15	4	----	----	----
Old tailings	1	100	5	1	----	----	----
Copper cleanings	(3)	10	----	4	1,500	----	----
Lead:							
Cleanings	(3)	1	26	11	----	100	----
Mill cleanings	(3)	47	184	1,385	2,100	14,900	----
Old slag	(3)	4,518	21	10,564	1,100	213,900	----
Old tailings	1	60	1	6	----	1,600	----
Total	2	4,736	257	11,977	4,700	230,500	----
Total "lode" material	91	868,903	77,892	2,055,273	8,386,000	28,224,000	74,264,000
Gravel (placer operations)	17	----	1,647	244	----	----	----
Total, all sources	108	868,903	79,539	2,055,517	8,386,000	28,224,000	74,264,000

[1] Detail will not necessarily add to totals because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] From properties not classed as mines.
[4] Less than 1 ton.

Gold from 19 mines in Teller County represented 54 percent of the gold output, and gold from 3 mines in San Miguel County 33 percent. The remainder came from 73 mines in 18 other counties. All of the gold from Teller County came from gold ore and was recovered at the Carlton mill. Fifty-five percent of the gold output came from ores of gold and silver, 43 percent from ores of copper, lead, and zinc, and the remaining 2 percent (except for a small quantity from clean-up, slag, and tailings material) from placer mining.

Iron Ore.—Output of iron ore increased threefold over that of 1957. All was brown ore produced and shipped by C. K. Williams & Co. from the Iron Springs Placer deposit for use in the manufacture of paint.

Iron ore for The Colorado Fuel and Iron Corp. steel plant at Pueblo was obtained from company mines in Utah and Wyoming. Curtailment of operations at this plant in December 1957 continued throughout the first quarter of 1958. As new orders for products were received, 500 mill workers were called back to work on April 7 and an additional 400 resumed work on April 28. Operations were normal throughout the remainder of the year. Modernization and expansion at the plant during the year included the rebuilding of 31 coke ovens,

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1958, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation:					
Ore	9,385	3,373			
Cleanings	5	2			
Old tailings	5	1			
Total	9,395	3,376			
Cyanidation: Ore	42,546	6,860			
Total recoverable in bullion	51,941	10,236			
Concentration, and smelting of concentrates:					
Ore	22,078	1,179,569	5,618,400	26,140,400	74,264,000
Old tailings	1	6		1,600	
Total	22,079	1,179,575	5,618,400	26,142,000	74,264,000
Direct-smelting:					
Ore	3,626	853,494	2,762,900	1,853,100	
Cleanings	26	15	1,500	100	
Mill cleanings	199	1,389	2,100	14,900	
Old slag	21	10,564	1,100	213,900	
Total	3,872	865,462	2,767,600	2,082,000	
Placer	1,647	244			
Grand total	79,539	2,055,517	8,386,000	28,224,000	74,264,000

installation of new grinding and galvanizing units, enlargement of the coupling shop, and the installation of new blast furnace hoisting and charging equipment.

Lead.—Lead output dropped 33 percent, and value of production declined 45 percent (from $6 to $3.3 million) compared with 1957. The value decline resulted not only from a reduced production but also from a lower price for lead; the 1958 weighted annual average price for lead was 11.7 cents per pound compared with 14.3 cents for 1957 and 15.7 cents for 1956. The production drop primarily was due to yearlong inactivity of three former major lead and zinc producers (Rico Argentine Mining Co. at Rico in Dolores County, the Keystone Unit of the American Smelting and Refining Co. in Gunnison County, and Resurrection Mining Co. in Lake County), which had been closed in mid-1957.

The leading 1958 lead producers (in order of output) were Idarado Mining Co. (Treasury Tunnel-Black Bear-Smuggler Union group of mines), The New Jersey Zinc Co. (Eagle mine), and Emperius Mining Co. (Emperius mine). These three mines supplied 86 percent of the lead output. The first two companies had a full year's operation, but Emperius Mining Co. closed its mine and mill at Creede from June 1 to early November, the first general shutdown of this operation in 25 years. It was reopened on a curtailed basis.

Manganese.—Manganese-ore production (shipments) from one mine each in Custer, El Paso, and Summit Counties and two each in Fremont and Saguache Counties was 20 percent above 1957. All was marketed under the Government "carlot" program administered by the GSA.

United States Manganese Corp. (owned by Vitro Corp. of America and Sheer-Korman Associates, Inc.—each 40 percent interest—and the Great Divide Mining and Milling Corp.—20 percent) continued development of the Hierarc process for the production of manganese compounds from rhodonite deposits in the Eureka area of San Juan County near Silverton. The work was done in a pilot plant at West Orange, N.J., under a GSA contract.

Molybdenum.—The entire production of molybdenum came from the Climax mine in Lake County operated by Climax Molybdenum Co. Division, American Metal Climax, Inc. A substantial decline in output resulted from a reduction in the demand for molybdenum caused by a drop in iron and steel production, particularly alloy steels. Because of this, production from Climax was rescheduled at a lower rate in the spring of 1958 and the employee workweek was reduced from 48 to 40 hours. Compensatory wage increases that the company considered unwarranted were demanded by the workers, and a 12-week strike resulted, which further reduced the total output for the year from this mine. In its annual report the company reported that molybdenum production was 40 percent less than in 1957.

Rare-Earth Metals and Thorium.—Shipments of rare-earth and thorium minerals reached 650 tons valued at $35,000 and consisted almost entirely of thorite mined and processed within the State. The stimulus to thorium production resulted from the purchase of thorium ores by Wah Chang Corp. for milling at its Marion mill near Boulder. The concentrate was shipped to an eastern company for further processing. As a result of the outlet for thorite, the mine production of rare-earth and thorium minerals reached 1,008 tons from approximately 16 properties in 5 counties. The Zabel-Beardsley lease in the Hardscrabble District of Custer County was operated by Calico Minerals, and 440 tons of thorite was produced, making it the largest single thorite-producing property. The Cotter Corp. of Canon City recovered low-grade thorite from the Star claims in Custer County, making it the second largest producer. The Anna Lee mine, operated by George Austin & Richard Reese, Gendev Corp., Leland Niles, and Peter Seerie Corp., was also an important source of thorite.

Wah Chang Corp. by yearend discontinued operation of its mill because of high operating cost and the transportation cost to east coast markets. As a result, practically all mining operations were discontinued.

Activity in the rare-earth field consisted mainly of small exploration and development in Jefferson and Park Counties. A small quantity of yttrium mineral specimens was sold.

Silver.—Silver production was 26 percent less than in 1957. Ninety-eight percent was recovered as a byproduct of ores of copper, lead, and zinc, 1 percent from ores of gold and silver, and 1 percent from cleanup, slag, and tailings material and placer mining. Five operations—The New Jersey Zinc Co., Idarado Mining Co., Emperius Mining Co., Leadville Lead Corp., and Bald Eagle Mining Co.-Jackpot Oil Co. (Bald Eagle mine)—supplied 95 percent of the production.

Tin.—Tin concentrate was recovered as a byproduct of the treatment of molybdenum ore from the Climax mine, but none was reported as production in 1958 because it was not marketed. A new byproduct

plant, reported by American Metal Climax, Inc., to have cost approximately $2 million, was placed in operation early in the spring. Tailing from the Climax molybdenum mill is treated in the new plant to recover tin, tungsten, and pyrite.

Tungsten.—Tungsten was recovered as a byproduct of molybdenum ore mined and milled at Climax. According to the American Metal Climax, Inc., annual report, 435,000 pounds of tungsten contained in concentrate was recovered, and this, along with prior accumulation, was sold during the year. The reduction from 1957 production of 744,000 pounds of tungsten reflected the lower rate of mine output of molybdenum ore, partially offset by higher recoveries from initial operation of the new byproduct plant at Climax.

In the former active tungsten-mining area of Boulder County, Tungsten Mining Co. mined and stockpiled 1,000 tons of ore from the Tungsten mine. The ore was in a part of the mine that was caving and was mined to avoid losing it.

Uranium.—Uranium ore production from 16 counties increased 27 percent in quantity and 44 percent in value over that of 1957 and the average grade rose from 0.26 to 0.28 percent uranium oxide. Major production continued to be from Montrose County with 45 percent of the total, followed by Mesa with 16 percent and San Miguel with 15 percent. The uranium-ore reserve estimated by AEC as of December 31 was 4.4 million tons averaging 0.30 percent uranium oxide compared with 4.1 million tons averaging 0.29 percent uranium oxide on December 31, 1957.

TABLE 10.—Mine production of uranium ore [1]

County	1957				1958			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]
Boulder					3	2,246	21,249	$95,186
Clear Creek	1	(3)	(3)	(3)				
Dolores	1	(3)	(3)	(3)	1	(3)	(3)	(3)
El Paso	1	(3)	(3)	(3)				
Fremont	4	(3)	(3)	(3)	9	7,931	46,093	193,673
Garfield	1	(3)	(3)	(3)	1	13	28	63
Grand	2	(3)	(3)	(3)				
Hinsdale					1	9	33	117
Jefferson	6	(3)	(3)	(3)	7	20,254	264,739	1,219,897
La Plata	1	(3)	(3)	(3)				
Las Animas	9	(3)	(3)	(3)				
Mesa	109	122,028	704,784	$2,976,085	100	151,857	845,264	3,542,653
Moffat					17	(3)	(3)	(3)
Montezuma					1	(3)	(3)	(3)
Montrose	245	425,330	2,169,750	9,036,508	261	420,338	2,275,618	9,427,008
Park					1	357	1,640	6,729
Pueblo					2	1,971	9,917	40,418
Rio Blanco	8	(3)	(3)	(3)	13	6,203	40,917	174,773
Saguache	5	1,706	12,224	52,730	6	104,946	465,932	1,894,911
San Juan	2	(3)	(3)	(3)	1	4	77	362
San Miguel	119	88,514	454,037	1,858,275	140	142,556	790,617	3,311,440
Undistributed		102,477	463,816	1,681,013		81,021	568,702	2,579,024
Total	514	740,055	3,804,611	15,604,611	564	939,706	5,330,826	22,486,254

[1] Based on data supplied to the Bureau of Mines by the AEC.
[2] F.o.b. mine value, base price, grade premiums, and exploration allowance.
[3] Figure withheld to avoid disclosure of individual company confidential data; included with "Undistributed."

Union Carbide Nuclear Co. completed construction of its 1,000-ton-a-day plant at Rifle and began operating in January replacing the existing 280-ton-a-day plant, one of the oldest in the State. Cotter Corp. completed construction of its plant at Canon City and began operating in July. The plant, designated as a pilot operation with a rated capacity of 100 tons a day, processed from 70 to 90 tons daily, mostly from deposits in the Colorado Front Range. Vanadium Corp. of America closed its mill at Naturita, the oldest operating mill on the Colorado Plateau, on January 31 and transferred all processing operations to its plant at Durango. AEC authorized expansion of the Durango mill from 430 to 750 tons daily. The corporation will continue to purchase ores tributary to the Naturita mill for processing at Durango.

AEC completed its study (begun in October 1957) concerning the adequacy of milling capacity in the various uranium mining areas in April. The study showed that facilities in western Colorado (Maybell and the Uravan Mineral Belt areas) were adequate to process ores developed before November 1, 1957, by the end of 1962. There was, however, only a limited market for uranium ores from the Colorado Front Range. Ores in Front Range deposits vary in character from primary and secondary minerals in vein deposits (some of it quite high in uranium) to the secondary mineralization in sandstones and other sedimentaries (much of it low grade). The wide variation in minerals and mineral association requires a flexible processing method, and auxiliary circuits for ores having unusual characteristics might be necessary in a mill designed for ores from the area. A mill having a daily capacity of 200 tons was recommended and several companies, including Cotter Corp. at Canon City and the Golden Cycle Corp. at Cripple Creek, submitted proposals to construct such a mill. At yearend the proposals were being considered.

AEC announced on May 24, 1956, that it would guarantee the purchase of uranium oxide in concentrates from domestic ores produced and delivered during the period April 1, 1962, through December 31, 1966, at the previously established price of $8 a pound of uranium oxide in acceptable concentrate. On November 24, 1958, the program was modified to the extent that the previously announced guarantee would be limited to concentrate recovered from ores developed before Novmber 24, 1958. The Commission could, however, make contracts to purchase concentrate recovered from ores developed after November 24, 1958, to the extent that conditions dictate, and on such terms, conditions, and prices that the Commission determines to be equitable to both the producer and the Government. The purpose of the revision was to prevent overproduction and to assure an adequate supply of uranium for military and domestic uses.

Vanadium.—Uranium processing plants at Durango, Grand Junction, and Uravan recovered vanadium from uranium ores containing a sufficient quantity of vanadium to warrant the cost of recovery. The quantity of vanadium recovered from Colorado ores was 24 percent below that of 1957. Because of an abundant supply of vanadium and curtailment in the manufacture of alloy steels early in the year, only those ores richest in vanadium were processed. The quantity proc-

essed at Colorado mills was 9 percent below that of 1957, and the average grade of ore treated in 1958 was 1.24 percent vanadium oxide compared with 1.20 percent in 1957.

Zinc.—Zinc output declined 21 percent, but the value of production dropped 31 percent below comparable 1957 level because of a lower weighted annual average price for zinc for the year. The price for 1958 was 10.2 cents a pound compared with 11.6 cents for 1957 and 13.7 cents for 1956.

The leading zinc producers (in order of output) were The New Jersey Zinc Co. (Eagle mine), Idarado Mining Co. (Treasury Tunnel-Black Bear-Smuggler Union group of mines), and Emperius Mining Co. (Emperius mine), which accounted for 98 percent of the zinc output. Three of the former major lead- and zinc-producing mines in the State (Rico, Keystone, and Resurrection), closed in mid-1957, were inactive throughout 1958.

NONMETALS

Cement.—A record was established in terms of sales of types I, II, III, and V portland and masonry cements. Shipments for the year exceeded 1957 by 23 percent and came from the Portland and Boettcher plants of Ideal Cement Co. Sixty-seven percent of the portland cement sold was transported by trucks and the remainder by rail. Ideal continued to produce the bulk of its limestone requirements although some purchases were made. The company also mined sand and sandstone in the vicinity of both plants. The remaining raw materials needed for the manufacture of cement were purchased. The electrical energy requirements reached 122 million kw.-hr., and nine rotary kilns were in operation during the entire year. The bulk of the shipments were to Colorado consumers, but sales were reported to purchasers in Kansas, Nebraska, New Mexico, Texas, Utah, and Wyoming.

Clays.—A gain in residential and industrial construction utilizing brick and other heavy clay products resulted in an 11-percent increase in the output of all types of clay. In 1958, 37 underground and open-pit mines were operated—2 more than in 1957. Jefferson, Pueblo, Douglas, and Boulder were the principal clay-producing counties of the 10 that reported output. Fire-clay production totaled 267,000 tons and miscellaneous clay 182,000 tons in 1958. Clay Production, Inc., in Bent County was idle, and accordingly no bentonite was mined.

Mining activities were carried on by 26 companies or individuals that either sold their entire output or used it in manufacturing clay products. Of the 449,000 tons of clay produced, 253,000 tons was sold by producers and 196,000 tons used. The principal fire-clay producers were George W. Parfet Estate, Inc., Stroud A. Whisenhunt, General Refractories Co., and Robinson Brick & Tile Co. The major producers of miscellaneous clay in the State were Colorado Brick Co., Wesley Conda, Lakewood Brick & Tile Co., and Robinson Brick & Tile Co.

Feldspar.—The output of crude feldspar continued to decline, falling to 35,000 tons—21 percent below 1957. Although the total national

TABLE 11.—Production of clays, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Bent	20	$80		
Boulder	50,757	88,825	50,000	$87,500
Delta	587	1,027	(1)	(1)
Douglas	71,000	184,150	(1)	(1)
El Paso	6,810	18,689	7,334	21,387
Fremont	4,813	16,850	9,006	35,380
Huerfano	5,597	30,784	6,516	35,838
Jefferson	183,658	383,703	237,611	531,664
Las Animas	10,578	24,329	7,637	16,190
Mesa	1,696	2,561	568	848
Pueblo	67,840	227,273	70,067	223,757
Undistributed			59,789	158,127
Total	403,356	978,271	448,528	1,110,691

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

demand for ground feldspar remained relatively stable, a decrease in the average price for Glass-grade feldspar seriously affected Colorado operations. By the end of the year International Minerals & Chemical Corp. announced that it would no longer purchase ore, and plans were made to shut down its Denver grinding plant. The Salida mill of Western Feldspar Milling Co. continued to operate on ore from M & S, Inc., the major mining operation in the State. The bulk of the ground feldspar sold was shipped to Illinois and Oklahoma, although some material went to consumers in Texas and Kansas and some was exported to Mexico.

Chaffee County was the principal producing area with the M & S mine the only producing property.

Fluorspar.—Plant shipments of Acid-grade fluorspar rose 16 percent above 1957, and 74 percent of these shipments went to the Government stockpile. However, mine production dropped 19 percent below 1957—the difference between crude ore mined and crude fed to the mill was made up by a heavy withdrawal from stocks of ore mined in earlier years. This situation developed as a result of the anticipated closing on December 31, 1958, of the Government fluorspar purchase program. Ozark-Mahoning Co. shut down its Jamestown operation on December 31 and planned closing its Northgate plant early in 1959. General Chemical Division, Allied Chemical Corp., operated its Burlington mine and Valmont milling plant throughout 1958. The Acid-grade concentrate was shipped to the company-owned plant for the manufacture of hydrofluoric acid. In addition to its own mine production, the company also purchased ore from small mine operators near Evergreen, Jamestown, and Tarryall. Fifty tons of ore assaying 98 percent CaF_2 was sold to a Denver foundry by Beal & Monett of Green Mountain Falls.

Gem Stones.—Gem and ornamental stones and mineral specimens collected included turquois, agate, onyx, quartz crystals, and beryl. Two collectors reported the recovery of jade from the Hartsel and Monte Vista areas.

Gypsum.—As in 1957, Fibreboard Paper Products Corp. was the principal gypsum producer. The company shipped crude gypsum to

its Florence wallboard and lath plant as well as to the Portland cement plant of Ideal Cement Co. for use as a retarder and in the manufacture of plaster. United States Gypsum Co. operated its quarry near Fort Collins throughout the year. Ernest W. Monroe produced crude gypsum and shipped it to the Boettcher cement plant of Ideal Cement Co. for use as a retarder. The Atlas Mining & Manufacturing Co. of Delta continued to ship crude gypsum for use as a soil conditioner.

Construction was begun on a plaster-products plant by Fibreboard Paper Products Corp. The plant, being built adjacent to the company Florence wallboard plant, will take the place of the Portland plant now operated by Ideal Cement Co. Construction work will be completed early in 1959 at which time the Ideal Cement Co. plant will be dismantled.

Lime.—The Colorado Lime Co. began operating a lime plant at Pikeview, north Colorado Springs (formerly the Golden Cycle Corp.), and reported sales of both hydrated lime and quicklime. The limekiln of Basic Chemical Corp. at Glenwood Springs operated on a reduced scale, producing quicklime.

Mica.—The production of scrap mica increased to 387 tons, 24 percent above 1957. Fremont County was the principal producing region. No hand-cobbed mica was reported produced.

Although there was an increase in the quantity of scrap mica produced, the bulk of the mica ground at the Pueblo mill of International Minerals & Chemical Corp. was from company operations in South Dakota and Tennessee. Coupled with the relatively low price for ground mica and the increasing cost of mining crude mica, International closed its Pueblo mill near the end of 1958. With the closing of the company feldspar and mica mills (the only custom purchaser of these commodities except for a small mica mill at Arvada) the mining of pegmatites all but ceased. Those few dikes still being operated were worked for beryl, and with the prospect of no market for accessory minerals—feldspar and mica—the continuation on previous scales of pegmatite mining was doubtful.

Perlite.—Crude perlite was mined by Persolite Products, Inc., at the Rosita mine in Custer County. The company took over the operation of the Rosita property after it had been released by the Great Lakes Carbon Corp. The crude rock was ground by Flexore, Inc., at Silver Cliff and reshipped to Florence for expanding; Persolite moved its Denver expanding plant to Florence. The expanded perlite was marketed in the Colorado Springs, Denver, and Pueblo areas. Western Mineral Products Co. continued to operate a small expanding unit at its Denver vermiculite plant on rock shipped from New Mexico.

Pumice.—Colorado Aggregates Co., Inc., Ideal Lava Products Co., McCoy Aggregate Co., and Roaring Forks Pumice Co. together increased scoria output 36 percent above 1957. A gain in sales by McCoy Aggregate Co. in Routt County was the principal reason for the advance. Consumption of scoria for use as railroad ballast and roofing aggregate accounted for the bulk of the sales, and 14,000 tons was used in concrete aggregate.

Pyrites.—Despite a cutback by Rico Argentine Mining Co., pyrite

output in 1958 was higher than in 1957. This gain was due to an increase in production by American Metal Climax, Inc., and to the sale of pyrite-bearing tailing by the New Jersey Zinc Co. to the Allied Chemical Corp. for the manufacture of sulfuric acid at Denver. The Rico pyrite was used to produce sulfuric acid by Rico Argentine Mining Co. at its acid plant at Rico.

Salt.—The need for salt (in brine) for uranium processing was responsible for the continued production of this commodity by Union Carbide Nuclear Co. at its Montrose operation.

Sand and Gravel.—A record in the production of sand and gravel was reached—20.6 million tons or 26 percent more than in 1957. The construction of highways was the most important factor in the overall gain in output. Government-and-contractor production (mainly for highway construction) reached 12.5 million tons in 1958 compared with 7.8 million tons in 1957. Of the 8.1 million tons of production classed as commercial, 3.6 million tons was paving sand and gravel, which brought the total of material used for road construction to 16.1 million tons.

TABLE 12.—Production of sand and gravel in 1958, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Adams	1,648	$2,195	La Plata	249	$218
Alamosa	11	5	Larimer	749	1,020
Arapahoe	1,693	1,646	Las Animas	1,225	635
Archuleta	13	16	Lincoln	337	208
Baca	104	73	Logan	324	186
Bent	70	36	Mesa	878	786
Boulder	619	520	Mineral	11	10
Chaffee	188	163	Moffat	413	260
Cheyenne	175	120	Montezuma	432	409
Clear Creek	360	367	Montrose	139	117
Conejos	19	18	Morgan	178	94
Costilla	84	76	Otero	10	9
Crowley	102	76	Ouray	12	12
Delta	217	189	Park	44	61
Dolores	102	87	Pitkin	6	7
Douglas	136	104	Prowers	147	108
Eagle	156	140	Pueblo	2,454	1,748
Elbert	320	160	Rio Blanco	85	69
El Paso	1,826	1,350	Rio Grande	(1)	(1)
Fremont	76	103	Routt	15	12
Garfield	49	40	San Miguel	40	22
Gilpin	10	7	Sedgwick	96	47
Grand	(1)	(1)	Summit	42	39
Gunnison	115	111	Washington	210	167
Hinsdale	7	3	Weld	625	423
Huerfano	389	211	Yuma	440	283
Jackson	34	12	Undistributed	1,190	1,527
Jefferson	1,534	1,472	Total	20,626	17,842
Kiowa	180	41			
Kit Carson	38	24			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Producers in 57 of 63 counties reported output. Pueblo County (with a record production of 2.5 million tons) was the leading source, followed by El Paso, Arapahoe, Adams, Jefferson, and Las Animas, all of which produced 1 million tons or more. The leading commercial producers included Colorado Materials Co., Cooley Gravel Co., Brannan Sand & Gravel Co., Western Paving Construction Co., Northwestern Engineering Co., and Fountain Sand & Gravel Co. Some of the principal contractors engaged in contractual highway

TABLE 13.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Molding	16	$17		
Building	2,751	2,756	1,914	$2,084
Paving	407	308	174	182
Filter	18	18	(1)	(1)
Other [2]	78	101	69	74
Total	3,270	3,200	2,157	2,340
Gravel:				
Building	2,072	2,740	2,154	3,041
Paving	3,055	2,721	3,606	3,268
Other	163	161	230	171
Total	5,290	5,622	5,990	6,480
Total sand and gravel	8,560	8,822	8,147	8,820
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	117	88		
Paving	173	205	48	50
Total	290	293	48	50
Gravel:				
Building	293	196	243	209
Paving	7,257	4,683	12,188	8,763
Total	7,550	4,879	12,431	8,972
Total sand and gravel	7,840	5,172	12,479	9,022
ALL OPERATIONS				
Sand	3,560	3,493	2,205	2,390
Gravel	12,840	10,501	18,421	15,452
Grand total	16,400	13,994	20,626	17,842

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes blast, engine, railroad ballast and sand indicated by footnote 1.

construction were Pioneer Construction Co., C. L. Hubner & Co., Peter Kiewit Sons' Co., Gardner Construction Co., San Ore Construction Co., Herren-Strong, and Colorado Constructors, Inc.

The December 31 report of the Federal Bureau of Public Roads [4] showed that Colorado ranked 34th in the Nation in mileage of all construction underway on the system, with 33.4 miles. In all mileage completed on the 41,000-mile superhighway network, Colorado ranked fourth with 164 miles.

Stone.—In general, the 411,000-ton increase in the production of crushed limestone (the most important type of stone produced in the State) was responsible for the overall 20-percent gain in the output of all types of stone quarried. The increased demand for cement resulted in the expanded limestone production by Ideal Cement Co. at its Portland and Boettcher pits. Colorado Materials Co. produced a considerable quantity of limestone for use in concrete and as road stone.

[4] Bureau of Public Roads, Status of Federal-Aid Highway Programs, Dec. 31, 1958: BPR 59–2.

TABLE 14.—Production of stone in 1958, by counties

County	Short tons	Value	County	Short tons	Value
Adams	67,100	$57,800	Jefferson	3,900	$7,700
Arapahoe	1,800	2,900	La Plata	1,400	8,400
Baca	1,000	8,800	Larimer	683,592	1,053,236
Boulder	8,391	80,714	Lincoln	800	5,100
Chaffee	250,776	467,400	Mesa	2,900	14,700
Cheyenne	500	3,800	Moffat	2,800	12,400
Clear Creek	693	9,190	Montezuma	1,153	9,060
Costilla	1,500	9,000	Montrose	1,700	8,500
Crowley	100	400	Otero	100	400
Delta	1,500	3,100	Prowers	600	4,200
Dolores	300	1,800	Pueblo	6,700	14,500
Douglas	3,284	6,063	Rio Blanco	600	3,500
Eagle	745	5,302	Sedgwick	200	100
Elbert	200	1,100	Teller	878	13,170
El Paso	574,557	1,230,620	Weld	75,200	88,500
Fremont	1,190,744	1,646,596	Yuma	1,600	11,200
Garfield	33,100	99,100	Undistributed	1,100	9,300
Gilpin	200	300			
Gunnison	4,157	23,196	Total	2,930,270	4,943,047
Huerfano	4,400	21,900			

TABLE 15.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1954	2,624	$41,154	----	----	321	$12,093	1,734,191	$1,599,196
1955	3,018	51,329	----	----	226	12,044	1,991,916	2,766,544
1956	36,135	155,169	----	----	(1)	(1)	2,036,486	2,951,737
1957	18,367	111,425	3,500	$65,000	679	28,782	2,200,500	3,238,900
1958	10,837	82,060	----	----	2,058	186,012	2,701,750	4,004,500

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1954	45,421	$445,875	21,447	$13,775	1,804,004	$2,112,093
1955	98,170	629,289	55,689	48,847	2,149,019	3,508,053
1956	153,371	1,994,599	24,176	115,136	2,250,168	5,216,641
1957	121,619	721,595	3,800	2,600	2,438,465	4,168,302
1958	37,641	342,412	177,984	328,063	2,930,270	4,943,047

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

The quantity of stone used for commercial purposes rose from 2.4 million tons in 1957 to 2.7 million tons in 1958. Stone used for other purposes, mainly highway construction, increased from 51,000 tons to 190,000 tons for the same period. The miscellaneous-stone classification recorded a significant gain for this usage. A drop in the demand for dimension sandstone used for flagging and rough construction had an adverse affect on the production of dimension sandstone in Boulder and Larimer Counties. Output fell to 9,600 tons—78 percent below 1957.

Vermiculite.—Western Mineral Products Co. purchased crude vermiculite from Montana mines and exfoliated it at its Denver plant. The finished product was used almost equally between loose-fill insulation and lightweight aggregates.

TABLE 16.—Stone sold or used by producers, by uses

Use	1957		1958	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble—short tons	23,314	$242,895	3,669	$48,225
Dressed construction—cubic feet	5,953	22,600		
Approximate equivalent in short tons	500			
Rough architectural—cubic feet	51,634	100,192	34,702	72,766
Approximate equivalent in short tons	4,079		2,729	
Dressed architectural—cubic feet	75,008	104,103	41,237	206,336
Approximate equivalent in short tons	5,856		3,302	
Rough monumental—cubic feet	11,561	29,395	15,924	38,596
Approximate equivalent in short tons	1,092		1,339	
Dressed monumental—cubic feet	900	20,000	900	25,000
Approximate equivalent in short tons	76		76	
Curbing—cubic feet	265	812	281	851
Approximate equivalent in short tons	21		22	
Flagging—cubic feet	150,213	43,285	26,580	24,003
Approximate equivalent in short tons	11,717		2,073	
Total dimension stone (quantities approximate in short tons)	46,655	563,282	13,210	415,777
Crushed and broken stone:				
Riprap—short tons	54,200	67,400	179,800	310,900
Metallurgical—do	534,800	1,025,200	217,600	400,500
Concrete and roadstone—do	344,600	425,000	796,800	1,426,800
Chemical—do	(1)	(1)	64,200	153,000
Miscellaneous—do	[3] 1,458,210	[2] 2,087,420	[3] 1,658,660	[3] 2,236,070
Total crushed and broken stone—do	2,391,810	3,605,020	2,917,060	4,527,270
Grand total (quantities approximate in short tons)	2,438,465	4,168,302	2,930,270	4,943,047

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Miscellaneous."
[2] Includes sugar factories, terrazzo, filter beds, cement, lime, marble chips, and special-use aggregate.
[3] Includes asphalt filler, coal dust, stone sand, cement, lime, terrazzo, uranium reagent, marble dust, roofing chips, sand and grits, marble whiting, plaster and cleaning sands, and paving and exposed aggregate panels.

REVIEW BY COUNTIES

Adams.—Petroleum production (from 17 fields) was 23 percent below that of 1957.

Output of sand and gravel dropped to 1.6 million tons compared with 2.3 million tons in 1957 as a result of a shift in highway-construction activity away from the county. Seven commercial operators produced 1.6 million tons, and two Government-and-contractor producers reported the production of 54,000 tons of paving gravel. Colorado Materials Co. quarried 55,000 tons of crushed limestone from its Hubbell pit, and construction and maintenance crews of the Colorado Department of Highways and Colorado Constructors, Inc., as contractors for the department, produced 12,100 tons of crushed miscellaneous stone.

Gold and silver were recovered as byproducts of six sand and gravel washing and screening operations. Kerkling & Slensker recovered gold and silver from sluicing gravel produced from the Brannan pits Nos. 8 and 10, the F. S. Rizzuto pit, and the Inland Sand & Gravel pit, as did R. U. Madden from the Hehl Sand & Gravel pit, and Cooley Gravel Co. from the North Plant pit.

TABLE 17.—Value of mineral production in Colorado, by counties

County	1957	1958 [1]	Minerals produced in 1958 in order of value
Adams	[2] $5,804,321	$4,600,957	Petroleum, sand and gravel, stone, gold, silver.
Alamosa	----------	5,100	Sand and gravel.
Arapahoe	1,503,300	1,648,500	Sand and gravel, stone.
Archuleta	[2] 413,740	366,030	Petroleum, sand and gravel.
Baca [3]	12,500	81,800	Sand and gravel stone.
Bent	[2] 21,400	39,490	Sand and gravel, petroleum.
Boulder	[2] 2,103,050	2,183,910	Fluorspar, sand and gravel, uranium ore, clays, stone, peat, petroleum, silver, gold, lead, gem stones, copper, feldspar, beryllium concentrate.
Chaffee	970,629	812,747	Stones, feldspar, sand and gravel, lead, gem stones, copper, silver, beryllium concentrate, mica (scrap), gold.
Cheyenne	101,000	124,200	Sand and gravel, stone.
Clear Creek	370,797	530,134	Sand and gravel, lead, gold, silver, copper, stone, feldspar, gem stones, beryllium concentrate, mica (scrap).
Conejos	----------	18,400	Sand and gravel.
Costilla	27,470	108,650	Sand and gravel, pumice, stone.
Crowley	22,900	76,800	Sand and gravel, stone.
Custer	533,248	34,092	Rare-earth metals ore and concentrate, perlite, manganese ore and concentrate, silver, lead.
Delta	688,585	474,138	Coal, sand and gravel, stone, clays, gypsum.
Dolores [4]	509,539	366,650	Pyrites, sand and gravel, stone, uranium ore.
Douglas	223,059	267,561	Clays, sand and gravel, stone, gem stones.
Eagle	8,583,711	8,166,132	Zinc, silver, lead, copper, sand and gravel, gold, pyrites, pumice, stone.
Elbert	36,215	160,650	Sand and gravel, stone, gem stones.
El Paso	[2] 1,537,084	2,704,096	Sand and gravel, stone, coal, lime, clays, rare-earth metals ore and concentrate, manganese ore and concentrate, gold, gem stones, silver.
Fremont	[2] 13,630,004	14,558,403	Cement, stone, coal, gypsum, uranium ore, sand and gravel, petroleum, clays, feldspar, beryllium concentrate, columbium-tantalum concentrate, mica (scrap), manganese ore and concentrate, rare-earth metals ore and concentrate.
Garfield [5]	295,643	265,915	Coal, stone, sand and gravel, lime, gem stones, uranium ore.
Gilpin	[2] 19,460	25,467	Peat, gold, sand and gravel, silver, copper, lead, stone.
Grand	350,887	(6)	Sand and gravel, copper, silver.
Gunnison	2,906,473	1,804,144	Coal, sand and gravel, stone, silver, lead, rare-earth metals ore and concentrate, copper, gold.
Hinsdale	49	3,556	Sand and gravel, uranium ore, copper, silver.
Huerfano	558,074	674,232	Coal, sand and gravel, clays, stone.
Jackson	(6)	4,587,906	Petroleum, fluorspar, coal, sand and gravel.
Jefferson	[2] 3,588,267	3,286,762	Sand and gravel, uranium ore, clays, feldspar, gold, stone, petroleum, fluorspar, beryllium concentrate, mica (scrap), rare-earth metals ore and concentrate, gem stones, silver, columbium-tantalum concentrate.
Kiowa	[2] 101,740	40,700	Sand and gravel.
Kit Carson	2,200	23,600	Do.
Lake	50,344,051	32,947,213	Molybdenum, tungsten concentrate, pyrites, lead, silver, gold, copper.
La Plata [5]	[2] 485,183	447,316	Sand and gravel, coal, petroleum, stone, silver.
Larimer [3]	[2] 5,590,926	9,761,154	Cement, stone, sand and gravel, petroleum, gypsum, feldspar, mica (scrap), beryllium concentrate.
Las Animas [4]	11,059,872	8,526,026	Coal, sand and gravel, clays, carbon dioxide.
Lincoln	93,400	213,000	Sand and gravel stone.
Logan [7]	[2] 20,004,440	17,216,740	Petroleum, sand and gravel.
Mesa [5]	4,090,736	4,814,165	Uranium ore, sand and gravel, coal, stone, clays, gem stones.
Mineral	1,417,646	640,099	Lead, zinc, silver, gold, copper, sand and gravel, gem stones.
Moffat [7]	[2] 4,946,303	6,992,318	Petroleum, uranium ore, coal, sand and gravel, stone.
Montezuma	[2] 286,486	442,855	Sand and gravel, petroleum, stone, carbon dioxide, gold, silver, copper, uranium ore, lead.
Montrose [4]	9,327,512	9,614,034	Uranium ore, sand and gravel, salt, coal, stone, silver, copper, gold, gem stones.
Morgan [7]	[2] 20,883,960	21,744,850	Petroleum, sand and gravel.
Otero	95,650	9,600	Sand and gravel, stone.
Ouray	355	24,161	Sand and gravel, gold, lead, silver, copper, gem stones.
Park	190,985	317,685	Lead, sand and gravel, beryllium concentrate, silver, uranium ore, copper, gem stones, gold, mica (scrap), feldspar.

See footnotes at end of table.

TABLE 17.—Value of mineral production in Colorado, by counties—Continued

County	1957	1958 [1]	Minerals produced in 1958 in order of value
Phillips	$3,700		
Pitkin	(6)	(6)	Coal, sand and gravel.
Prowers	62,900	$112,400	Sand and gravel, stone.
Pueblo	1,183,273	2,026,975	Sand and gravel, clays, uranium ore, stone.
Rio Blanco [8]	[2] 86,151,998	69,341,011	Petroleum, uranium ore, coal, sand and gravel, stone.
Rio Grande	93,600	72,137	Sand and gravel, copper, gold, silver.
Routt	[2] 2,280,623	2,082,125	Coal, petroleum, pumice, sand and gravel, zinc, lead, silver.
Saguache [4]	75,984	2,057,193	Uranium ore, lead, zinc, gem stones, silver, manganese ore and concentrate, copper, gold.
San Juan [4]	469,242	245,473	Lead, zinc, gold, silver, copper, uranium ore, gem stones.
San Miguel [4]	10,219,988	10,020,355	Uranium ore, zinc, lead, copper, gold, silver, iron ore, sand and gravel.
Sedgwick	30,200	47,560	Sand and gravel, stone, gem stones.
Summit	326,913	91,076	Sand and gravel, zinc, lead, silver, gold, copper, manganese ore and concentrate.
Teller	1,630,020	1,535,847	Gold, stone, silver, peat, feldspar, gem stones, mica (scrap).
Washington [7]	[2] 21,442,560	20,477,770	Petroleum, sand and gravel.
Weld [3]	10,186,889	9,534,362	Petroleum, coal, sand and gravel, stone.
Yuma	341,600	294,200	Sand and gravel, stone.
Undistributed [9]	[2] 32,043,000	27,638,000	
Total [10]	[2] 338,504,000	305,284,000	

[1] Carbon dioxide (natural), natural gas, natural-gas liquids, and petroleum values are preliminary.
[2] Revised figure.
[3] Excludes natural gas.
[4] Excludes vanadium.
[5] Excludes natural gas and vanadium.
[6] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[7] Excludes natural gas and natural-gas liquids.
[8] Excludes natural gas and natural-gas liquids and vanadium.
[9] Includes natural gas, vanadium, natural-gas liquids, some sand and gravel, gem stones, and stone (1958), and values indicated by footnote 6.
[10] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

Arapahoe.—Eight commercial operators produced 1.2 million tons of sand and gravel, and six Government-and-contractor producers quarried 476,000 tons of paving gravel; the county ranked third in the State in output. Cooley Gravel Co. and Colorado Materials Co. were the major commercial operators, and construction crews for the Denver City Engineer accounted for the bulk of the Government-and-contractor output. Construction crews of the Colorado Department of Highways and Smith & Lucas as contractors for the department produced 1,800 tons of crushed miscellaneous stone.

Baca.—Natural-gas production in 1958 from the Greenwood and Prairie Dog fields was approximately the same as in 1957.

Bent.—A highway contract was awarded to Pioneer Construction Co. by the State highway department, and 69,600 tons of paving gravel was produced. Clay Productions, Inc., which produced bentonite for a number of years, was idle.

Petroleum was produced at the Bent's Fort field and natural gas at the Lubers field, discovered in 1957. Petroleum production was 83 percent below that of 1957. Carbon dioxide from wells in Las Animas County was processed at a plant at Ninaview.

Boulder.—Nonmetals again provided the bulk of the income to the mineral industry of Boulder County—accounting for 93 percent. Production and shipment of Acid-grade fluorspar was the principal commodity activity in the county with Ozark-Mahoning Co. operating its

Jamestown mines and mill and Allied Chemical Corp. working its Burlington mine and Valmont (Boulder) mill. The major portion of the mill production was used in the manufacture of hydrofluoric acid, although substantial shipments were made to the Government stockpile. The Ozark-Mahoning Co. closed its Jamestown mine and mill on December 31.

Sand and gravel production increased to 619,000 tons and came from 10 operations. The Colorado Brick Co. operated its Valmont pits and produced 50,000 tons of miscellaneous clay and shale for use at its Valmont brick plant. Dimension sandstone produced totaled 5,000 tons; crushed sandstone, 2,000 tons. Other stone production consisted of dimension granite produced by H. E. Lowdermilk for the Federal Bureau of Public Roads, dimension limestone quarried by the Bureau itself, and crushed miscellaneous stone quarried by Colorado Constructors, Inc., and Herren-Strong for the State highway department.

The S.N.N. Mining Co. operated the Little Bonnie pegmatite and recovered 300 pounds of hand-cobbed beryl.

Gold, silver, copper, and lead came from seven mines (six lode and one placer). La Salle Mining Co. produced uranium ore at the Fair Day and Four Day Lode mines. A contract for exploration of the two groups was approved by DMEA in June. Total amount of the contract was $54,200 with Government participation limited to 75 percent.

Chaffee.—Nonmetals, principally construction materials, accounted for 99 percent of the value of all minerals produced. The sand and gravel produced resulted from highway construction contracts let by the Colorado Department of Highways and the county highway department. The operation of the Monarch limestone quarry of The Colorado Fuel and Iron Corp. accounted for nearly all the stone output. The Homestake Strip of M & S, Inc., continued to be the only active feldspar operation; the crude ore was ground at the Salida mill of Western Feldspar Milling Co. Glen Lamberg & Sons operated the Silver Rocker group and recovered 900 pounds of hand-cobbed beryl and 5 tons of scrap mica. The beryl was shipped to Arvada and the mica ground at a mill at Pueblo.

Clear Creek.—Nonmetal commodities comprised nearly three-fourths of the value of production. Sand and gravel output rose to 278,000 tons of Government-and-contractor production which was quarried by contractors for the Federal Bureau of Public Roads, Colorado Department of Highways, and the Denver Water Board. The remaining 82,000 tons was output from two commercial operations. Hinman Bros. produced 193 tons of dimension granite for the Federal Bureau of Public Roads, and Gardner Construction Co. quarried 500 tons of crushed miscellaneous stone for the State highway department.

Feldspar was recovered from the Beaver Brook, Grover, Deer-Nod, and Paradise Mountain pegmatite dikes, and beryl and mica from the Grover dike. The feldspar was sold to a Denver grinding plant and the beryl and mica to a buyer in Arvada.

The value of the gold, silver, copper and lead output was $153,000 compared with $356,000 (including zinc) in 1957. Major production of these metals came from the Bald Eagle mine operated by the Bald

Eagle Mining Co. and Jackpot Oil Co. Ore from this mine was treated at the Front Range custom mill and the concentrates shipped to Leadville for smelting. Vicon, Inc., treated ore from the Dixie mine at its mill near Idaho Springs and shipped bullion and concentrate to the U.S. Mint and the Leadville smelter, respectively. Ore was produced from six other lode mines of which Fourth of July and Franklin were the most important. Michigan Chemical Co. operated the Silver Spruce mill on material that had been rejected from previous operations at the mill.

Costilla.—Monaghan & Smith Construction Co. and Stephenson Logging & Construction Co., as contractors for the Colorado Department of Highways, produced 83,900 tons of sand and gravel compared with 5,000 tons in 1957. Highway-construction activity of the State highway department also was responsible for the 1,500 tons of crushed miscellaneous stone quarried. Colorado Aggregate Co., Inc., operated Mesita Hill scoria deposit and sold prepared scoria for use in concrete and roofing aggregate; production was slightly less than in 1957.

Custer.—The principal reason for the sharp decline in mineral production was withdrawal of Great Lakes Carbon Corp. from perlite mining. The Rosita mine was leased by Persolite Products Co., which moved its expanding operation from Denver to Florence. A small quantity of crude material mined in 1958 was crushed by Flexore, Inc., at Silver Cliff and reshipped to Florence for expanding.

Shipments of thorite reached 910 tons compared with 93 tons in 1957. The purchase of thorite by Wah Chang Corp. for processing at its Boulder mill was the reason for the gain. The Anna Lee mine, Zabel-Beardsley lease, and Star claims were the properties worked.

Delta.—Coal accounted for more than half the value of minerals produced even though coal production from six mines declined 20 percent compared with 1957. The principal producer was the Juanita Coal & Coke Co. (King mine).

The Delta Sand and Gravel Co. commercially produced 9,000 tons of sand and gravel, and the Delta County Highway Department and Colorado Constructors, Inc., as contractors for the Federal Bureau of Public Roads, quarried 208,500 tons of paving gravel. Crews of the Colorado Department of Highways quarried 1,500 tons of crushed miscellaneous stone for use as concrete and roadstone. Agricultural gypsum was mined and sold by the Atlas Mining & Manufacturing Co. of Delta, and the Delta Brick & Tile Co. open-pit mined miscellaneous clay near Delta for making brick.

Denver.—The principal mineral industry of Denver County was processing minerals. Six brick plants produced building brick and other structural clay products. International Minerals & Chemical Corp. closed its Denver feldspar grinding mill during the latter part of the year. The Denver expanded perlite plant of Persolite Products, Inc., was dismantled and moved to Florence, but Western Mineral Products Co. continued to operate a small expanded perlite unit in conjunction with its exfoliated vermiculite plant. Allied Chemical Corp. manufactured sulfuric acid at its Denver plant throughout the year on pyrite purchased from Lake and Eagle County mines.

Throughput of five oil refineries in the Denver area increased 5 percent over that of 1957. Bay Petroleum Corp., a subsidiary of Ten-

nessee Gas Transmission Co., completed construction of a 3,800-barrel-a-day catalytic reforming unit using a platinum catalyst and placed it in service in April. Construction of additional gasoline storage capacity of 100,000 barrels also was completed. Oriental Refining Co. sold its 3,500-barrel-a-day plant at Denver (and its 1,000-barrel-a-day plant at Alamosa) to the Flank Oil Co. of Billings, Mont.

Dolores.—No lead-zinc ore or concentrate was shipped from the Rico-Argentine mine according to the Rico-Argentine Mining Co. This is the first year in 20 that the company had no income from nonferrous metal production. However, 958 tons of lead-zinc development ore was mined and milled and the resultant concentrates stockpiled. The mine workings in the lead-zinc areas and the milling facilities were maintained.

From June 30, 1957, to July 1, 1958, Rico Argentine reported production of 52,985 dry tons of pyrite—52,668 tons from the Mountain Springs area and 317 tons from the Argentine area. All, except 708 tons shipped to other users, was used for sulfuric-acid manufacture. The plant produced 46,646 tons of 100-percent basis commercial sulfuric acid in this period.

Highway-construction contracts let by the State and county highway departments resulted in the production of 102,200 tons of paving gravel and 300 tons of crushed miscellaneous stone.

Douglas.—Because substantially more paving gravel was produced the total value of mineral production was 20 percent above 1957. State and county highway department crews accounted for one-half of the production and C. L. Hubner Co. and Smith & Lucas, as contractors for the Colorado Department of Highways, the remainder.

Fire clay was mined by Helmer Bros. and S. A. Whisenhunt from the Helmer and Stevens mines, respectively, and the Robinson Brick & Tile Co. (Hogback mine). Robinson also reported miscellaneous clay production from the Diamond and Ute mines. John T. Fox and Helmer Bros. quarried limestone used for flux, and crushed miscellaneous stone was produced by construction crews and contractors for the Colorado Department of Highways.

Eagle.—The Eagle mine at Gilman, operated throughout 1958 by the Empire Zinc Division, The New Jersey Zinc Co., was the State's leading zinc and silver producer, had the second largest output of copper and lead, a substantial output of gold, and accounted for most of the Eagle County mineral production. Lead-zinc and copper ores were produced at the same rates as in 1957. A detailed description of the mill was published.[5] The company discontinued operation of its roasting plant at Canon City in May.

In 1958, as in 1957, sand and gravel activity was intensified by State highway-construction projects undertaken by contractors for the Colorado Department of Highways. Production in 1958 reached 156,000 tons and came from three contractor operations as well as by crews of the State highway department. Output of volcanic scoria nearly doubled in 1958 and came from deposits near Dotsero and Carbondale worked by Ideal Lava Products Co. and Roaring Forks Pumice Co., respectively. All crude material was processed by the mine operators and sold for use as concrete aggregate and ballast.

[5] Witthauer, F. J., Eagle Mill Recovers More Metal From Complex Ore: Min. World, August 1958, pp. 42–45.

Pyrite-bearing mill tailing (containing 36 percent sulfur) was shipped from the Gilman operation of New Jersey Zinc Co. to Denver for use in manufacturing sulfuric acid.

Exploration work at the Little Springs and other claims was begun by Basic Exploration Co. under a Government assistance contract with DMEA approved in November 1957. Total amount of the contract was $12,000 with Government participation limited to 75 percent.

El Paso.—Nonmetals continued to be the most important mineral products, accounting for 98 percent of the mineral value. Sand and gravel was the principal-value mineral, and of the 1.8 million tons produced in 1958, 875,000 tons was commercial material and 951,000 tons Government-and-contractor output. Colorado Materials Co. and Transit Mix Concrete Co. were the major operators among the eight commercial producers. State and county highway departments and the city of Colorado Springs produced 429,000 tons of paving gravel, and contractors for the Air Force Academy Construction Agency, U.S. Army Corps of Engineers, and State highway department quarried 522,000 tons; San Ore Construction Co. was the major contractor. El Paso County was second in stone production. Crushed limestone used as concrete aggregate and roadstone was the most important type. The Castle Concrete Co. and Colorado Materials Co. accounted for the entire production. Noncommercial crushed granite and miscellaneous stone were quarried and used on construction projects. Dimension marble was produced by Farnsworth & Chambers, Inc., for use as building stone. Three clay pits were operated, output rising from 6,800 tons in 1957 to 7,300 tons in 1958. The National Clay Products Co. and Robinson Brick & Tile Co. produced miscellaneous clay from the National and Apache No. 7 mines, and fire clay was quarried at the Husted pit of Standard Fire Brick Co. A limekiln was operated by the Colorado Lime Co. at Pikeview, and hydrated lime and quicklime were produced.

In 1958, 82 tons of thorite was produced compared with 39 tons in 1957. Although the Trail Mines group, operated by Trail Mines, Inc., and John Knox & Associates, was the principal mine, a small quantity of thorite was recovered from the St. Peters Dome area. All the ore was shipped to the Boulder mill of Wah Chang Corp. Rampart Mining Co. shipped a small quantity of ore containing 42.2 percent manganese from the Rampart No. 1 claim under the Government "carlot" program.

Fremont.—Ninety-two percent of the value of mineral production was of nonmetals. Portland and masonry cement was the major product; shipments were 6 percent greater than in 1957. Ideal Cement Co. operated its Portland plant and limestone quarry. Gypsum used in the manufacture of cement and wallboard was quarried by Fibreboard Paper Products Corp. near Coaldale. The company also produced wallboard and lath at its Florence plant. Construction work began on a plaster-products addition to the Florence facility. Limestone accounted for 97 percent of the total stone quarried. In addition to its use to manufacture cement, limestone was used as a flux, in the manufacture of refractories, as rock-dust, in sugar refining, and in the manufacture of terrazzo.

Production of feldspar continued to decline, reaching 2,100 tons,

28 percent below 1957. The Mica Lode, operated by Lockhart & Ellis and Kenneth R. Cox, was the major source of this mineral. Crude feldspar was purchased by International Minerals & Chemical Corp. and stockpiled at Parkdale for shipment to its Denver mill. In addition, the Mica Lode accounted for the bulk of the scrap mica and columbium-tantalum mined. The crude mica was shipped to a grinding plant at Pueblo, and the columbium-tantalum was resold to the Government stockpile. Columbium-tantalum also was recovered from the Devil's Hole and Lucky Star pegmatite deposits by Earl Waxon and Jed Newton, respectively; all output eventually reached the Government stockpile. The Mica Lode, the only beryl producer, reported production of 25,000 pounds.

Clay production consisted of 8,250 tons of fire clay mined by I & E Clay Co., George O. Stroup, and Refractories Division, H. K. Porter Co., Inc., and 750 tons of miscellaneous clay produced by the I & E Clay Co. Sand and gravel output, which rose to 76,000 tons, included 74,000 tons of paving gravel and 2,000 tons of structural sand from two commercial and two Government-and-contractor operations.

Coal production from 20 mines (18 underground, 2 strip) gained 12 percent over 1957. Two new mines (the Superior underground and the Corley strip No. 1) were opened by The Corley Co. Major producers were The Corley Co. at the Pioneer Canyon mine, Vento Coal Co. at the Vento mine, Beer Coal & Transportation Co. at the Beer Strip mine, and Canon National Coal Co. at the Canon National mine.

Uranium ore produced at nine operations was processed at Gunnison and Rifle. The Cotter Corp. completed its 100-ton-a-day pilot plant at Canon City and began operations in July; a major portion of the ore treated was from the Schwartzwalder mine in Jefferson County, but others in the Front Range contributed. Many of these ores were of the uraninite-pitchblende type from vein deposits and presented problems of recovery not found in the carnotite-type ores of the Colorado Plateau. Throughput of the plant was from 70 to 90 tons daily. A contract for exploration of the Lightning group of claims by D. A. C. Uranium Co. was approved by DMEA in May. Total amount of the contract was $17,900 with Government participation limited to 75 percent.

Garfield.—Coal continued to be the principal value commodity although its value was 48 percent less than in 1957. There were 6 mines, the major producer being the Rifle Coal Co. (North Canyon mine). Natural gas production from the Garmesa and Twin Buttes fields was 41 percent above that of 1957.

The 1,000-ton-a-day Union Carbide Nuclear Co. uranium-processing plant at Rifle, completed late in 1957, began operating in January. The mill, which replaced a 280-ton-a-day plant, the oldest in the State, was built at a cost of $8.5 million to process ores from the Colorado Plateau and other areas.

Crushed limestone quarried by Frank H. Norberg Co. and Basic Chemical Corp. accounted for nearly all the stone production. Three operations (two Government-and-contractor and one commercial) produced all the sand and gravel. Basic Chemical Corp. of Glenwood Springs operated its limekiln during part of the year.

Gilpin.—Gold, silver, copper, and lead production came from six lode and two placer mines. Glory Hole, Inc., milled a substantial tonnage of ore from its mine and recovered gold sponge and gold concentrate. Gold-silver ore was mined by E. A. Davis from the Pittsburg-Notaway group of claims, milled on a custom basis at the Silver Spruce mill, and the concentrate produced was shipped to the Arkansas Valley lead smelter. Less than 100 tons of ore was produced from each of the four other active lode mines.

Gunnison.—Coal production from nine mines was 3 percent less than in 1957. Nearly half of the coal was used in the manufacture of coke for western steel plants and because of a decline in demand for steel early in the year, output was curtailed.

Combined value of gold, silver, copper, and lead output from three mines was only $2,800 compared with five operations and $1 million (including zinc) in 1957 and $2.1 million in 1956. This precipitous decline primarily was the result of continued inactivity at the Keystone Unit, American Smelting and Refining Co.

Gunnison Mining Co. operated its 200-ton-a-day sulfuric acid leach uranium mill at Gunnison throughout the year.

Three contractors for the Colorado Department of Highways quarried 88,000 tons of paving gravel, and Hunt Construction Co. 27,000 tons. The bulk of the stone output was crushed miscellaneous stone from contractor operations supervised by the Colorado Department of Highways. Basic Chemical Corp. and Colo-Tex Stone Co. produced dimension marble used as building and monumental stone.

Huerfano.—Coal production from 10 mines was 9 percent below that in 1957. Major producers were Delcarbon Coal Co. at the Calumet No. 2, Morning Glory Coal Co. at the Morning Glory, and Skinner Coal Co. at the Gordon. A description [6] of the geology and coal resources of the Walsenburg area was published.

The Chamblin mine of Standard Fire Brick Co. produced 6,500 tons of fire clay. Sand and gravel output nearly doubled in 1958 as the result of highway-construction contracts let by the Colorado Department of Highways. Construction crews and contractors for the State highway department quarried 4,400 tons of crushed miscellaneous stone.

Jackson.—Petroleum production from four fields was 4 percent greater than in 1957. Carbon dioxide from wells in the McCallum and McCallum-S fields was vented.

Coal was produced at two mines (one underground, one strip). The Rosebud Strip, a new mine, was the major producer.

The Cowdrey fluorspar mine of Ozark-Mahoning Co. was active most of the year and the mined ore processed at the company Acid-grade plant also at Cowdrey. The Acid-grade concentrate was shipped to the Government stockpile, and a small quantity of crude material sold for use in the manufacture of cement. Graham Construction Co. worked on a Colorado Department of Highways contract, producing 34,400 tons of paving gravel.

Jefferson.—Nonmetals composed 62 percent of the value of mineral production. Sand and gravel was the principal product. Of 1.5 million tons of sand and gravel produced, 1.1 million came from eight

[6] Johnson, Ross B., Geology and Coal Resources of the Walsenburg Area, Huerfano County, Colo.: Geol. Survey Bull. 1042–0, 1958, pp. 557–583.

commercial operations, the Rio Grande Co. and Asphalt Paving Co. being the principal producers. The remaining 400,000 tons was quarried by construction crews and contractors for the Colorado Department of Highways.

Fire clay and miscellaneous clay played an increasingly important part in the county mineral industry. Output reached 238,000 tons in 1958—29 percent more than in 1957. Fifteen open-pit and underground mines were active. Robinson Brick & Tile Co. worked its Chieftain, Lariat, and Man properties; Denver Brick & Pipe Co. worked its Strainland and Ca Nos. 4 and 71 mines; and Denver Fire Clay Co. worked its North and South Golden mines. The principal producers were the G. W. Parfet Estate, Inc. (Green Mountain-Rockwell-Apex), Wesley Conda (State and Church pits), and Lakewood Brick & Tile Co. (Lindsay pit). Output of the various pegmatite deposit minerals fell below previous production totals. Although 17 mines or claims were worked during the year, output of feldspar and mica decreased substantially. The decline mainly was due to the closing of the Denver feldspar and Pueblo mica mills of International Minerals & Chemical Corp., as well as the increased cost of mining pegmatite deposits.

One ton of beryl was recovered from the Biggar Mica mine and the W. E. Branch property, and a small quantity of scrap mica from four other deposits.

Thorite recovered from the Twin Pine dike by Phillips-Carter-Osborn was shipped to the Boulder mill of Wah Chang Corp.

Fifty tons of fluorspar (98 percent CaF_2) was produced by Beal & Monett and sold to a Denver area foundry.

Gold and silver were recovered as byproducts at four sand and gravel washing and screening plants, Kerkling & Slensker (W. B. Slensker Placer) being the principal producer.

Uranium ore from seven mines was shipped to various processing mills for treatment. Major producers were the Denver Golden Oil Co., operating the Schwartzwalter mine, and Williams Mining Co., operating the Colorado Lease 519–16. Most of the ore was uraninite-pitchblende type containing from 0.21 to 1.08 percent uranium oxide. The average grade of all ore shipped was 0.65 percent uranium oxide. A contract for Government assistance to explore the Pallaoro Lease by Four Corners Uranium Corp. was approved by DMEA in October 1957. Work began early in 1958. Total amount of the contract was $15,400 with Government assistance limited to 75 percent.

Lake.—The entire output of molybdenum from Colorado came from the Climax mine of Climax Molybdenum Co. Division of the American Metal Climax, Inc. According to the company annual report, 6.4 million tons of molybdenum ore was produced and milled from the Climax mine, only 60 percent of its record production in 1957. Because of lower sales, mine output was reduced in the spring and averaged 29,300 tons an operating day for the balance of the year, compared with 34,400 tons a day in 1957. In rescheduling production at a lower rate in the spring the workweek per employee was cut back from 48 to 40 hours. As a result of this action, workers representing the production and maintenance sections demanded compensatory wage increases which the company considered unwarranted, and a

strike resulted. After 12 weeks the strike was settled on the basis of a revised pension plan, reduced premiums for hospitalization and group insurance and, in lieu of reopening wage discussions next July, a 7-cent-per-hour wage increase to become effective July 15, 1959.

According to the company 1958 annual report, 25.1 million pounds of molybdenum was contained in concentrate produced compared with 42.5 million pounds in 1957. Byproduct concentrates of tungsten, tin, and pyrite were recovered from the molybdenum ore in the new $2 million plant at Climax, completed and placed in operation early in 1958. Drilling of the main ore body established an additional 19 million tons of ore at present costs and price levels, and a re-evaluation of reserves added an additional 41 million tons of ore. The total ore reserve at the close of the year was calculated at 472 million tons. Before dilution in mining, this ore is equivalent to at least 2 billion pounds of molybdenum, according to the company.

A substantial quantity of pyrite was shipped to a Denver plant for use in the manufacture of sulfuric acid.

The Arkansas Valley lead smelter of the Colorado Department of the American Smelting and Refining Co. at Leadville operated throughout the year and treated ore and dump material from the six mines that accounted for the production of gold, silver, copper, and lead in Lake County. Ores and concentrates from other counties, other States, and foreign countries also were smelted at this plant. The company also was the principal producer of these metals in the county from material retreated from the American Smelter, Humboldt, and Little Ellen dumps.

La Plata.—Coal production (11 mines) was 15 percent below that of 1957. The principal producer was Victory Coal Co. (Victory Nos. 1 and 3 mines). Natural gas production declined 17 percent from that of 1957. Major production was from three of the six fields—Ignacio-Blanco, Ignacio, and Barker Dome. Petroleum production increased 50 percent over 1957.

Highway-construction activities by contractors for the Colorado Department of Highways resulted in the production of 244,000 tons of paving gravel; construction crews of the department accounted for the remaining 5,000 tons. Highway construction also was responsible for the 1,400 tons of crushed miscellaneous stone quarried.

Vanadium Corp. of America operated its plant at Durango for the recovery of uranium and vanadium oxides; ore was from company-owned mines and independent operations on the Colorado Plateau. The corporation transferred all milling operations to its Durango plant when the plant at Naturita was closed in January. Capacity of the Durango plant was increased from 430 to 750 tons daily.

Larimer.—Increases in shipments of cement, production of sand and gravel, and stone output were responsible for the 75-percent gain in the value of minerals produced. Nonmetals as a group accounted for 94 percent of the $9.8 million value of mineral production. Cement—all from the Boettcher plant of Ideal Cement Co.—led all commodities in value. The plant's two kilns were operated for 324 and 327 days, respectively, compared with 223 and 241 days in 1957.

Limestone for cement was quarried by Ideal Cement Co., whereas

gypsum used as a cement retarder was produced by E. W. Munroe. United States Gypsum Co. operated its Loveland gypsum quarry throughout the year, and limestone mined by Frank H. Norberg Co. was used principally in the manufacture of sugar and lime. Production of feldspar and mica was relatively unchanged from 1957; no hand-cobbed mica was produced, and beryl production decreased from 9 tons in 1957 to 2 tons. Of the four commercial sand and gravel operators who reported output of 561,000 tons, Weitzel & Sons was the major producer. Construction and maintenance crews of the Colorado Department of Highways and county highway department produced 177,000 tons of paving gravel, and Carl V. Hill as contractor for the Federal Bureau of Public Roads quarried 11,000 tons of paving gravel.

Petroleum production from five fields was 9 percent below that of 1957.

Las Animas.—Coal output accounted for $7.9 million of the county's total value of mineral production in 1958 of $8.5 million. All came from 12 underground mines and was 42 percent below that of 1957. Because of a decline in the demand for steel early in the year, operations at The Colorado Fuel and Iron Corp. Allen and Frederick mines, the two largest in the county, were curtailed. The entire production of these two mines was used in the manufacture of coke at the corporation's steel plant at Pueblo. A description[7] of the fire-protection system at the Allen mine was published.

Carbon dioxide was produced at the Nina View field and transported by pipeline to a processing plant at Ninaview in Bent County. Output of the plant, dry ice and liquid carbon dioxide, was marketed as far away as Montana and Texas. Production was 20 percent more than in 1957.

Construction of State and county highways in Las Animas County resulted in the production of 1.2 million tons of paving sand and gravel by three contractors for the State highway department and construction and maintenance crews of both the State and county highway departments. Fire clay was recovered from the Santa Fe mine of Scott-Ruiz Coal Co.

Logan.—Petroleum output valued at $17 million was produced from 67 fields and was 13 percent below that of 1957. This decline resulted primarily from the gradual depletion of the pools. Major producing fields were the Yenter, Graylin-NW, Cliff, and Atwood-E. New field discoveries included the Sandy Hill, Scarp, and Spring Creek.

Natural gas production was 13 percent below that of 1957. Natural gasoline, propane, and butane were recovered at the N. C. Ginther plants in the Yenter field and at the Kansas-Nebraska Natural Gas Co. Mount Hope plant.

Mesa.—Uranium ore shipments were valued at $3.5 million—three-quarters of the county's total value of mineral production. Major production was by Climax Uranium Co. from the Incline group and Bonanza mines, and Beaver Mesa Uranium, Inc., from the Rajah group and Pack Rat mines. A contract for Government assistance

[7] Van Natter, P. C., Fire-Protection System, Allen Coal Mine, Colorado Fuel and Iron Corp., Stonewall (P. O., Weston), Las Animas County, Colo.: Bureau of Mines Inf. Circ. 7852, 1958, 23 pp.

to the New Idria Mining & Chemical Co. for exploration of the Hubbard Homestead, Pack Rat, and other claims for uranium was approved by DMEA. Amount of the contract was $102,600 with Government assistance limited to 75 percent.

Climax Uranium Co. operated its 330-ton-a-day plant at Grand Junction for the recovery of uranium oxide and vanadium oxide. The AEC concluded the testing of new processes and process improvements at its Grand Junction pilot plant. Uranium mills west of the Mississippi River delivered concentrate containing 12,407 tons of uranium oxide to the Grand Juction Operations Office during the year. The approximate value of the concentrate was in excess of $231 million. Lucius Pitkin, Inc., was the contractor for AEC for ore-buying and concentrate-receiving functions at the Grand Junction Operations Office.

The American Gilsonite Co., jointly-owned by Barber Oil Co. and Standard Oil Co. of California, completed a full year's operation of its processing plant near Fruita in August. Although throughput was in excess of design capacity, the company announced plans to increase capacity of the plant from 700 to 850 tons a day. The company developed a bituminous road-paving concrete consisting of gilsonite, gravel, and an oil-base plasticizer which can be laid at temperatures below 35 degrees; tests have indicated wearing qualities comparable to other asphalt and oil mixtures.

Union Oil Co. suspended operations at its oil-shale experimental mine and retort at Grand Valley in July.

Coal production from seven mines increased 10 percent over that of 1957. Kerr Coal Co., operating the Cameo mine, was the largest producer and accounted for 85 percent of the total production. Over 67,000 tons, or 94 percent, of the production of the Cameo mine was used at the 22,000-kw. power plant at the portal of the mine, built and operated by Public Service Co. of Colorado. Plans were announced for doubling the capacity of the plant by 1960.

Natural-gas production at the Asbury Creek, Bar X, and Highline Canal fields was 14 percent below that of 1957. Four new gasfields were discovered.

The Grand Junction Brick & Tile Co. continued to mine miscellaneous clay for use in the manufacture of brick and other structural-clay products at its Grand Junction plant. Road construction was the principal outlet for the increased sand and gravel production, although 230,000 tons of commercial aggregate was produced. Crushed miscellaneous stone was used in highway construction.

Mineral.—Gold, silver, copper, lead, and zinc accounted for all mineral production except for gem stones and sand and gravel valued at $11,000. Metals were produced from three mines but mostly from the Emperius mine of the Emperius Mining Co., the third largest producer of silver, lead, and zinc in Colorado. Mining and milling was suspended June 1, the first shutdown in 25 years, but was reactivated in November on a limited basis. From 26,501 tons of ore containing 894 troy ounces of gold, 114,229 ounces of silver, 1,454 tons of lead, and 1,536 tons of zinc mined and milled during the year, lead and zinc concentrates were produced and shipped to the American Smelting and Refining Co. smelters at Leadville and Amarillo, Tex., respectively.

Sublet Mining Co. treated lead ore from the Holy Moses Nos. 1 and 2 in its mill at Creede and also retreated mill tailings.

Moffat.—Petroleum supplied $3.5 million and uranium ore $2.6 million of the county's $7 million value of mineral production. Coal, sand and gravel, and stones accounted for the remainder.

Petroleum was produced from 13 fields and was 16 percent below that of 1957. Natural gas produced at 11 fields—principally the Hiawatha, Powder Wash, and Sugar Loaf—also declined. Two new fields (Little Snake and Winter Valley) were discovered. Mountain Fuel & Supply Co. recovered natural gasoline, propane, and butane from wet-petroleum gas at its natural gasoline plant.

Uranium ore was produced at 17 operations, the majority of them operated by Trace Elements Corp. The 300-ton-a-day processing plant at Maybell, operated by Trace Elements Corp., completed a full year's operation (operation began in December 1957). The plant used separate acid-leach circuits for high-grade and low-grade ores.

Colowyo Coal Co. produced coal at its Red Wing mine.

Montezuma.—Sand and gravel continued to account for most mineral production. Six contractors for the Federal Bureau of Public Roads and Colorado Department of Highways were responsible for nearly all the production.

Petroleum production from the Dove Creek and Mancos River fields was 20 percent below that of 1957. Natural gas production from the Dove Creek field also declined. Carbon dioxide from the McElmo field was 30 percent greater than in 1957. The gas was processed by Colorado Carbonics Corp. at its plant on McElmo Creek. Dry ice and liquid carbon dioxide were marketed in the Four Corners area of Colorado, New Mexico, Arizona, and Utah. One new field, the Marble Wash, was discovered. Uranium ore from the Blue Eagle mine was shipped to Uravan for processing.

Montrose.—Uranium mining and milling was the primary mineral-industry activity in the county, and uranium ore produced at 261 operations represented 45 percent of the production in the State. Output was 1 percent below that of 1957; however, the grade of ore mined increased from 0.25 to 0.27 percent uranium oxide. The five major operators, Union Carbide Nuclear Co., Climax Uranium Co., Vanadium Corp. of America, Worcester Mines, and Golden Cycle Corp., accounted for 87 percent of the production. Most of the ore was processed at the 1,100-ton-a-day Union Carbide Nuclear Co. mill at Uravan. Ore also was processed at mills at Durango, Grand Junction, and Rifle. The Vanadium Corp. of America plant at Naturita was closed on January 31, and all milling operations were transferred to its plant at Durango. A contract for Government assistance in the exploration of the Renegade claims by Rex Uranium Corp. was approved by DMEA. Total amount of the contract was $30,300, with Government participation limited to 75 percent.

Morgan.—Petroleum output accounted for all but $94,000 of the $21.7 million total value of mineral production in Morgan County in 1958. Production came from 34 fields and increased 6 percent over that of 1957. Natural gas production from oil wells increased 39 percent over the previous year. Dry gas was produced at the Vallery and Adena fields. Natural gasoline, propane, and butane were recovered

at the Pure Oil Co. Adena Gasoline Plant No. 24. The county led the State in the number of exploratory and development wells completed and also led in the number of discoveries and successful development completions. Discovery, early in the year, in the Bijou area led to increased exploration and development. The West Bijou discovery flowed 930 barrels of oil a day and was followed by the Bijou discovery that flowed 13.5 million feet of gas a day. A third discovery 1.5 miles northeast of the West Bijou discovery flowed 960 barrels of oil a day and was named the North Bijou field. Active development followed the discoveries, and by the end of the year 12 oil producers had been added to the West Bijou field, 5 to the North Bijou field, and 3 oil producers and 1 gas producer to the Bijou field.

Following a discovery midway between the Pinneo-SW and Pinneo fields, a new field, the Zorichak, was outlined and included the Pinneo, Pinneo-SW, and Pinneo-N fields. Active development followed, and 15 more producing wells in the field were completed including a second producing horizon. The Luster field discovery flowed 70 barrels of oil a day, and subsequent development resulted in four oil producers and one gas well. Other discoveries included the Rake, Lamb, and Trend fields. Development in the Trend field resulted in four producing wells by the end of the year. Further exploration of an existing well was listed as the discovery of the Bike field. When completed, the well flowed 7.7 million cubic feet of gas a day. All discoveries and successful development wells were completed in the D and J sandstone members of the Dakota formation.

Ouray.—A small production of gold, silver, copper, and lead, accounting for half of the value of mineral output, came from material recovered by Camp Bird Colorado, Inc., from a cleanup of the Camp Bird mill, and by the Bay City Mining & Milling Co. from material from the Revenue mine dump treated in the company mill 3½ miles north of Ouray. Camp Bird had 10 men doing development at the mine. Bay City, in addition to treating its own ore, accepted custom ore from local operators or lessees.

Park.—Combined value of output of gold, silver, copper, and lead in Park County increased from $100,000 (including zinc) in 1957 to $198,000. Leadville Lead Corp. supplied most of the 1958 production of these metals. Lead ore (3,572 tons) was produced by the corporation from the Hilltop mine and shipped to the Leadville smelter. Uranium ore produced at the Lucky Jim group was shipped to the mill at Gunnison for processing.

The Boomer Lode, the principal beryl-producing mine in the Nation, operated throughout 1958. The production of beryl was 227,248 pounds averaging 9.17 percent BeO. In addition, 84,630 pounds of material assaying 2.84 percent BeO was sold. Mountain Dale Mining Co. was the operator and, except for the low-grade ore, all shipments were made to the Government purchase depot at Custer, S. Dak. The J & S Lode was also worked, and 8,017 pounds of ore was produced, averaging 9.25 percent BeO; shipment also went to the Government stockpile.

The Douglas claim, operated by Harold E. Douglas, produced a small quantity of feldspar and scrap mica. Lockhart & Ellis worked the Micanite dike for feldspar, and Charles Erickson recovered scrap

mica from the Holsted Mica dike. Construction and maintenance crews of the Colorado Department of Highways and two contractors for the department produced 43,600 tons of paving gravel.

Pitkin.—Coal production from four mines increased 23 percent compared with 1957. Thompson Creek Coal & Coke Corp. operated its Thompson Creek Nos. 1, 2, and 3 mines, and Mid-Continent Coal & Coke Co. operated its Dutch Creek mine. Mid-Continent Coal & Coke Co. began operation of 23 beehive coke ovens at Redstone in April.

Prowers.—A discovery credited to the county in 1958 was from a well abandoned in 1957 in the Atoka and Keyes formations. After reworking, including two acid treatments, the well produced 2.3 million cubic feet of gas a day from the Morrow formation. There has been no production within 35 miles of the discovery. No development was attempted during the year.

Pueblo.—Constructions materials—clays, sand and gravel, and stones—accounted for 98 percent of the value of mineral production. A twofold increase in sand and gravel production was due entirely to a concentration of highway construction by the Colorado Department of Highways. Pueblo County was the leading producing region in the State, and road contracts let by the State and county highway departments resulted in the production of 1.9 million tons of paving gravel. Pioneer Construction Co., San Ore Construction Co., and Broderick & Gibbons, Inc., were the major contractors. Fountain Sand & Gravel Co. was the principal commercial producer.

Output of all clays was 70,000 tons valued at $224,000. Six mines or groups of mines were operated, and 45,000 tons of fire clay was produced at five mines and 25,000 tons of miscellaneous clay at one mine. Fire-clay producers were Colorado Fire Clay Co. (Nellie-Helen mine), General Refractories Co. (Turkey Creek mines), Harbison-Walker Refractories Co. (Miller mine), Standard Fire Brick Co. (Rock Creek mine), and The Colorado Fuel and Iron Corp. (San Carlos mine). Miscellaneous clay was mined by the Summit Brick & Tile Co. for use in the manufacture of brick and other structural clay products.

Uranium ore from the George Avery and Mineral Rights mines was shipped to mills at Rifle and Gunnison for processing.

Rio Blanco.—Although Rio Blanco County continued to lead the State in petroleum production, output of petroleum and natural gas (from five oilfields and six gasfields) was 19 percent and 9 percent, respectively, below that of 1957. Major production continued to be from the Rangely and Wilson Creek fields with the greatest decline at the Rangely field. Unit operation of the Rangely field and the beginning of waterflood operations required adjustments in production schedules and resulted in lower output. The Baxter Pass gasfield, 9 miles northwest of the Twin Buttes field was the only discovery in 1958. Initial flow was 8.6 million cubic feet a day from the Dakota formation and a lesser amount from the Morrison formation. Natural gasoline, butane, and propane were recovered from natural gas at the plant operated by The California Co. at Rangely. Wesco Refining Co. operated its 2,000-barrel-a-day refinery at Rangely, but throughput was 20 percent below that of the previous year.

Coal production from three mines was slightly below that of 1957. The major producer was Jenkins & Mathis Coal Co. at the Rienau mine.

Uranium ore from 13 operations was shipped to Rifle for processing. Major producers were Devereaux Bros. at the Burrell No. 5 and Coal Creek No. 1 mines and McAlester Fuel Co. at the Burrell No. 3, Butterfly No. 2, and Last Day No. 1 mines.

Routt.—Coal production (from six underground and three strip mines) declined 14 percent from that of 1957. The Colorado & Utah Coal Co. abandoned the Harris mine January 31 after 44 years of operation, and the Keystone Coal Co. closed its Keystone mine February 28 after operating 32 years. Major production was from the Edna and Osage strip mines on the Lennox and Wadge seams.

Petroleum production (from three fields) was 71 percent greater than in 1957, and largely was from the Tow Creek and Curtis fields, the latter a 1958 discovery in the Niobrara formation 5 miles southeast of the Tow Creek field. One successful development well northwest of the Curtis discovery was completed, and an exploratory well (Mancos shale) a mile south of the Tow Creek field, which was included in the Tow Creek field.

Pumice (scoria) production by McCoy Aggregate Co. of Steamboat Springs returned to the 1956 level after the marked drop in 1957. The bulk of the output was used as railroad ballast and the remainder in concrete aggregate.

Saguache.—Uranium ore (from six operations) supplied $1.9 million of the county's $2.1 million value of mineral production and increased from 1,700 tons in 1957 to 105,000 tons in 1958. Major producer was the Gunnison Mining Co. at its Los Ochos mine, all of which was processed at the company mill at Gunnison. A contract for Government assistance in exploration of the Lookout claims for uranium by Gibralter Minerals Co. was approved by DMEA. Total amount of the contract was $30,600, and Government participation was 75 percent.

The value of gold, silver, copper, lead, and zinc in Saguache County increased from $7,000 in 1957 to $135,000 in 1958. Superior Mines Corp. accounted for most of this increase by its production of ore from the Antoro and Rawley mines and by the construction of its new 100-ton-a-day mill at Bonanza to provide a market for ore produced in this area.

Jim McRee and Rampart Mining Co. shipped manganese ore and concentrate with a manganese content of 40 percent or more from deposits in the county under the Government "carlot" program administered by the GSA.

San Juan.—The major producer of gold, silver, copper, lead, and zinc was the Argyle Mining & Milling Co., which mined ore from the Osceola, Pride of the West, and Hematite mines and treated it in the company's Pride mill. Ores from other mines in this area also were treated in this mill. Marcy-Shenandoah Corp. produced and shipped ore from the Garry-Owen mine, and also renovated the old Shenandoah-Dives mill (near Silverton) renamed the Silverton Central mill. The company announced plans to open the 700-ton-

per-day mill after the close of the year and accept custom ore in addition to treating ore from its own mines.

A contract for Government assistance in exploration of the Surprize claims for uranium by the Gaddis Mining Co. was approved by DMEA. Total amount of the contract was $17,900 with Government participation 75 percent. A small quantity of ore was produced by the company and shipped to the mill at Gunnison for treatment.

San Miguel.—Most of the gold, silver, copper, lead, and zinc produced (which accounted for $6.6 million of the $10 million total value of mineral production in the county) came from the Idarado Mining Co. operation of the Treasury Tunnel-Black Bear-Smuggler Union group of mines. This group was the State's leading gold, copper, and lead producer and ranked second in silver and zinc output. The Newmont Mining Corp., 74.2 percent owner of the Idarado Mining Co., stated in its annual report for 1958 that 382,100 tons of ore (averaging 0.08 ounces of gold and 2.08 ounces of silver per ton, 2.07 percent lead, 0.72 percent copper, and 3.48 percent zinc) was milled at the company-owned Pandora mill from this group of mines compared with 457,850 tons in 1957.

Iron ore (brown ore) was shipped by C. K. Williams & Co. from the Iron Springs Placer mine for use in the manufacture of paint. The entire production of iron ore in Colorado was from this deposit.

Uranium ore production was 61 percent greater than in 1957, and the county ranked third in the State. Shipments were made to mills in Colorado and Utah and to upgrading plants at Slick Rock and at Green River, Utah. Principal producers were Union Carbide Nuclear Co. and Dulaney Mining Co.

Summit.—Horn & Burger (Wellington mine) and Lisbon Valley Uranium Co. (Chautauqua mine) were the major producers of gold, silver, copper, lead, and zinc. Ore from the Wellington was shipped to the United States Smelting Refining and Mining Co. mill at Midvale, Utah, and that from the Chautauqua was treated at the Toledo mill near Montezuma. DMEA contracts were executed projects at two mines. Knight Mining Corp. entered a $20,400 contract for exploration for copper-lead-zinc on the New York claims, and Norbute Corp. had a $190,800 contract for exploration for lead-zinc at the Sts. John mine. Government participation was 50 percent in both contracts.

Teller.—Gold production accounted for all but $29,000 of the $1.5 million of mineral production. The gold (and silver), all from 19 mines in the Cripple Creek district, was recovered at the Carlton mill. The major producers (in order of output) were The Golden Cycle Corp. (Ajax mine), The Cresson Consolidated Gold Mining and Milling Co. (Cresson mine), The United Gold Mines Co. (Deadwood mine, Golden Cycle dump, Vindicator dump, and Hull City dump), and Deadwood Leasing Co. (Free Coinage mine), the State's 2d, 3d, 4th, and 6th largest gold producers, respectively.

According to the annual report of The Golden Cycle Corp., 99,971 tons of company and custom ore averaging $15.25 per ton was treated at the company Carlton mill, compared with 116,408 tons averaging $14.13 in 1957. Production from the Ajax mine was 28,486 tons averaging $28.39 a ton, compared with 28,868 tons averaging $27.45

in 1957. Production in 1958 was about evenly divided between the Queen of the Hills-Bobtail and the Newmarket vein systems. Company-mined ore production came from the 2,600–3,100 levels, inclusive; lessee ore came from the 1,700–2,600 levels.

The Cresson Consolidated Gold Mining and Milling Co. stated in its annual report that the company produced 6,945 tons of ore averaging $13.73 a ton from the Cresson mine and that 21,849 tons of ore averaging $10.83 a ton was produced from this mine by lessees. It was decided to discontinue all company mining at the Cresson mine in favor of complete lessee operation, under company supervision.

The United Gold Mines Co., in its annual report to stockholders for 1958, reported production of 26,340 tons of ore averaging $8.19 per ton. Of this, 7,564 tons came from the Deadwood mine, 9,021 tons from the Golden Cycle dump, 6,602 tons from the Vindicator dump, and 2,830 tons from the Hull City dump. No ore was taken and no exploration was done on the Vindicator mine. The Deadwood Leasing Co. nearly doubled its 1957 output of ore and continued to be the largest producer among the independent operators.

Three pegmatite deposits were mined for feldspar and mica. The Garver dike operated by E. S. Robinson was the major producer of feldspar during the year followed by the Daisybell and Black Cloud. The Black Cloud dike was worked by Ralph Pierce and Carl Quist and produced the only mica in the county in 1958.

Washington.—Petroleum production (from 51 fields) was 3 percent below that of 1957. Drilling activity and exploration and development continued but at a lower rate than in 1957. Discoveries included the Azure, Cone, Hirst, Hone, Ramp, Rill, and Spar fields; with the exception of the Azure field, which was completed in the D sandstone, all discoveries were in the J sandstone of the Dakota formation. A new producing horizon in the J sandstone was found at the Rago field. Natural gasoline, butane, and propane were recovered by Continental Oil Co. at its Little Beaver gas-products plant No. 25.

Weld.—Petroleum production (from 33 fields) was 10 percent below that of 1957. Five new fields were discovered—Antelope in the Sussex formation, Flag and Terrace in the D sandstone, and Tower and Vigor in the J sandstone of the Dakota formation. Coal was produced at six underground mines; output was 7 percent below that of 1957. Principal producers were The Imperial Coal Co. (Eagle and Imperial mines) and The Clayton Coal Co. (Lincoln and Washington).

The Mineral Industry of Connecticut

By Stanley A. Feitler [1]

CONNECTICUT mineral production in recent years has been increasingly dominated by sand, gravel, and stone. These three commodities supplied 94 percent of the total value of mineral production in 1958, compared with 83 percent in 1953, 84 percent in 1948, and 46 percent in 1943. The value of mineral production in 1958 was 18 percent less than in 1957. New Haven County mineral production was valued at $4.1 million, the highest in the State. The value of Hartford County production was $3.4 million, and output from Fairfield and Litchfield Counties was valued at more than $1 million.

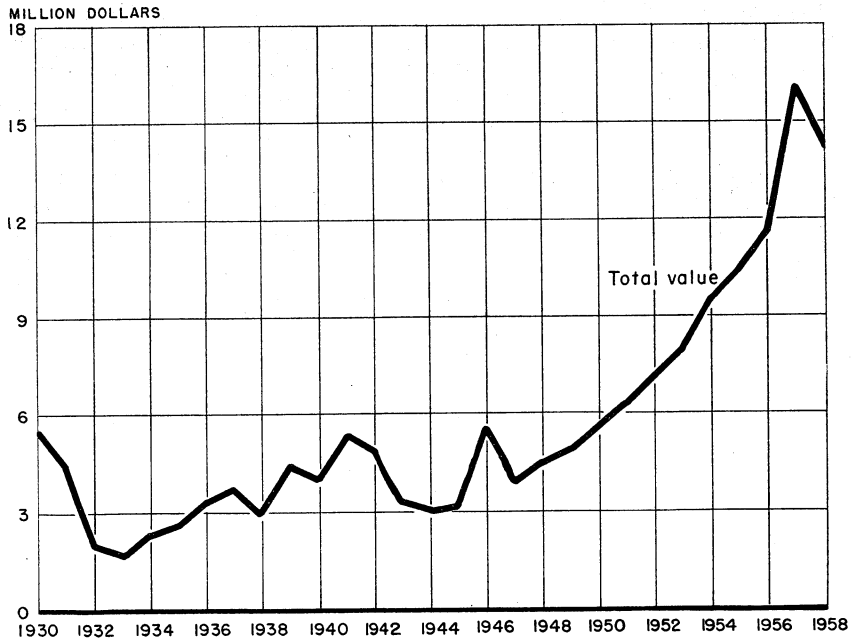

FIGURE 1.—Value of mineral production in Connecticut, 1930–58.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

TABLE 1.—Mineral production in Connecticut[1]

Minerals	1957		1958	
	Short tons (unless otherwise stated)	Value (*thousands*)	Short tons (unless otherwise stated)	Value (*thousands*)
Clays	308,236	$409	198,831	$299
Gem stones	(2)	(3)	(2)	3
Lime	30,341	503	28,996	464
Peat	2,004	11	1,764	11
Sand and gravel thousand short tons	4,777	5,042	5,019	5,479
Stone do	6,199	10,040	4,223	6,863
Value of items that cannot be disclosed: Beryllium concentrate, feldspar, sheet mica, gem stones (1957)		119		89
Total Connecticut		16,055		13,128

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Figure withheld to avoid disclosing individual company confidential data.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Demand for building brick decreased, resulting in greatly reduced clay production. Several clay pits were idle, and others were operated at a reduced rate. The Stiles Corp. successor to I. L. Stiles & Sons Corp. at North Haven discontinued manufacturing lightweight aggregate from clay early in the year.

Feldspar.—Output of feldspar decreased 14 percent in tonnage and 25 percent in value, compared with 1957. The average value per long ton of crude feldspar $7.31, was $1.10 less than the 1957 value. Production from two open-pit mines was hauled by truck to local grinding plants. Grade was maintained by selective mining and some hand-sorting.

Gem Stones.—Improved canvass and inclusion of mineral specimens resulted in a substantially higher value for this commodity than in previous years. Gem, mineral, and lapidary clubs were especially active in Middlesex County, where numerous pegmatites offer collectors an opportunity to find gem stones as well as a variety of rare minerals. Increased production also was reported from Litchfield County.

Lime.—Demand for lime was less than in 1957; the only producer in the State operated at 85 percent of capacity. Consumption by uses when compared with 1957 showed small fluctuations. Requirements for construction and chemical uses were down, but purchases for agricultural applications increased. Manufacture of magnesium metal at Canaan consumed over 40 percent of the total tonnage produced. About one-third of hydrated-lime production was marketed in Massachusetts and New York.

Mica.—The small production of mica was sold to the Franklin (N.H.) General Services Administration (GSA) Materials Service Depot. Both hand-cobbed and full-trimmed mica were sold to the depot; no sales of scrap mica were reported. Only two mines were worked.

Peat.—Bogs in Hartford, Middlesex, and Tolland Counties were exploited by producers, who sold peat for use as a soil-conditioner. The average value per ton was $6.38.

Sand and Gravel.—Increased production of sand and gravel was due principally to sand and gravel output for paving, gaining 18 percent in quantity and 34 percent in value over 1957. The average price per ton rose 16 cents for commercially produced paving sand and 4 cents for gravel. Sand and gravel for fill valued at $242,000 was produced although none had been reported in 1957. Price changes in the various categories were irregular with more increases than decreases.

TABLE 2.—Sand and gravel sold or used by producers, by classes of operation and uses

Use	1957		1958	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Molding	[1]	[1]		
Structural	1,260,560	$1,295,098	1,194,636	$1,182,724
Paving	1,288,620	1,185,754	1,377,768	1,497,269
Grinding and polishing	[1]	[1]		
Fill			64,440	33,232
Gravel:				
Structural	986,216	1,349,605	861,526	1,199,172
Paving	648,897	746,273	914,868	1,086,940
Railroad ballast	[1]	[1]		
Other	[1]	[1]	127,816	165,849
Fill			261,386	208,819
Undistributed [2]	352,804	362,423	113,470	65,968
Total	4,537,097	4,939,153	4,915,910	5,439,973
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving	181,990	81,911	62,505	23,210
Gravel: Paving	57,890	20,435	40,400	15,501
Total	239,880	102,346	102,905	38,711
Grand total	4,776,977	5,041,499	5,018,815	5,478,684

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes filter sand, railroad ballast sand (1958), other sand, and data indicated by footnote 1.

Stone.—Because the Connecticut Turnpike was virtually completed in 1957, demand for stone dropped significantly, decreasing 32 percent in both tonnage and value.

Stone requirements were met by quarrying basalt, granite, limestone, and sandstone, in order of decreasing tonnage, from all counties except Middlesex and Tolland. Basalt was the principal stone used as concrete aggregate, roadstone, and riprap and the only stone used for railroad ballast. A few tons were used as rough dimension stone. Granite was used as concrete aggregate, roadstone, dimension stone, and riprap. Crushed limestone was used as flux, road material, stucco, and in manufacturing lime. Limestone was ground to suitable size and used in agriculture and pottery. Other applications included

filler in paint, rubber, and asphalt. Only a small tonnage of limestone was used for dimension stone. Silica (quartz) was ground to specifications and sold for use in special glass, as an abrasive, foundry sand additive, and filler.

TABLE 3.—Stone sold or used by producers, by uses

Use	1957		1958	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Dimension stone:				
Building stone:				
Rubble	918	$13,900	(1)	(1)
Rough construction	425	3,573	(1)	(1)
Rough architectural	(1)	(1)	2,650	$63,866
Rough monumental	(1)	(1)	180	17,436
Dressed construction	2,534	89,391	(1)	(1)
Dressed architectural	1,089	26,246		
Curbing and flagging	264	7,610	160	5,706
Undistributed [2]	483	39,669	2,902	63,729
Total dimension stone (quantities approximate in short tons)	5,713	180,389	5,892	150,737
Crushed and broken stone:				
Agstone	(1)	(1)	61,536	274,691
Concrete, roadstone	5,930,823	8,982,647	[3] 3,567,395	[3] 5,240,448
Quartz (ground)	(1)	(1)	25,000	222,000
Undistributed [4]	262,265	877,399	563,066	974,642
Total crushed and broken stone	6,193,088	9,860,046	4,216,997	6,711,781
Grand total	6,198,801	10,040,435	4,222,889	6,862,518

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes figures indicated by footnote 1.
[3] Incomplete figure, part not included is combined with "Undistributed."
[4] Includes riprap, flux, railroad ballast, part of concrete and roadstone (1958), other crushed and broken stone, and figures indicated by footnote 1.

METALS

Production of hand-sorted beryl concentrate was 32 percent below 1957. The sacked beryl containing 12.3 percent BeO was sold to the GSA depot at Franklin, N.H.

Approximately 170 foundries produced a wide variety of ferrous and nonferrous castings from primary and secondary metals. Secondary nonferrous metal was treated in eight smelters in Fairfield, Hartford, and New Haven Counties. These smelters processed solder, babbitt, remelt lead, aluminum, aluminum alloys, white metal alloys, zinc die cast alloy, remelted zinc, spelter, copper and copper alloys, brass, and bronze.

REVIEW BY COUNTIES

Fairfield.—Sand and gravel as building, paving, and fill material was produced by 13 companies. Bethel Sand & Gravel Co., successor to Senior Sand & Gravel Co., Inc., produced paving sand and the Bernard F. Dolan Co., building sand in Bethel. John Lomazzo & Sons Corp. was active in the Weston area, Peter B. German, near Fairfield, and E. Drenckham, at Cos Cob. The Bridgeport area was supplied by Daddario Sand & Gravel Co. and Grasso Construction Co.

The three active producers in Stamford were DeLeo Bros., Inc., Richard Morris, and Long Ridge Development. Paving gravel was produced at Westport by L. H. Gault & Son, Inc., and at Greenwich by Cecio Bros. Calve Bros., Darien, produced gravel for fill.

Connecticut Agstone Co., Danbury, mined dolomitic limestone for use as rough dimension stone, flux, agstone, and for roof and driveway surfacing.

Carpenter Steel Co. of New England (Bridgeport), successor to Northeastern Steel Corp. with annual capacity of 84,000 tons, produced blooms, billets, strip and bars. Plans were made for expanding the operation.

TABLE 4.—Value of mineral production in Connecticut, by counties

County	1957	1958	Minerals produced in 1958 in order of value
Fairfield	(1)	(1)	Sand and gravel, stone, gem stones.
Hartford	$4,405,894	$3,443,759	Stone, sand and gravel, clays, peat, gem stones.
Litchfield	1,615,996	1,368,018	Stone, lime, sand and gravel, gem stones.
Middlesex	499,659	413,721	Sand and gravel, clays, feldspar, peat, gem stones, mica.
New Haven	6,431,052	4,069,602	Stone, sand and gravel, clays, beryl, mica, gem stones.
New London	(1)	(1)	Stone, sand and gravel.
Tolland	(1)	(1)	Peat.
Windham	(1)	(1)	Sand and gravel, stone.
Undistributed	3,101,975	[2] 3,832,919	
Total	16,055,000	13,128,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes sand and gravel and gem stones unspecified by county.

Hartford.—Crushed basalt (traprock) sales were 63 percent of the county total and 17 percent of the value of all mineral production in the State. The New Haven Trap Rock Co. at its Plainville No. 4 Quarry sold broken and crushed stone as road material, railroad ballast, and riprap, shipping 20 percent of its tonnage by railroad. Sherman Sand & Stone Co. produced road material from its quarry in Plainville. Arborio & Sons, Inc. (Farmington), the Edward Balfe Co. (Newington), Materials Service, Inc. (East Granby), and Angelo Tomasso (New Britain), crushed basalt for road material and riprap. Fourteen companies produced sand and gravel for use principally as building, paving, and fill materials. Smaller quantities were sold for filter medium and for highway use—on icy or freshly oiled roads and for drainage. Sherman Sand & Gravel Co. built a new sand and gravel plant at Southington. The larger producers of sand and gravel were Dunning Sand & Gravel Co., Inc. (Farmington), Farmington Sand & Gravel Corp. (Farmington), Russak Bros., Inc. (Plainville), Helming Bros. (Bristol), Materials Service, Inc. (East Granby), and Connecticut Sand & Gravel Co., Inc. (Avon). No production was reported by Alexander Jarvis Co. (Manchester) and Louis Delbon (Avon). Production of 101,000 tons of sand and gravel by State and local agencies was used principally on highways within the county; mostly for minor road repairs and for sanding icy roads.

Hartford County continued to be the leading producer of clays in the State although demand for building brick decreased, causing a sharp drop in clay output. Two companies were inactive and four others, active but producing less than in 1957.

High-quality crude feldspar was ground for use as an abrasive in soap in a mill at Manchester. Most of the feldspar processed was mined by an affiliate outside the State.

Humus peat produced from a bog near Manchester for use as a soil conditioner was reported at about half the value of 1957 production.

Litchfield.—Sand and gravel was prepared and marketed by six producers principally as structural and paving material. A small tonnage was sold for sanding roads and miscellaneous uses. Lime Rock Sand & Gravel Co. moved its sand and gravel plant from Salisbury to Canaan but reported no production.

The quantity and value of limestone were about the same as in 1957. The New England Lime Co. Canaan quarry crushed high magnesium limestone for its lime kilns. Additional tonnage and stone too small for kiln feed was reduced to specification sizes and sold for use as whiting, rubber filler, and for agricultural purposes. U.S. Gypsum Co. at Falls Village quarried, prepared, and marketed limestone as open-hearth flux and for agricultural, pottery, stucco, and asphalt uses. The Conklin Limestone Co., Inc., quarried and marketed agricultural limestone at Canaan.

New England Lime Co. produced lime from dolomitic limestone in its two oil-fired rotary kilns and single hydrator. Quicklime was sold to Nelco Metals, Inc. (Canaan), for use in making calcium and magnesium metal and to the building industry as mason's lime. Hydrated lime was sold as finishing lime for use in construction and as agricultural lime.

Gem and mineral collectors were active and reported finding topaz, epidote, quartz, fluorite, tremolite, and scheelite.

Middlesex.—Deep River Construction Co. (Deep River), owned by Stanley Wollock, produced sand and gravel for paving and sand for roads at a plant near Essex. Butler Sand Service (Portland), produced building sand. Shore Line Washed Sand & Stone Co., Inc. (Madison), produced sand and gravel for concrete and construction and sand for roads from a bank at Killingworth. Heser & Bugg produced sand for roads and sand and gravel for paving from a bank at Clinton. All four companies have stationary plants.

The Michael Kane Brick Co. in Middletown, sole clay producer in the county, mined clay for building brick. A new clay-storage shed was built in 1958 to replace one demolished by snow and wind.

Mixed potash-soda feldspar, mined by Eureka Feldspar Mining & Milling Co. from an opencut in the Hale pegmatite near Portland, was trucked to its nearby mill and ground for use in pottery. The Hale pegmatite has little or no zoning and yields a uniform mixture of perthite and plagioclase. The Worth-Spar Co., Inc., mined potash-type feldspar by opencut in a zoned pegmatite at Cobalt, trucking the crude feldspar to its mill for grinding into an abrasive used in soap.

Eugene McGuire, a new peat producer, dug reed-sedge peat and J. Werden Clark produced humus peat from bogs near Old Saybrook.

Total production for the year was lower than in 1957, but the price per ton was higher.

Dumps and exposed workings at pegmatites near Portland, Middletown, and Haddam Neck, yielded a variety of gem stones and mineral specimens. Gem varieties of beryl recovered included aquamarine, morganite (pink), and golden beryl. Lithium minerals reported were kunzite, lepidolite, cookeite, and spodumene.

A few pounds of good-quality full-trimmed mica was produced from a pegmatite at the Enegren Mica mine near East Hampton. Tourmaline, red garnet, green apatite, and pale-green beryl were reported to occur at this mine.

New Haven.—New Haven County led in mineral production and in value of stone although production was 39 percent less than in 1957. A. N. Farnham, Inc. (New Haven), produced crushed basalt for concrete and roadstone uses. York Hill Traprock Co. (Meriden) produced riprap, railroad ballast, concrete aggregate, and roadstone at its York Hill Trap Rock Quarry. Foxon Trap Rock Co., Inc. (New Haven), and New Haven Trap Rock Co. (North Branford, No. 7 Quarry), (Wallingford, Middlefield No. 1 Quarry) prepared basalt for use as riprap, concrete aggregate, and roadstone. Charles W. Blakeslee & Sons, Inc. (Hamden), produced rough dimension stone and riprap from basalt at its Pine Rock Quarry. Large tonnages were crushed and screened for paving and concrete aggregate. Granite for rough architectural use was quarried at the Stony Creek Quarry by Castellucia & Sons, Inc.

Eight companies at stationary plants and one dredge processed sand and gravel. The quantity used for building was almost twice that used for paving. Principal producers of sand and gravel were Elm City Construction Co. (North Haven), Beard Sand & Gravel Co., Inc. (Milford), and Meriden Wallingford Sand & Stone Co., Inc. (Wallingford), who sold sand and gravel for building and paving. A. N. Farnham, Inc. (New Haven), and Estate of Stillman H. Rice (New Haven) sold sand and gravel only for use in building. John J. Doyle Sand & Gravel Co., Inc. (Montville), produced sand and gravel for building material, some of which was used in Government construction projects. Lorentz & Howard, Inc. (Bozrah), produced washed and unwashed sand and gravel for paving.

Plasticrete Corp. (Hanaden) acquired the brick plants, cement block plant, and lightweight aggregate-manufacturing facilities of I. L. Stiles & Son Brick Co. on January 1, 1958. Under the name, Stiles Corp., the company produced building brick and cement blocks but reported no lightweight aggregate; clay was mined from its pit at North Haven. A small part of the raw clay mined was used by Stiles Corp. to make brick; the rest was sold as miscellaneous clay.

Burritt R. Curtis mined beryl at the Southford Quarry, Southbury, for the fifth consecutive year. Hand-sorted concentrate was sold to GSA at the Franklin, N.H., depot.

Benson Mine near Southbury yielded a small quantity of strategic mica, which was sold as hand-cobbed mica to GSA for the national stockpile.

National Gypsum Co., Buffalo, N.Y., calcined gypsum mined out-of-State and produced gypsum building products at its New Haven

plant, formerly operated by Connecticut Adamant Plaster Co. New and larger calcining kettles, an elevator, a dust-collector, and a bundler were installed.

Chase Brass & Copper Co., Inc., Waterbury, in addition to the regular line of copper, copper alloys, and aluminum, produced rhenium rod, wire, and strip, zirconium in various forms including tubing, and titanium products. Experiments to develop techniques for forming osmium metal were conducted during 1958.

Olin Mathieson Chemical Corp. was reported building a new metallurgical research center at New Haven.

Enthone, Inc., a subsidiary of American Smelting & Refining Co., built a new research laboratory in New Haven to develop more effective metal finishing compounds and treating processes.

New London.—Barrett Division of Allied Chemical Corp. produced concrete aggregate, roadstone, and riprap at its Montville granite quarry, where screening capacity was increased during the year. Rough monumental stone was produced from granite quarries by E. Locarno & Sons and Golden Pink Granite Quarry Co., Niantic. The Millstone Granite Quarry, Inc. (Waterford), produced riprap and various types of building and monumental stone.

Lantern Hill Silica Co. (North Stonington) mined sandstone and prepared it for market by crushing, grinding, screening, drying, and magnetic separation. Production was greater than in 1957. The ground silica was used mainly in special glass and also as foundry sand, abrasive, and inert mineral filler.

Olin Mathieson Chemical Corp. was beginning to produce nuclear fuels in its new plant at Montville. Nuclear reactor cores were assembled for military and industrial use. Basic raw materials were produced outside the State.

Tolland.—Bonair Peat Co. recovered humus peat from a bog near Ellington.

Windham.—Four companies produced sand and gravel. Dunning Sand & Stone Co. (Wauregan) increased capacity by installing additional crushing and screening equipment. Production was prepared for use as concrete aggregate, paving material, railroad ballast, and fill. R. A. Rawson Sand & Gravel (Putnam), Ernest Joly & Sons (Danielson), and Martin F. McCarthy & Son, Inc. (Putnam), produced sand and gravel for use as building and paving material and for road-sanding and repair.

R. B. Marriott & Sons quarried dimension stone for use as curbing and rough dimension stone from a granite quarry near Oneco.

Knox Glass Co., Inc., began constructing a glass container plant at Putnam.

The Mineral Industry of Delaware

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the Delaware Geological Survey.

By Robert D. Thomson [1]

THE VALUE of Delaware mineral production in 1958 rose to $1.1 million, 9 percent higher than 1957. Sand and gravel and stone increased in value of output, because of expanding Federal and local road-building programs. Clay output, however, declined.

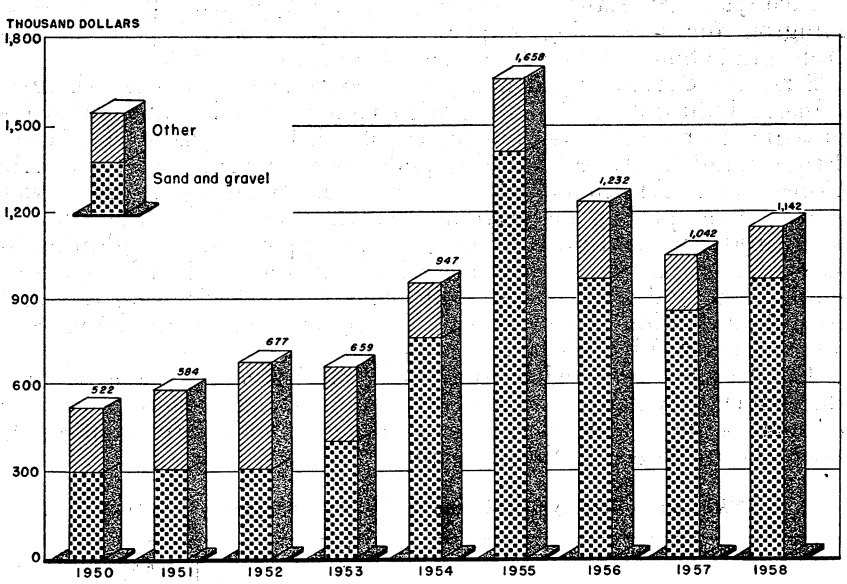

FIGURE 1.—Value of mineral production in Delaware, 1950–58.

[1] Acting Chief, Division of Mineral Industries, Region V, Bureau of Mines, Pittsburgh, Pa.

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TABLE 1.—Mineral production of Delaware [1]

Mineral	1957		1958	
	Thousand short tons (unless otherwise stated)	Value (thousand)	Thousand short tons (unless otherwise stated)	Value (thousand)
Sand and gravel	974	$860	1,090	$962
Value of items that cannot be disclosed: Clays and stone		182		180
Total Delaware		1,042		1,142

[1] Production as measured by mine shipments and mine sales (including consumption by producers).

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Clay output was less in 1958 than in 1957 due mainly to a continuing decline in demand for building brick. Brick plants were active in New Castle and Sussex Counties.

Fluorspar.—St. Lawrence Fluorspar Corp. operated a plant at Wilmington for processing imported fluorspar. Chief product was Acid-grade fluorspar for use in manufacturing chemicals .

Sand and Gravel.—Sand and gravel continued to be the principal mineral industry in Delaware, with both production and value increasing 12 percent. Output increased chiefly because of expanding Federal and local road building and new construction at Dover Air Force Base. Approximately 41 percent more sand and gravel was marketed as paving material in 1958 than in 1957, while sales of structural sand and gravel dropped over 70 percent. In addition to use as paving and structural material, sand was marketed for use as engine sand and gravel for miscellaneous uses. Of the total sand and gravel production 51 percent was washed or screened, and 59 percent was transported by truck.

Employment reported by sand and gravel producers total 75 production employees working 158,751 man-hours. Of the total number of men employed, 26 were active throughout the year at portable operations and 49 at stationary plants.

TABLE 2.—Employment in the sand and gravel industry in 1958

	Men working daily	Average active days	Man-hours worked
Stationary	49	261	106,060
Portable	26	232	52,691
Total	75	251	158,751

Stone.—Output of stone in 1958 was slightly less than in 1957. Granite, the only stone produced in the State, was crushed and marketed for use as concrete aggregate and stone sand. Stone shipped in from other States continued to slow the Delaware stone industry.

Sulfur.—Recovered elemental sulfur was produced by Tidewater Oil Co. at its Delaware City cracking plant. This company uses the Claus process to recover sulfur from crude oil received from other States and foreign countries.

METALS

Iron and Steel.—Colorado Fuel & Iron Corp. operated seven basic open-hearth furnaces at its Claymont plant, producing steel for use in local plate and pipe mills.

The American Manganese Steel Division of American Brake Shoe & Foundry Co. operated electric furnaces at New Castle to produce austenitic manganese castings.

Ferrous scrap dealers were active in Wilmington, Dover, and Smyrna. Shipments from yards consist principally of No. 1 and No. 2 Heavy Melting steel, cast-iron scrap other than borings, and bundles.

Smelter.—The North American Smelting Co. Wilmington smelter and refinery was active throughout 1958. Five rotary, 3 crucible, 3 sweat and 3 reverbatory furnaces, plus 9 kettles, were used to produce brass, bronze, aluminum and zinc casting alloys, solder, babbitts, and type metal. Annual capacity was 75 million tons. Primary metals consumed were aluminum, antimony, copper, lead, tin, and zinc; all of these were imported from other States or foreign countries. Most scrap metal consumed originated in Delaware.

Pyrites.—Pyrite concentrate from Bethlehem Cornwall Corp., Lebanon, Pa., was processed at Sparrows Point to recover sulfur and a cobalt-bearing residue. The residue was shipped to Pyrites Co., Wilmington, Del., where the cobalt was recovered and sinter produced.

REVIEW BY COUNTIES

Kent.—Sand and gravel was produced near Dover and Milford, principally for paving material and fill. Overall production of sand and gravel increased about 65 percent over 1957. Among the active producers, St. Jones River Gravel Co. and Clough & Caulk Sand & Gravel operated stationary plants producing prepared sand and gravel. F. M. Carpenter produced bank-run gravel near Milford.

New Castle.—Production of sand and gravel increased about 8 percent over 1957, and was marketed principally as paving material. Washed sand was produced from stationary plants by Petrillo Bros., Inc., near Wilmington in Minquadale Township; Delaware Sand & Gravel Co., New Castle; and Whittington's Sand & Gravel Co., Newark. Bank-run gravel was produced by Parkway Gravel, Inc., near Hares Corner.

The Delaware Brick Co. operated an open pit at New Castle. All miscellaneous clay produced at this site was crushed, ground, and screened at a local plant for use in manufacturing building brick.

Petrillo Bros., Inc., produced granite from a quarry near Wilmington. Rock was produced by the bench method of mining. Three benches were worked averaging 20 feet high and 40 feet wide. At the crushing plant, new screens were added, and the size of the secondary crusher was increased.

Sussex.—Bank-run sand was produced by Lewes Sand Co., while Henry G. Graves & Sons operated a portable plant near Lewes for producing paving material.

The Mineral Industry of Florida

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Florida.

By Lawrence E. Shirley [1] and Robert O. Vernon [2]

MINERAL production in Florida reached an alltime high in 1958, with a total value of $142 million—an increase of 1 percent above 1957 and 1 percent over 1956, the former record year. Continued high output of phosphate rock and record-breaking production of masonry and portland cement, crushed limestone, miscellaneous clay and staurolite more than offset declines in production of sand and gravel, titanium minerals, kaolin, and fuller's earth.

Florida led the States in producing phosphate rock and zircon, and was the second-ranking State in the production of peat and titanium concentrates. Leading industries were mining and processing phosphate rock, quarrying limestone, and manufacturing cement. Leading companies in the State, in order of value of mineral production, were General Portland Cement Co., Lehigh Portland Cement Co., and International Minerals and Chemical Co.

Employment and Injuries.—Reports submitted to the Bureau of Mines by producers in the mineral industries indicated that 16 percent more mines and quarries and mills were active during the year and that the number of men working increased 11 percent over 1957. Employment in nonmetal mines decreased 1 percent but increased in quarries and mills, metal mines, and sand and gravel mines 33, 9, and 6 percent. The average working day in all industries decreased 2 percent; there was an increase of 2 percent in nonmetal mines, and decreases in quarries and mills, and metal mines of 7 and 1 percent, and no change in sand and gravel mines. Man-days worked in all industries increased 9 percent over 1957; nonmetal mines increased less than 1 percent, quarries and mills, metal mines, and sand and gravel mines increased 24, 7, and 5 percent. Gains in employment were due to the increased number of new operations beginning during the year, which rose in spite of the business recession in the Nation, and an unusually severe winter in Florida.

The overall injury frequency rate decreased 22 percent under 1957; nonmetal mines decreased 41 percent, quarries and mills decreased 12 percent, and metal mines and sand and gravel mines decreased 30 and 50 percent. There was no increase in the number of fatal accidents, which totaled three in 1957 and three in 1958.

[1] Commodity-industry analyst, Knoxville Field Office, Region V, Bureau of Mines, Knoxville, Tenn.
[2] Director, Florida Geological Survey, Tallahassee, Fla.

TABLE 1.—Mineral production in Florida [1]

Mineral	1957		1958	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays	422	$6,067	450	$5,808
Gem stones	(2)	(3)		
Natural gas—million cubic feet	34	4	35	5
Peat	38	195	36	165
Petroleum (crude)—thousand 42-gallon barrels	461	(4)	[5] 448	(4)
Phosphate rock—thousand long tons	10,191	64,789	10,851	68,951
Sand and gravel	6,753	6,148	5,490	4,388
Stone	21,786	30,467	[6] 23,549	[6] 30,983
Titanium concentrates	263	[7] 10,643	190	5,495
Zirconium concentrate	57	1,976	30	1,018
Value of items that cannot be disclosed: Cement, lime, rare-earth metals concentrates, staurolite, stone (dimension limestone, 1958), and values indicated by footnote 4		22,514		28,508
Total Florida [8]		[7] 140,467		142,111

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $1,000.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Preliminary figure.
[6] Excludes certain stone, value included with "Items that cannot be disclosed."
[7] Revised figure.
[8] The total has been adjusted to eliminate duplicating the value of clay and stone.

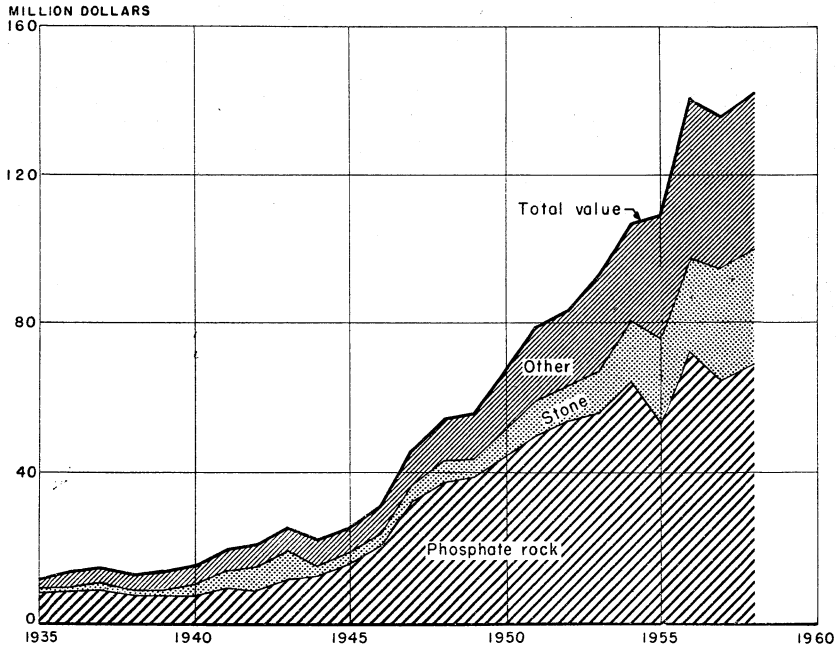

FIGURE 1.—Value of phosphate rock and stone and total value of mineral production in Florida, 1935–58.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-days worked	Fatal injuries	Nonfatal injuries	Injuries per million man-days
	1957						
Nonmetal mines	30	3,193	274	875,236	2	68	80
Quarries and mills	70	1,959	279	546,676	1	137	252
Metal mines	4	416	279	116,138		8	69
Sand and gravel mines	31	368	271	99,875		48	480
Total	135	5,936	276	1,637,925	3	261	161
	1958 [1]						
Nonmetal mines	34	3,164	279	881,283	1	40	47
Quarries and mills	82	2,609	259	675,943	1	150	223
Metal mines	4	452	276	124,627		6	48
Sand and gravel mines	36	389	271	105,231	1	24	238
Total	156	6,614	270	1,787,084	3	220	125

[1] Preliminary figures.

Consumption, Trade, and Markets.—Florida's continuing growth increased trade and opened up new markets. New plants and major expansions totaled 700 for all industries, indicating greater consumption of goods and services and increased trade. The State was a convenient economic gateway to the Caribbean and Latin-American areas and had 13 deep-water ports used by domestic and foreign shipping. In addition, Florida had 1,000 miles of navigable inland waterways and a river system that provided barge navigation to markets of neighboring States and to the Midwest via the gulf and the Mississippi River. The State had highway systems that provided rapid transit of goods. Rail connections with Florida ports provided good transportation over a network of 4,700 miles of track owned by 13 railroads. Transportation of mineral commodities was accomplished by truck, railway, and waterway, depending upon location and distance from markets.

Some phosphate rock and kaolin were exported. Crude gypsum and perlite produced out of State were processed in Florida for local consumption. Fuller's earth, kaolin, titanium, and zirconium concentrates were shipped out of State for further processing and consumption. Phosphate rock was processed in the State and marketed throughout the Nation. Crushed limestone, oystershell, staurolite, and miscellaneous clay were mined and processed locally in manufacturing cement, which was used in the State and also shipped out of State.

Trends and Developments.—Rapid population increase has contributed most to new trends and developments in Florida's varied industries. Missile research and development and the electronics and aircraft industries have advanced significantly, but smaller industries also have made great strides. The mineral-industry growth is evidenced by record-breaking production and processing of cement, phosphate rock, and other commodities. Davison Chemical Co., Division of W. R. Grace Co., added new facilities to its triple superphosphate plant near

Bartow, and American Cyanamid completed construction of a 200,000 ton-a-year triple superphosphate plant. Lehigh Portland Cement Co. and General Portland Cement Co. completed new cement plants near Miami, with an annual capacity of 2.5 million barrels each. Southern Lightweight Aggregate Co. began constructing a lightweight-aggregate plant near Russell, Clay County. Rockdale Stone Co., Inc., of Coral Gables, completed and placed in operation a new crushed-stone plant near Rockdale, Dade County.

Heavy mineral activity was curtailed considerably during the year owing to lower world demand for titanium and rare-earth metals. Heavy Minerals Co. closed its new plant near Panama City, and Union Carbide and Carbon Corp. and Glidden Paint Co. deferred plans for mining and processing heavy minerals in Nassau County. Columbia National Corp., near Pensacola, made its first lot shipment of Nuclear grade zirconium sponge to the Atomic Energy Commission during the year.

New plants or facilities under construction include the U.S. Phosphoric Co. diammonium phosphate plant at East Tampa; the Sunshine State Refineries Cos. 20,000-barrel petroleum refinery at East Tampa; and new facilities at Tampa for storing dry and liquid sulfur. Michigan Chemical Corp. began construction at Port St. Joe of a seawater magnesia plant. Design capacity is 125 to 150 tons a day of Chemical and Refractory grade magnesium oxide for manufacturing basic brick and other refractory products, rubber, paper and ceramics.

The practice of precasting complete bridge parts, combined with prestressing, reached a new peak for the usage of concrete. As a result, the State highway department enlarged its staff and concrete-testing laboratories greatly. The Materials and Tests Section now has laboratories at Pensacola, Panama City, Tampa, Leesburg, Jacksonville, Jupiter, and Dania. In the construction of the Pensacola Bay Bridge, bridge sections 60 feet in length, accommodating four lanes of traffic, were constructed in two units weighing 160 tons each. These spans were transported about 200 miles by barge and set in place as finished bridge decks. The Florida Engineering and Industrial Experiment Station at Gainesville was a major research center, serving both private industry and the State. Some of the station's work in 1958 included studies in behavior and strength of prestressed concrete and development of processes for extracting fluorine from phosphate ores.

Florida State University had under construction a 10-million-volt Van der Graff accelerator for basic research. Florida Power Corp. and Tampa Electric Co. were jointly constructing a 50,000-kilowatt nuclear power reactor for the west coast of Florida. The Florida Power Corp. completed the first unit of the Paul L. Bartow plant near St. Petersburg and installed a 121,000-kilowatt generating plant that increased the total generating capacity of the corporation to 700,000 kilowatts.

The first complete waterway shipment of coal from the Western Kentucky field to Tampa took place. Eight barges carried the coal over a 1,100-mile route down the Ohio and Mississippi Rivers. It was transferred to ocean-going equipment at New Orleans, shipped across the Gulf of Mexico to Tampa, and delivered to an electric utility.

Construction began on a $150 million, 1,500-mile, natural gas pipeline to extend from Texas to Florida's peninsular area. Natural gas from southern Louisiana gasfields will be tapped enroute and will supply industry as well as household consumers.

Legislation and Government Programs.—Several major phosphate producers in Polk and Hillsborough Counties joined in an industry research program to determine the facts about alleged air pollution from phosphate production. For the 1957–59 biennium the Florida State Legislature appropriated $65,000 for establishing the Florida Air Pollution Control Commission. The commission began studies and had authority to adopt control regulations.

The legislature also appropriated $200,000 for use of the Florida Development Commission in studying and promoting industrial development in the smaller communities and counties. While considerable progress was made during the biennium, with assistance from the Florida Geological Survey, a greater degree of success is anticipated in future years.

First contracts were let for Florida's 1,164-mile portion of the federally supported Interstate Highway System. The expanding highway program has directly caused many new plants to begin producing materials for use in highway and bridge construction.

The U.S. Department of the Interior took steps toward leasing Florida offshore areas for oil and gas.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—The total production of cement increased 32 percent in tonnage and 28 percent in value over 1957; increases are attributable to two new plants and increased production by the two existing plants. Portland cement increased 34 percent in tonnage and 30 percent in value; masonry cement increased 18 and 15 percent. Construction of two new cement plants west of Miami, Dade County, was completed and production reported for the portion of the year operated. A Lehigh Portland Cement Co. plant in the Everglades near Miami went into production in August. Its annual capacity was 2½ million barrels. Plant equipment included two 12- by 11- by 475-foot rotary kilns, three 1,250-hp. mills for raw grinding, three 1,250-hp. mills for clinker grinding, and two 900-hp. mills for sand. Other equipment consisted of a unique rapid-loading system, a 48- by 60-inch jaw crusher, a horizontal clinker cooler, and 30 concrete storage silos, each 32 feet in diameter and 124 feet high and having a combined capacity of 450,000 barrels. The principal raw material will be coral rock from the Everglades; seven basic types of cement will be produced, as well as specially tested cements required by the State and the United States Government.

A $15 million plant of the General Portland Cement Co., west of Miami, started production late in the year. Annual capacity of the plant was 2½ million barrels; equipment consisted of two 11-foot, 3-inch by 425-foot kilns, a 13- by 16-foot preliminary raw mill, a 9½- by 36-foot regrind mill, and two 13- by 16-foot finish mills.

Clays.—Total clay production increased 7 percent in tonnage but decreased 4 percent in value. Florida ranked first in the Nation in the production of fuller's earth. Total production was 211,000 tons valued at $5.1 million, declines of 6 and 5 percent from 1957. Kaolin declined 2 percent in tonnage and 4 percent in value. Miscellaneous clay increased 23 percent in tonnage and 25 percent in value. Fuller's earth was mined in Gadsden County by Mining & Chemical Corp. of America (La Camelia mine), Floridin Co. Inc. (Quincey mine), and Magnet Cove Barium Corp. (Havana mine). Kaolin was mined in Putnam County by Edgar Plastic Kaolin Co. (Edgar mine) and United Clay Mines Corp. (No. 4 mine). Miscellaneous clay for use in cement was mined in Citrus County by General Portland Cement Co. (Citrus County mine) and in Dade County (Miami Clay mine). Appalachee Correctional Institute (Chattahoochee mine) mined miscellaneous clay in Gadsden County for use in building brick.

Southern Lightweight Aggregates Co., Richmond, Va., began constructing a plant to manufacture lightweight aggregate; the company planned to mine clay on acquired properties near Russell, Clay County, which will be processed in rotary kilns at high temperatures.

Gypsum.—Imported crude gypsum was calcined and used in manufacturing building products by the United States Gypsum Co. at Jacksonville.

Lime.—The City of Miami (Hialeah limekiln) produced 24,500 tons of high-calcium lime, valued at $257,000, used for chemical and other industrial purposes. Dixie Lime Products Co. (Ocala No. 1 limekiln) produced quicklime and hydrated lime for masons' and chemical uses.

Perlite.—Crude perlite from three Western States was expanded for use in building plaster, lightweight aggregate, and soil conditioning by three companies in Hialeah, Jacksonville, and Vero Beach. Production of expanded material decreased 3 percent in tonnage and increased 12 percent in value over 1957.

Phosphate Rock.—For the 65th consecutive year Florida was the leading State in phosphate-rock production.

Land-pebble phosphate comprised more than 98 percent of total production. Output came from eight companies at 14 mines in Polk and Hillsborough Counties. International Minerals Co., Polk County, was the largest producer. Most of the land pebble production consumed domestically was used in manufacturing ordinary and triple superphosphate. A substantial quantity was exported.

Kibler-Camp Phosphate Enterprises (Section 5 mine), Citrus County, was the only hard-rock phosphate producer. The manufacture of elemental phosphorus consumed most of the hard-rock output, although a small tonnage was used for agricultural purposes.

Soft-rock production was 4 percent higher in tonnage and 14 percent higher in value over 1957. Output came from five producers in Citrus County and from one producer at mines in Columbia and Gilchrist Counties. Output was used for stock and poultry feed and direct application to the soil.

Davison Chemical Co., Division of W. R. Grace Co., added new facilities costing $1.5 million to its triple superphosphate plant at Bartow, enabling the plant to produce run-of-pile triple superphos-

phate in powder form, in addition to the granulated material formerly produced. Both processing and storage facilities were added to the plant. The new product is obtained by raising the strength of phosphoric acid by evaporation to more than 54 percent P_2O_5 from the 39 percent used for granulated material. This higher strength acid is combined with ground phosphate rock in a TVA-type cone mixer and the resulting slurry is solidified on a setting belt. After curing in the storage plant the product is milled and screened. This additional process does not raise the overall production total of the plant.

A new 200,000-ton-a-year triple superphosphate plant of the American Cyanamid Co., Brewster, was completed and reached its design capacity. The plant produces a nongranular fertilizer for subsequent ammoniation and compounding and a granulated superphosphate. Daily capacity was 400 tons of 75 percent phosphoric acid and 600 tons sulphuric acid. Fumes and gases from the operation are scrubbed, and acid wastes are neutralized and clarified prior to discharge. The company mines returned to full production after operations had been curtailed in April to reduce company inventories.

The City of Bartow, prompted by a phosphate mining company's interest in land owned within the city limits, approved an amended ordinance governing mining in the city. Although an ordinance permitting mining was adopted by the city commission several years ago, regulations had not been written. Among the provisions now established, before a permit is issued, mined-out lands must be leveled satisfactorily for use as building sites. Only the northeast and northwest corners of the city were zoned for mining purposes.

A mineralogical laboratory was completed by International Minerals & Chemical Co. at its experimental research station at Mulberry, Polk County. The laboratory is designed to allow full-range mineral investigations from studying the composition of new-found ores to determining the economic feasibility of mining and marketing minerals. Equipment for the new laboratory included facilities for differential thermal analysis, X-ray diffraction, spectrography, and high-powered microscopic studies. The Florida laboratory conducts about 50 percent of the total company research program and handles inorganic chemistry, chemical processing and engineering, mineral beneficiation, and mineralogy. In addition, the research station had 15 pilot-plant and sub-pilot-plant facilities, enabling duplication of most of the company's commercial production facilities in the mineral industry.

TABLE 3.—Marketable production of phosphate rock

Year	Hard rock		Soft rock		Land pebble		Total	
	Thousand long tons	Value (thousands)	Thousand long tons	Value (thousands)	Thousand long tons	Value (thousands)	Thousand long tons	Value (thousands)
1949–53 (average)	68	$518	80	$435	8,260	$48,014	8,408	$48,967
1954	79	622	94	576	10,264	63,302	10,437	64,500
1955	91	734	70	452	8,586	52,454	8,747	53,640
1956	96	809	59	378	11,668	73,103	11,823	74,290
1957	80	689	51	365	10,059	63,736	10,191	64,789
1958	87	737	53	414	10,711	67,800	10,851	68,951

TABLE 4.—Phosphate rock sold or used by producers, by uses

Use	1957			1958		
	Long tons	Value	Average unit value	Long tons	Value	Average unit value
Ordinary superphosphate	4,611,066	$29,391,573	$6.37	4,420,998	$28,527,147	$6.45
Triple superphosphate	[1] 1,812,717	[1] 11,360,500	[1] 6.27	1,300,879	8,377,661	6.44
Phosphoric acid (wet process)	(1)	(1)	(1)	979,816	5,575,153	5.69
Elemental phosphorus, ferrophosphorus, phosphoric acid	704,699	4,457,547	6.33	593,478	3,544,784	5.97
Direct application to the soil	622,663	3,984,106	6.40	(2)	(2)	(2)
Stock and poultry feed	279,950	1,807,331	6.46	(2)	(2)	(2)
Other uses	8,000	50,229	6.28	976,710	6,362,827	6.51
Exports	2,604,787	16,894,649	6.49	2,301,087	14,965,389	6.50
Total	10,643,882	67,945,935	6.38	10,572,968	67,352,961	6.37

[1] Includes rock for phosphoric acid (wet process).
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."

Sand and Gravel.—Output of sand and gravel used or sold by producers declined to 5.5 million tons valued at $4.4 million—decreases of 19 percent in tonnage and 29 percent in value. Thirty-six operators produced sand in 13 counties; four of these companies also produced gravel in Broward, Dade, Escambia, and Gadsden Counties. The leading producers of sand and gravel were Oak Ridge Sand Co., Standard Sand & Gravel Co., and Mammoth Sand Co., all of Polk County. Sand and gravel was used principally for building and paving; small tonnages were used for blasting, engine, filter and molding sands, and railroad ballast.

Producers reporting for the first year in new locations include Taylor Sand Co., Bay County; Milton Addison, Broward County; and Davenport Sand Co. Inc., Silver Lake Estate, and Samuel L. Shaw, Lake County.

Staurolite.—E. I. du Pont de Nemours & Co., Inc., recovered staurolite as one of the byproducts in concentrating titanium minerals at the Highland and Trail Ridge plants, Clay County. Production increased 57 percent in tonnage and 64 percent in value and was used principally as an iron and aluminum additive in manufacturing portland cement.

Stone.—Total stone production set an alltime record high for the State during 1958, attesting to the rapid industrial progress in construction of new highways, bridges, port developments and expansions, and new buildings and plants to house new industries. Output increased 8 percent in tonnage and 2 percent in value, totaling 23.5 million tons, valued at $31 million. Crushed limestone was produced in 21 counties at 69 mines by 57 individual companies and 1 county highway department. Output increased 11 percent in tonnage and 3 percent in value. Leading producers were: Ideal Crushed Stone Co., Dade County; Camp Concrete Co., Hernando County; and Hollywood Quarries, Inc., Broward County. Dimension limestone was produced in four counties by four companies; output decreased 23 percent in tonnage and 73 percent in value.

Oystershell production totaled 1.1 million tons valued at $2.1 million, an increase of 2 percent in value. This commodity continues to

TABLE 5.—Sand and gravel sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Bay	72,800	$59,319	104,733	$84,468
Broward			12,102	8,695
Escambia	287,393	265,944	356,716	303,351
Indian River	8,667	5,360	7,695	4,700
LaFayette	36,956	25,869	24,786	20,307
Leon	51,829	52,209	(1)	(1)
Palm Beach	22,244	5,810		
Pinellas	91,646	133,620	85,479	127,502
Polk	(1)	(1)	2,766,395	2,035,190
Putnam	(1)	(1)	1,082,884	844,527
Washington	10,100	6,267		
Undistributed [2]	6,171,644	5,593,476	1,048,963	959,812
Total	6,753,279	6,147,874	5,489,753	4,388,552

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes production from Dade, Gadsden, Lake, Volusia, and counties indicated by footnote 1.

TABLE 6.—Sand and gravel sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	4,474,332	$3,519,949	$0.79	4,075,483	$3,094,847	$0.76
Paving	601,685	478,340	.80	676,452	519,506	.77
Filter	2,465	2,960	1.20	9,404	11,014	1.17
Engine	7,000	3,500	.50			
Other [1]	338,361	193,148	.57	334,329	213,345	.64
Total sand	5,423,843	4,197,897	.77	5,095,668	3,838,712	.75
Gravel:						
Paving	(2)	(2)	(2)	201,219	348,931	1.73
Structural	(2)	(2)	(2)	185,530	194,359	1.05
Other	1,329,436	1,949,977	1.47	7,336	6,550	.89
Total gravel	1,329,436	1,949,977	1.47	394,085	549,840	1.40
Grand total	6,753,279	6,147,874	.91	5,489,753	4,388,552	.80

[1] Includes molding, blast, and miscellaneous sands.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Other gravel."

gain in importance in its use in concrete and roadstone and screenings and as poultry grit. The leading producers of oystershell were Bay Dredging Co., Hillsborough County; Benton & Co., Inc., Pinellas County; and Bay Towing & Dredging Co., Walton County.

Rockdale Stone, Inc., Coral Gables, has completed and put in operation a new crushed-stone plant near Rockdale, Dade County. The plant is designed for a capacity of 250 tons an hour. Stripping, underwater quarrying, and primary pit loading are under contract. A rotary drill is used for primary drilling, and after blasting the material is moved with two draglines. Other equipment used in the plant includes a wobbler-feeder, primary and secondary impactors, surge bin, reciprocating feeder, vibrating screens, water scalper and sand dewaterer. At present a 2- by 120-foot conveyor is being installed to

permit direct loading from the tunnel and rinsing screen. Shipments are made by rail and truck. The company also operates a new ready-mixed concrete batching unit at the new rock plant.

Several articles were written during the year on crushed stone operations.[3]

TABLE 7.—Crushed limestone sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Alachua	(1)	(1)	694,481	$676,999
Broward	5,035,512	$5,709,363	5,137,967	6,395,124
Collier	(1)	(1)	442,252	423,638
Dade	4,794,634	7,237,530	7,422,265	9,360,795
Hernando	3,378,139	6,233,659	2,898,740	4,441,113
LaFayette	169,500	169,500	59,000	59,000
Levy	1,054,541	1,305,721	1,019,004	1,156,346
Marion	(1)	(1)	1,218,371	1,296,569
Monroe	220,000	235,000	293,750	260,000
Palm Beach	200,930	155,837	199,500	229,600
Pasco	74,967	93,708	(1)	(1)
Sumter	158,294	170,000	(1)	(1)
Undistributed [2]	5,185,396	6,820,030	3,047,762	4,620,087
Total	20,271,913	28,130,348	22,433,092	28,919,271

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes Citrus, Flagler, Hendry, Jackson, Lee, Manatee, St. Johns, Sarasota, and Sewannee Counties.

TABLE 8.—Crushed limestone and oystershell sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roadstone	18,109,420	$24,553,343	$1.36	19,806,047	$25,147,629	$1.27
Agstone	588,655	1,684,349	2.86	467,955	1,361,774	2.91
Poultry grit	(1)	(1)	(1)	47,915	580,980	12.13
Other [2]	3,077,802	3,906,134	1.27	3,227,576	3,892,564	1.21
Total	21,775,877	30,143,826	1.38	23,549,493	30,982,947	1.32

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes riprap, stone sand, asphalt filler, cement, lime, and other uses.

METALS

Rare-Earth Metals.—Florida ranked third in the Nation in production of rare-earth metals. Shipments of monazite declined drastically from 1957 owing to decreased production of all heavy minerals. Rutile Mining Co. of Florida, near Jacksonville, Duval County, was the only producer in the State recovering monazite as a byproduct in concentrating titanium minerals.

[3] Pit and Quarry, Industrial Limerock, Inc., vol. 51, No. 3, September 1958; The Ocala Lime Rock Corp., vol. 50, No. 11, May 1958; West Coast Rock Co., Inc., vol. 51, No. 2, August 1958; Rock Products, Oolite Crushed Stone Co., vol. 61, No. 8, August 1958; R. H. Wright & Son, vol. 61, No. 6, June 1958.

Titanium Concentrates.—Florida ranked second in the Nation in titanium production for the third consecutive year. Production of titanium concentrates, both ilmenite and rutile, declined 28 percent in tonnage and 48 percent in value. Ilmenite production decreased 26 percent in tonnage and 43 percent in value and production and value of rutile decreased 84 and 88 percent separately.

E. I. du Pont de Nemours & Co., Inc., produced ilmenite from the Highland mine near Lawtey, Clay County, and from Trail Ridge mine near Starke, Clay County. Du Pont assumed full operation of ilmenite mining and separation facilities of both mines from Humphreys Gold Corp. to fully integrate company operations and improve economic functions. Humphreys Gold Corp. had operated the Trail Ridge mine since 1948 and the Highland mine since 1954.

Rutile Mining Co. of Florida, near Jacksonville, Duval County, and Florida Minerals Co. (Vero mine), near Vero Beach, Indian River County, produced ilmenite and rutile concentrates for use by the paint industry, in the fabricating titanium metal and alloys, and for manufacturing welding rods.

Heavy Minerals Co. closed its newly constructed plant near Panama City because of lower world demand for heavy minerals. Union Carbide & Carbon Corp., Amelia Island, and Glidden Paint Co., Fernandina Beach, both in Nassau County, deferred plans for mining heavy minerals and for plant construction.

Zircon.—Florida again ranked first in the United States in the production of zircon. Output declined 53 percent in tonnage and 48 percent in value from 1957; there was also a decrease in the unit price per ton to the lowest figure in the State's history. E. I. du Pont de Nemours & Co., Inc., produced zircon as a byproduct in mining ilmenite from the Trail Ridge and Highland mines, Clay County. Rutile Mining Co. of Florida, near Jacksonville, Duval County, and Florida Minerals Co., near Vero Beach, Indian River County, produced zircon as a byproduct of rutile and ilmenite mining. The zircon was used principally in foundry sands, refractories, and ceramics.

Columbia National Corp. (near Pensacola in Santa Rosa County) made its first lot shipment of Nuclear grade zirconium sponge to the Atomic Energy Commission. The company had a $23 million contract with AEC to supply 3.5 million pounds of zirconium over a 5-year period.

MINERAL FUELS

Natural Gas.—Production of natural gas increased 3 percent in output and 25 percent in value.

Construction was begun on a $150-million, 1,500-mile, natural gas pipeline extending from McAllen, Tex., to Miami. The line will move 282 million cubic feet of gas a day along a 24-inch main line and will pick up gas en route from southern Louisiana gasfields. Plans call for increasing capacity to 410 million cubic feet a day after the first phase of construction is completed. New industrial growth was foreseen in the mineral and chemical industries as a result of this new pipeline.

Peat.—In the United States in 1956 Florida ranked first in total peat production; in 1957, third; and in 1958, second. Peat production

in 1958 was 36,000 tons valued at $165,000, a 5-percent decline in tonnage and 15-percent drop in value from 1957, with a total of nine producers in four counties for both years. The leading producing county was Hillsborough, followed by Orange, Palm Beach, and Putnam Counties, in order of output. One company produced reed sedge; one, reed-sedge and humus peat; and the remaining companies produced humus peat. Peat was used chiefly for soil improvement.

Petroleum.—Crude petroleum production, all from Collier County in the Everglades, was 448,000 barrels, a 3-percent decline in quantity but an 11-percent increase in value. Cumulative production through 1958 totaled 5.7 million barrels. At the end of the year 11 wells were producing. Development drilling and exploration activity decreased. Seven wildcat wells drilled were all dry holes; 4 wells were drilled in the Panhandle section and 3 wells in the Peninsular part of the State. There were no discoveries. Geophysical activity increased considerably in the Peninsular Area and consisted of core drill, gravity meter and seismograph crews.

The U.S. Department of the Interior took preliminary steps toward the leasing of submerged lands off the Florida coast for oil and gas exploitation. The oil and gas industry was invited to nominate areas it would like to have offered for leasing on the Outer Continental Shelf in the Marquesas area near the Florida Keys. This is the first notification by the Government of its intention to lease offshore oil and gas exploration areas off the Florida coast. Currently there are Federal oil and gas leases in the Gulf of Mexico off the Texas and Louisiana coasts.

REVIEW BY COUNTIES

Mineral production was recorded in 38 of 67 Florida counties. Limestone was produced in 17 counties, sand and gravel in 13, oystershell in 6, phosphate rock in 5, peat in 4, and heavy minerals, cement, and miscellaneous clay, each, in 3 counties. The year's two leading counties in value of mineral production, Polk and Hillsborough, have led the State for a number of years; other important counties, in order of production value, were Dade, Flagler, Broward, Clay, and Gadsden.

Alachua.—Crushed limestone was quarried for concrete aggregate, roadstone, and screenings by Newberry Corp. (Newberry Haile quarry), Ocala Lime Rock Co. (Ocala Haile quarry), Parker Brothers (Parker Haile quarry), who also produced for agricultural purposes, Peacock Lime Rock Co. (Peacock quarry), and Williston Shell Rock Co. (Buda and Williston Haile quarries). Production increased 23 percent in tonnage and 18 percent in value and is attributable to one new operation and to increased production among the others.

Bay.—Cato Sand Co. (Mill Bayou mine) and Taylor Sand Co. (Taylor mine)—a new operation reporting for the first year—produced building sand. Sand from both operations was transported exclusively by truck.

Broward.—Total mineral production value increased 12 percent over 1957 owing to an increased output of crushed limestone and the addition of a new sand and gravel operation reporting for the first year.

TABLE 9.—Value of mineral production in Florida, by counties[1]

County	1957	1958	Minerals produced in 1958 in order of value
Alachua	(2)	$676,999	Limestone.
Bay	$39,319	84,468	Sand and gravel.
Broward	5,709,913	6,405,069	Limestone, sand and gravel.
Citrus	2,431,487	2,660,503	Limestone, phosphate rock, miscellaneous clay.
Clay	(2)	(2)	Ilmenite, zircon, staurolite.
Collier	1,994,864	(2)	Petroleum, limestone, natural gas.
Columbia	(2)	(2)	Phosphate rock.
Dade	9,653,675	13,618,527	Limestone, cement, lime, sand and gravel, miscellaneous clay.
Duval	(2)	(2)	Oystershell, ilmenite, zircon, rutile, monazite.
Escambia	265,944	303,351	Sand and gravel.
Flagler	(2)	(2)	Cement, limestone.
Gadsden	(2)	(2)	Fuller's earth, sand and gravel, miscellaneous clay.
Gilchrist	(2)	(2)	Phosphate rock.
Hendry	----------	(2)	Limestone.
Hernando	6,233,659	4,441,113	Do.
Hillsborough	19,899,754	20,384,262	Cement, phosphate rock, oystershell, peat.
Indian River	(2)	(2)	Rutile, ilmenite, zircon, sand and gravel.
Jackson	(2)	(2)	Limestone.
Lafayette	195,369	79,307	Limestone, sand and gravel.
Lake	(2)	(2)	Sand and gravel.
Lee	(2)	(2)	Limestone, oystershell.
Leon	52,209	(2)	Sand and gravel.
Levy	1,305,721	1,156,346	Limestone.
Manatee	(2)	(2)	Limestone, oystershell.
Marion	(2)	(2)	Limestone, lime.
Monroe	(2)	(2)	Limestone.
Orange	78,957	(2)	Peat.
Palm Beach	174,595	(2)	Limestone, peat.
Pasco	109,458	(2)	Limestone.
Pinellas	(2)	(2)	Oystershell, sand and gravel.
Polk	58,404,358	63,401,780	Phosphate rock, sand and gravel.
Putnam	1,261,098	(2)	Sand and gravel, kaolin, peat.
St. Johns	(2)	(2)	Limestone.
Sarasota	(2)	(2)	Do.
Sumter	170,000	(2)	Do.
Suwannee	(2)	(2)	Do.
Volusia	(2)	(2)	Sand and gravel.
Walton	(2)	(2)	Oystershell.
Washington	6,267	----------	Sand and gravel, peat, stone.
Undistributed	28,019,353	29,003,251	
Total	136,026,000	142,111,000	

[1] The following counties had no mineral production: Baker, Bradford, Brevard, Calhoun, Charlotte, De Soto, Dixie, Franklin, Glades, Gulf, Hamilton, Hardee, Highlands, Holmes, Jefferson, Liberty, Madison, Martin, Nassau, Okaloosa, Okeechobee, Osceola, St. Lucie, Santa Rosa, Seminole, Taylor, Union, and Wakulla.

[2] Figure withheld to avoid disclosing individual company confidential data, included with "Undistributed."

The county ranked second in the State in production of crushed limestone and fifth in total value of mineral production. Twelve companies produced crushed limestone at 13 quarries, 1 less than in 1957. Principal producers were Maule Industries, Inc. (Prospect quarry), Hollywood Quarries, Inc. (Broward County quarry), and Meekins, Inc. (Meekins quarry). The material was used primarily for concrete aggregate, roadstone, and screenings and was transported primarily by truck with a small tonnage hauled by rail. Hallandale Rock Corp. (Hallandale quarry) produced, in addition to crushed limestone, a small tonnage of dimension limestone as rubble for foundations, retaining walls and similar construction. Milton Addison produced paving and fill sand and paving gravel at an operation near Delray Beach.

Citrus.—Soft phosphate rock production totaled 39,000 tons valued at $322,000, a decrease of 18 percent in tonnage and 6 percent in value from 1957. Producers, in order of output, were Soil Builders, Inc. (Mincoll mine), Sun Phosphate Co. (Dunnellon mine), Kellogg Co.

(Kellogg mine), Superior Phosphate Co. (Bar mine), and Camp Phosphate Co. (Hernando mine). Production was used for agricultural purposes, primarily as direct application to the soil, and for stock and poultry feed.

Kibler-Camp Phosphate Enterprise (Section 5 mine) was the only hard-rock-phosphate producer in the State; output was 87,000 tons valued at $737,000, an increase of 9 percent in tonnage and 7 percent in value over 1957. Production was used for the manufacture of elemental phosphorus and for agricultural purposes.

General Portland Cement Co. (Citrus County quarry) mined crushed limestone and miscellaneous clay for making cement at its Tampa operation.

Clay.—E. I. du Pont de Nemours & Co., Inc. (Highland and Trail Ridge mines), produced ilmenite, staurolite and zircon. Ilmenite production decreased 26 percent in tonnage and 44 percent in value compared with 1957; zircon decreased 50 and 51 percent; staurolite increased 57 and 64 percent over 1957. Du Pont took over the mining and separation facilities of both mines controlled by the company from Humphrey's Gold Corp., who operated the Trail Ridge mine since 1948 and the Highland mine since 1954.

Southern Lightweight Aggregate Co. began construction of a plant near Russell to manufacture lightweight aggregate and planned to mine clay on nearby properties.

Collier.—Crushed limestone, produced by three companies, declined 48 percent in tonnage and 44 percent in value from 1957; producers were Sunniland Limerock Co. (Sunniland quarry), Industrial Limerock, Inc. (Industrial Sunniland quarry), and Naples Rock and Paving Co. (Ochopee quarry). The material was used for concrete aggregate, roadstone, and screenings and was shipped by truck. Crude petroleum output decreased slightly. Production of natural gas increased 3 percent in output and 25 percent in value.

Columbia.—The only mineral producer in the county, Loncala Phosphate Co. (Fort White mine), mined soft rock phosphate which was processed at the Lake City Junction plant.

Dade.—Mineral production continued to rise during the year and the county moved up from fourth ranking in 1957 to third in the State in total value of mineral production. The county ranked first in the State in production of crushed limestone. Twelve companies operated 15 quarries, 5 of which were new, as follows: Lehigh Portland Cement Co. (Miami quarry), Florida Portland Cement Co. (Everglades quarry), Sample Rock Co., Inc. (Opa Locka quarry), Brooks Paving Co. (No. 3 quarry), and Rockdale Stone Co., Inc. (Perrine quarry). Leading producers were Ideal Crushed Stone Co. (Dade County quarry), Maule Industries, Inc. (Red Road and Tropical quarries), and Three Bays Improvement Co. (Rockdale and Hialeah Garden's quarries). Production was used primarily in cement manufacture, concrete aggregate, roadstone, and stone sand or screenings. Transportation of the material was 76 percent by truck, 13 percent by waterway, and 11 percent by railroad. Rockdale Stone, Inc., of Coral Gables, completed and placed in operation a new crushed-stone plant near Rockdale with a capacity of 250 tons an hour.

Lehigh Portland Cement Co., reporting for the first year, produced masonry and portland cement. The company completed a new plant with a capacity of 2.5 million barrels a year in the Everglades near Miami. General Portland Cement Co., in addition to crushed limestone, produced miscellaneous clay which was used in the manufacture of portland cement. The company completed a $15 million plant west of Miami with a 2.5 million-barrel annual capacity.

The City of Miami (Hialeah limekiln) produced 24,500 tons of high-calcium lime used for chemical and other industrial purposes.

Sand and gravel was produced by T. J. James Construction Co., Inc. (James mine), Des Rochers Sand Co., Inc. (Cape Florida mine), and Sample Rock Co., Inc. (Opa Locka mine). The material was used as fill and lawn-dressing sand, paving and road sand, and paving and road gravel; transportation was 84 percent by truck and 16 percent by waterway.

Perlite, Inc., expanded western perlite at Hialeah for use as lightweight aggregate.

Duval.—White Shell Corp. (White Shell plant) crushed oystershell for use as poultry grit. Production increased slightly over that last reported in 1955 and was 41,000 tons valued at $511,000.

Rutile Mining Co. of Florida (Jacksonville mine) mined ilmenite, rutile, and byproducts zircon and monazite. Total production and value decreased 42 and 86 percent from 1957.

United States Gypsum Co. calcined gypsum for use in manufacturing building products at its plant in Jacksonville, Tennessee Products & Chemical Co. expanded western perlite at its Jacksonville plant, and Zonolite Co. exfoliated vermiculite at its Jacksonville location. All material used in these plants came from other States.

Escambia.—Word Gravel Co. (Century mine), Campbell Sand and Gravel Co. (Flomaton mine), and Clark Sand Co. (Pensacola mine) produced sand and gravel; output increased 25 percent in tonnage and 11 percent in value over 1957. The material was used primarily for building sand, with a small tonnage used for filter and blast sand; the material was shipped by truck and railroad.

Flagler.—The county dropped from third most important in mineral production in the State in 1957 to fourth, although total crushed limestone and cement production increased substantially during the year. Lehigh Portland Cement Co. (Bunnell mill) manufactured portland and masonry cement and mined crushed limestone from its Coquina quarry, which was used in making cement.

Gadsden.—Nearly 60 percent of the United States production of Fuller's earth came from Gadsden County. The county ranked seventh in the State in total value of mineral production. Production of Fuller's earth was 210,000 tons valued at $5.1 million, a decline of 6 percent in tonnage and 5 percent in value from 1957. Three companies remained active, as in 1957: Floridin Co., Inc. (Floridin mine), Mineral and Chemical Corp. of America (La Camelia and Willacoochee mines), and Magnet Cove Barium Corp. (Havana mine); the material was used as filler in insecticides and fungicides, as a filtering agent, in rotary-drilling mud, and for the manufacture of chemicals. Appalachee Correctional Institute mined 8,100 tons of miscellaneous clay for use in manufacturing heavy clay products. Florida Gravel

Co. (Chattahoochee mine), and Brundydge Sand Co. (Havana mine) produced building, paving and road sand, and paving and road gravel.

Gilchrist.—The Loncala Phosphate Co. (Mona mine) mined soft phosphate rock, the only mineral produced in the county; production increased considerably over 1957.

Hendry.—Caloosa Rock Corp. (La Belle quarry) crushed limestone for concrete aggregate, roadstone, and screenings. This is a new operation reporting for the first year and the only mineral producer in the county.

Hernando.—The county ranked third in producing crushed limestone; total production decreased 14 percent in tonnage and 29 percent in value under 1957. Producers were Camp Concrete Co. (Gay quarry), Brooksville Rock Co., Inc. (Broco quarry), William P. McDonald Corp. of Florida (Conrock quarry), Florida Rock Products Co. (Diamond Hill quarry), and Aripeka Limerock Co., Inc. (Aripeka quarry). The material was transported 72 percent by railroad and 28 percent by truck.

Hillsborough.—As in 1957, Hillsborough County ranked second in the State in total value of mineral production owing to continued high output of phosphate rock and cement; the county led the State in peat production. American Cyanamid Co. (Sidney mine) and the American Agricultural Chemical Co. (Boyette mine) produced land-pebble phosphate rock for agricultural and industrial uses. General Portland Cement Co. (Tampa mill), produced portland and masonry cements. Bay Dredging & Construction Co. (Lease No. 639) dredged oystershell, but at a reduced tonnage from 1957. Peat was produced by Agricultural Organics Corp. and Austin J. Stearns near Seffner, Jack O. Holmes near Tampa, Frank E. Stearns near Sydney, and Ruth C. McKissick near Limona; the material was used as a soil conditioner and consisted of both humus and reed-sedge types.

Indian River.—Florida Minerals Co. (Vero mine) mined heavy sands containing ilmenite, rutile, and zircon and sent them to the Palm Bay plant for concentration and separation; production of all minerals increased over 1957. Ben Walker mined structural sand, and Airlite Processing Co. expanded western perlite, for use in lightweight concrete and plaster, at their Vero Beach plant.

Jackson.—Marjax Co. (Marjax quarry) crushed limestone and was the only mineral producer in the county.

Lafayette.—Williston Shell Rock Co. (Dell quarry) crushed limestone for concrete aggregate, roadstone, and screenings; 59,000 tons was produced during the year, a decrease in tonnage from 1957. Suwannee River Sand Co. (Lafayette County mine) produced 25,000 tons of paving sand.

Lake.—Sand and gravel, the only commodity produced in the county, showed a slight increase in tonnage and value over 1957. Central Sand Co. (Tavares mine) and three new producers for the year—Davenport Sand Co. (Clermont mine), Silver Lake Estates (Leesburg mine) and Samuel L. Shaw (Mount Dora mine)—produced building, fill, and paving, and road sands. The material was transported by truck for three producers and by railroad and motortruck for one producer.

Lee.—West Coast Rock Co., Inc. (Fort Myers quarry), crushed limestone for use in concrete, roadstone, and screenings. Fort Myers Shell Co. (Lease No. 1082) reported production of oystershell for use in concrete for the first year.

Leon.—Asa Maige Sand Co. (Norfleet mine) and Middle Florida Sand Co. (Tallahassee mine) mined building, paving, and road sands. The Federal Bureau of Mines maintained a mining field station throughout the year at Tallahassee, collecting data on titanium, clays, and other minerals of importance within the State.

Levy.—Six operators crushed limestone from seven quarries; total production decreased slightly under 1957. Producers were Connell & Schultz (Williston quarry), Dixie Lime Products Co. (Lebanon quarry), Levy County Lime Rock Co. (No. 1 and No. 3 quarries), United Limerock Co. (United Williston quarry), and Ralph Swiney (Raleigh quarry), a new producer for the year. The material was used primarily for concrete aggregate, roadstone, and screenings; transportation was 69 percent by railroad and 31 percent by truck.

Manatee.—Manatee Dolomite Co. (Bradenton quarry) produced crushed limestone for agricultural uses and dimension limestone for use as building stone; Bradenton Dredging & Shell Co. (Lease No. 61) produced oystershell for concrete aggregate and road material.

Marion.—Crushed-limestone production in the county decreased 12 percent in tonnage and 16 percent in value from 1957. Producers, in order of output, were: Dixie Lime Products Co. (Plant No. 3 quarry), Ocala Lime Rock Corp. (Kendrick quarry), Cummer Lime & Manufacturing Co. (Kendrick and Martin quarries), and W. L. Cobb Construction Co. (York quarry). The material was used for concrete aggregate, roadstone, screenings, and agricultural purposes; transportation was 47 percent by railroad, 45 percent by truck and 8 percent by waterway. Dixie Lime Products Co. (Ocala No. 7 lime-kiln) produced lime for building and chemical purposes.

Monroe.—Charley Toppino & Sons, Inc. (Stock Island quarry) crushed limestone for concrete and roadstone. Keystone Art Co. (Winleys Key quarry) quarried dimension limestone for building purposes.

Orange.—Daetyler Peat mine, Orlando, and Raymond Johnson, Apopka, produced peat for use as a soil conditioner.

Palm Beach.—Palm Beach County Highway Department (Palm Beach County quarry), and Belle Glade Rock Co. (Belle Glade quarry), crushed limestone for use in concrete aggregate and as roadstone. Latham Farm, near West Palm Beach, produced peat for use as a soil conditioner.

Pasco.—Bailey Production Co. (Bailey quarry), crushed limestone during a part of the year. This was the only commodity reported from the county during the year.

Pinellas.—Largo Washed Sand Co. (Largo mine), produced structural sand. Benton & Co., Inc. dredged oystershell for concrete aggregate and roadstone.

Polk.—Polk County was again the leading mineral producing county in the State; total value of mineral production was $63 million compared to $58 million in 1957, and was due to increases in land pebble phosphate output. Producers of phosphate rock, in order of

production, were: International Minerals & Chemical Co. (Achan and Noralyn mines), American Agricultural Chemical Co. (South Pierce mine), Virginia-Carolina Chemical Corp. (Clear Springs and Homine mines), Davison Chemical Division of W. R. Grace Co. (Bonny Lake and Pauway No. 4 mines), American Cyanamid Co. (Orange Park mine), Armour Fertilizer Works (Armour mine), and Coronet Phosphate Division of Smith-Douglas Co., Inc. (Tenoroc mine). Davison Chemical Division of W. R. Grace Co. added $1.5 million in new facilities to its Ridgewood triple superphosphate plant near Bartow; American Cyanamid Co. completed construction of its new phosphate plant near Brewster and company mines resumed full production after a short curtailment to reduce company inventories. The City of Bartow approved an amended ordinance governing phosphate mining within the city limits. International Minerals & Chemical Co. announced the opening of a mineralogical laboratory at its Experimental Research Station at Mulberry.

Sand production totaled 2.8 million tons valued at $2 million, and decreased slightly from that reported in 1957. Nine operations were active and leading producers were: Standard Sand & Silica Co. (Standard mine), Oak Ridge Sand Co., Inc. (Achan mine), and Mammoth Sand Co. (Lake Wales mine). Most of the material was used as building sand, but smaller tonnages were used as paving and road sand, blast sand, filter sand, fertilizer filler, and for roofing granules. The material was transported 96 percent by railroad and 4 percent by truck.

Putnam.—Edgar Plastic Kaolin Co. (Edgar mine) and United Clay Mines Corp. (No. 4 mine) produced kaolin for use in pottery and stoneware, floor and wall tile, and clay crucibles; production decreased slightly from 1957. Total sand production increased 11 percent in tonnage and 11 percent in value over 1957; 6 operations were active, the same number as in 1957, and leading producers were: Diamond Interlachen Sand Co., Inc. (Interlachen mine), Keuka Sand Co. (Putnam County mine), and All-Florida Sand Co. (All-Florida Interlachen mine). The sand was used for building sand, and as a paving and road sand. Peat, for use as a soil conditioner, was produced by Glen St. Mary Nurseries Co. near Florahoma.

St. Johns.—Phillips McLeod (St. Johns County quarry) produced crushed limestone and dimension stone.

Sarasota.—Florida Dolomite Co. (Florida Dolomite quarry) crushed limestone for agricultural use.

Sumter.—Central Quarries, Inc. (Sumterville quarry), crushed limestone for concrete aggregate and roadstone.

Suwanee.—Live Oak Stone Co. crushed limestone for roadstone and concrete aggregate.

Volusia.—White Sand & Materials Co. (New Smyrna Beach mine) produced a small tonnage of building sand.

Walton.—Bay Dredging & Towing Co. dredged oystershell for concrete aggregate and roadstone.

The Mineral Industry of Georgia

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Georgia.

By James L. Vallely [1] and Garland Peyton [2]

RECORD HIGH production of kaolin, crushed granite, slate, masonry cement, and scrap mica highlighted the mineral industry of Georgia in 1958. Among the States, Georgia led in the production of kaolin and crude iron oxide pigments, ranked second in fuller's earth and mica, third in barite and bauxite, and sixth in talc.

Georgia's mineral industry was dominated by the mining and processing of clays, and by the quarrying and processing of stone, which together comprised 83 percent of the total value of production. Leading companies were Georgia Marble Co., Minerals & Chemical Corp. of America, Southern Clays, Inc., Georgia Kaolin Co., and J. M. Huber Corp.

Total value of production established a new annual record, surpassing $75 million for the first time. Total value increased 8 percent over 1957, the previous record year.

TABLE 1.—Mineral production in Georgia [1]

Mineral	1957		1958	
	Thousand short tons (unless otherwise stated)	Value (thousand)	Thousand short tons (unless otherwise stated)	Value (thousand)
Clays	2,707	$30,120	2,942	$31,253
Coal	13	63	9	44
Gem stones	(3)	(3)	(3)	(3)
Iron ore (usable)---thousand long tons, gross weight	443	2,109	209	1,008
Manganiferous ore, short tons, gross weight	2,203	(4)	(4)	(4)
Mica, sheet---pounds	16,933	158	15,102	82
Peat	5	44	4	(4)
Sand and gravel	2,127	2,096	2,631	2,693
Stone	[5] 9,065	[5] 15,833	12,129	31,108
Talc and soapstone	49	106	(4)	(4)
Value of items that cannot be disclosed: Barite, bauxite, beryllium concentrate (1957), cement, feldspar, iron oxide pigments, mica (scrap), manganese ore, stone (1957 marble, slate, crushed sandstone) and values indicated by footnote 4	----	20,082	----	10,145
Total Georgia [6]	----	69,799	----	75,106

[1] Production as measured by mine shipments, mine sales, or marketable production (including consumption by producers).
[3] Weight not recorded.
[3] Less than $1,000.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Excludes certain stone, value for which is included with "Items that cannot be disclosed."
[6] The total has been adjusted to eliminate duplicating the value of clays and stone.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Knoxville, Tenn.
[2] Director, Geological Survey of Georgia, Atlanta, Ga.

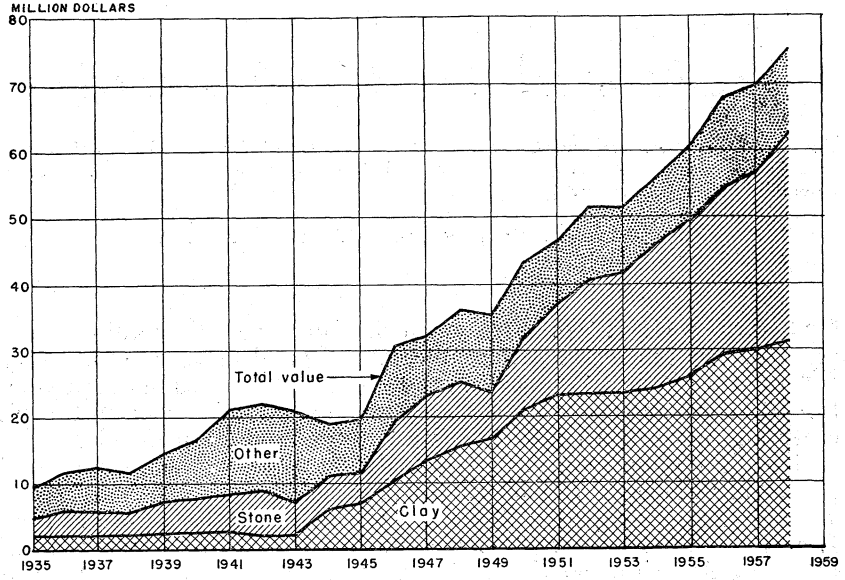

FIGURE 1.—Value of clays and stone, and total value of mineral production in Georgia 1935–58.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-days worked	Fatal injuries	Nonfatal injuries	Injuries per million man-days
1957							
Quarries and mills	66	2,771	256	710,690	2	184	262
Nonmetal mines	55	2,046	272	557,401		89	160
Sand and gravel mines	27	202	260	52,612		10	190
Metal mines	20	165	188	31,027		4	129
Coal mines	6	23	150	3,443			
Total	174	5,207	260	1,355,173	2	287	213
1958 [1]							
Quarries and mills	74	2,890	247	713,881	3	217	308
Nonmetal mines	70	3,200	286	914,694	3	184	204
Sand and gravel mines	38	298	270	80,329		8	100
Metal mines	20	158	133	21,061		4	190
Coal mines	5	18	155	2,795			
Total	207	6,564	264	1,732,760	6	413	242

[1] Preliminary figures.

Employment and Injuries.—Employment in the mineral industries was 28 percent higher than in 1957, the apparent increase being due in part to better coverage of sand and gravel operations. Employment as measured by man-days worked in nonmetal mines was 64 percent higher, sand and gravel 53 percent higher, quarries and mills was virtually the same as in 1957, while metal mines decreased 32 percent and coal mines 19 percent.

Six fatalities occurred in the State's mineral industries, three in nonmetal mines and three in quarries and mills compared with two in quarries and mills in 1957. Frequency rates (injuries per million man-days) were higher in metal and nonmetal mines and quarries and mills while the rate for sand and gravel operations was lower. There were no lost time accidents in the coal mines in the last 2 years.

Trends and Developments.—In response to increasing demands for construction minerals in highway, industrial and general construction, many new quarries for crushed and dimension stone began production. Stockbridge Stone Co. was merged with and became an operating division of Vulcan Materials Co. American Industrial Clay, Inc., began producing fuller's earth. Plant improvement and expansions were announced by Georgia Vitrified Brick and Clay Co., Harlem ($500,000); Oconee Clay Products Co., Milledgeville, Burns Brick Co., Macon, and Marquette Cement Co., Rockmart ($4 million); National Gypsum Co. installed new dock loading facilities at the Savannah plant, and Bestwall Gypsum Co. planned to construct a plant at Brunswick to manufacture gypsum board, lath and plaster from imported crude gypsum. American Oil Co. also increased its crude capacity at the Savannah refinery.

Legislation and Government Programs.—The Defense Minerals Exploration Administration (DMEA) program for the exploration of strategic and critical minerals expired on June 30, 1958, and was superseded by the Office of Minerals Exploration (OME). Under these programs four mica contracts totaling $31,060 were active; all were completed during the year.

TABLE 3.—Defense Minerals Exploration Administration mica contracts in force during 1958

Operator	Property	County	Amount [1]
Homer Boone	Taylor	Hart	[2] $12,572
Boone's & Phillips'	Medford	Upson	6,292
Lee Medford	Little Brown	do	5,516
Lee Medford	Mathis	do	6,680

[1] Government participation, 75 percent.
[2] Revised figure.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Primary barite production declined for the first time since 1953. Although tonnage and total value were lower than in 1957, the record year, by 24 and 10 percent, unit value was 18 percent higher. Crushed and ground barite were shipped for use in chemicals, glass, rubber fillers and well drillings. All production came from Bartow County.

Cement.—Cement production increased 20 percent in tonnage and 24 percent in value with both masonry and portland cements contributing to the increase. Production of masonry cement established a new annual record. Marquette Cement Mfg. Co., Rockmart, manufactured portland and masonry cements and Penn-Dixie Cement Corp., Clinch-

field, manufactured portland cement only. Out-of-State shipments were principally to Florida markets with minor tonnages to Alabama, North Carolina, and South Carolina.

Clays.—Clay was the top ranking mineral in the State in terms of value. Total production value has consistently increased except for 1943 and 1949 for the past 20 years and in 1958 made up 42 percent of all the State's mineral production. Kaolin and miscellaneous clay increased in both tonnage and value; fuller's earth was up 7 percent in tonnage but decreased 6 percent in value. Clays were mined in 19 counties by 36 companies. Kaolin was produced in Glascock, Richmond, Twiggs, Washington, and Wilkinson Counties by 17 companies, fuller's earth in Decatur, Grady, Jefferson, Thomas, and Twiggs by 5 companies, and miscellaneous clay in 12 counties by 14 companies. Georgia led the Nation in the production of kaolin, and ranked second in output of fuller's earth. Leading producers of kaolin were Minerals & Chemical Corp. of America, Georgia Kaolin Co., and J. M. Huber Corp. Leading producers of fuller's earth were Cairo Production Co., Inc., and The Diversey Corp. Production of kaolin was 2 percent more than in 1956, the previous record year.

Feldspar.—Appalachian Minerals Company mined feldspar rock and produced flotation concentrate for glass and pottery uses at its mill near Monticello.[3] Production was lower than in 1957, and 15 percent below 1956, the record year.

Gem Stones.—Corundum from Towns County was the only gem material reported.

Mica.—Sheet mica production was 15,100 pounds valued at $81,600, including 4,580 pounds of full-trimmed sheet mica and 6,870 pounds of punch obtained from 114,000 pounds of hand-cobbed mica. All hand-cobbed and trimmed mica was sold to the Government through the General Services Administration (GSA) at the Spruce Pine

TABLE 4.—Clays sold or used by producers, by counties

County	Kaolin and fuller's earth				Miscellaneous clay			
	1957		1958		1957		1958	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Bibb					296,431	$118,600	(1)	(1)
Crawford							300	$300
Fulton							44,100	17,640
Gordon					24,480	9,800	24,000	9,600
Jefferson	6,221	$136,800	12,989	$246,791				
Richmond	91,699	670,515	57,452	404,210	(1)	(1)	(1)	(1)
Thomas	(1)	(1)	(1)	(1)	2,685	1,074	2,600	1,040
Twiggs	916,772	17,213,584	953,302	17,292,760				
Washington	258,153	4,739,856	388,628	7,148,097				
Wilkinson	344,089	5,620,704	270,213	4,575,024				
Other counties [2]	119,959	1,350,840	98,044	1,107,121	646,724	258,700	1,090,868	450,018
Total	1,736,893	29,732,299	1,780,628	30,774,003	970,320	388,174	1,161,868	478,598

[1] Included with "Other counties."
[2] Includes production of kaolin or fuller's earth in Baldwin (1957), Decatur, Glasscock, and Grady; miscellaneous clay in Columbia (1958), Floyd, Houston, Polk, Walker (1958), Whitfield; and values indicated by footnote 1.

[3] Pit and Quarry, vol. 51, No. 4, October 1958.

(N.C.) Purchase Depot. Compared with 1957, production of sheet mica was 11 percent lower in quantity and 48 percent lower in value. Scrap mica was 12 percent greater in both tonnage and value, and established a new annual record. Mica was produced in 8 counties by 14 operators.

Hart was the principal sheet producing county; Cherokee, Hart, and Pickens were the principal scrap producers.

Four DMEA contracts for mica were active, one in Hart County and three in Upson County. The total amount of the contracts, all completed during the year, was $31,060, with Government participation 75 percent.

TABLE 5.—Kaolin sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Pottery and stoneware:						
Whiteware	54,847	$994,494	$18.13	60,134	$1,094,550	$18.20
Stoneware, including chemical stoneware	(1)	(1)	(1)	200	3,554	17.77
Art pottery, etc.	747	5,461	7.31	733	5,160	7.04
Refractories:						
Firebrick and block	229,039	1,620,206	7.07	159,772	1,278,095	8.00
Glass refractories	(1)	(1)	(1)	13,857	246,239	17.77
Foundries and steelworks	(1)	(1)	(1)	281	4,993	17.77
Sagger, pins, stilts and wads	(1)	(1)	(1)	2,074	36,855	17.77
Architectural terra cotta				1,130	20,080	17.77
Fillers:						
Paper	492,537	8,765,648	17.80	477,285	8,387,137	17.57
Paper coating	658,335	13,077,309	19.86	704,277	13,896,955	19.73
Rubber	82,581	1,250,977	15.15	80,059	1,235,269	15.43
Linoleum and oilcloth	(1)	(1)	(1)	3,674	65,244	17.76
Paint	(1)	(1)	(1)	38,446	771,664	20.07
Fertilizer	(1)	(1)	(1)	1,492	27,948	18.73
Plastics, organic	(1)	(1)	(1)	9,548	215,293	22.55
Other [2]	140,608	2,505,612	17.82	132,474	1,852,111	13.98
Exports	(1)	(1)	(1)	11,262	207,114	18.39
Total	1,658,694	28,219,707	17.01	1,696,698	29,348,261	17.30

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes enameling (1957), floor and wall tile, insecticides and fungicides, catalysts, chemicals, portland and other hydraulic cements (1958), other filler, refractory and miscellaneous uses, and uses indicated by footnote 1.

TABLE 6.—Sheet mica produced, by counties

County	1957		1958	
	Pounds	Value	Pounds	Value
Elbert	537	$551	(1)	(1)
Hart	(1)	(1)	12,600	$68,573
Jasper	(1)	(1)	32	319
Monroe	220	3,402		
Pike	(1)	(1)	2	29
Upson	11,579	132,827	1,542	8,608
Other counties	[2] 4,597	[2] 21,103	[3] 926	[3] 4,052
Total	16,933	157,883	15,102	81,581

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."
[2] Butts, Cherokee, Hart, Jasper, Macon, Oconee, and Pike Counties.
[3] Cherokee, Elbert, Pickens, and Spalding Counties.

Sand and Gravel.—After a 2 year decline, production of both sand and gravel was higher than in 1957, increasing 24 percent in tonnage and 28 percent in value, but was 12 percent below 1955, the record year. Structural sand showed the greatest gain—45 percent in tonnage and 55 percent in value. Blast, filter, glass, and railroad ballast sand also were higher in both tonnage and value. Paving, molding, and sands for other uses declined. Small tonnages of grinding and engine sands were also produced. Total gravel production increased less than 5 percent, but the value was up 39 percent. Thirty-four companies were active in 21 counties; all produced sand; gravel came from Muscogee County except for a very small tonnage from Fulton County. Crawford, Dougherty, Effingham, Muscogee, Talbot, and Thomas were the principal producing counties. Leading producers were Dawes Silica Mining Co., Inc., and Atlanta Sand & Supply Co.

Stone.—Stone was first in tonnage and second in value among the minerals produced in Georgia. Production has steadily increased every year since 1943; 1958 tonnage and value again reached a new record. Total crushed stone, including slate, increased 12 percent in tonnage and 19 percent in value. Crushed granite, sandstone and crushed and ground slate showed substantial increases. Crushed limestone was down 2 percent in tonnage but up 2 percent in value. Crushed marble on the other hand was 4 percent less in both tonnage and value. Both crushed granite and slate established new annual records.

Dimension stone decreased 6 percent in tonnage and 4 percent in value. Dimension granite increased 9 percent in tonnage but decreased 3 percent in value. Dimension marble decreased 30 percent in tonnage but was 10 percent higher in value. Only a small tonnage of dimension sandstone was quarried.

Stone was produced in 32 counties, with granite in 19, limestone in 7, marble in 3, sandstone in 4 and slate in 3 counties. Granite was produced from 46 quarries by 30 companies and 2 Government-and-con-

TABLE 7.—Sand and gravel sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Chattooga	3,217	$7,009	4,167	$9,376
Colquitt	14,000	24,000		
Dougherty	113,566	88,645	242,134	181,811
Douglas			9,720	6,221
Evans	7,668	10,194	2,956	4,434
Fulton	19,324	16,819	74,291	59,488
Montgomery	(1)	(1)	2,520	1,350
Richmond	104,520	64,500	(1)	(1)
Sumpter			23,468	8,692
Talbot	265,655	224,245	(1)	(1)
Taylor	135,000	60,750	170,451	77,937
Ware	47,026	41,341	(1)	(1)
Other counties [2]	1,416,742	1,558,943	2,101,785	2,343,580
Total	2,126,718	2,096,446	2,631,492	2,692,889

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties".

[2] Includes Bibb, Brooks, Chatham, Crawford, Effingham, Elbert, Glynn, Long, Muscogee, Rabun (1957), Spalding (1958), Thomas, and counties indicated by footnote 1.

TABLE 8.—Sand and gravel sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Structural sand	1,137,372	$729,249	$0.64	1,649,902	$1,133,745	$0.69
Paving sand	428,052	303,820	.71	353,701	280,338	.79
Paving gravel	(1)	(1)	(1)	103,000	154,500	1.50
Other sand and gravel [2]	561,294	1,063,377	1.89	524,889	1,124,306	2.14
Total sand and gravel	2,126,718	2,096,446	.99	2,631,492	2,692,889	1.02

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other sand and gravel."
[2] Includes glass, molding, grinding and polishing, blast, engine, filter, ground sand, railroad ballast and other sands, structural and other gravel.

tractors, limestone from 9 quarries by 8 companies and 1 Government-and-contractor, marble from 6 quarries by 3 companies, dimension sandstone from 3 quarries in Pickens County, quartz and quartzite each by 1 company, and slate by 3 companies. Leading producers of crushed granite were Stockbridge Stone Division of Vulcan Materials Co., Weston & Brooker Co., and Tyrone Rock Products Co., and of dimension granite were Coggins Granite Industries, Inc., and Davidson Granite Co., Inc. Georgia Marble Co. was the leading producer of crushed and dimension marble. Leading producers of crushed limestone were the two cement companies, Penn-Dixie Cement Corp. and Marquette Cement Mfg. Co.

Talc and Soapstone.—Production of crude and sales of sawed and ground talc were considerably lower than in 1957. All production came from two companies in Murray County, Georgia Talc Co. and Cohutta Talc Co.

TABLE 9.—Dimension granite sold or used by producers, by counties

County	1957			1958		
	Cubic feet	Short tons (equivalent)	Value	Cubic feet	Short tons (equivalent)	Value
De Kalb	525,427	43,632	$799,043	703,476	58,366	$787,248
Elbert	[1] 553,185	46,569	1,464,192	537,181	45,536	1,470,605
Madison	149,998	12,450	449,994	132,000	11,000	396,000
Oglethorpe	[1] 285,565	23,695	608,192	273,350	22,792	557,544
Total	1,514,175	126,346	3,321,421	1,646,007	137,694	3,211,397

[1] Revised figure.

METALS

Bauxite.—Production of bauxite was 18 percent lower in both tonnage and value, and was 62 percent below 1943, the record year. American Cyanamid Co., the only producer, operated open pit mines in Floyd, Macon, and Sumter Counties and a drying plant at Halls Station in Bartow County.

TABLE 10.—Crushed granite sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete, road metal	6,696,753	$9,374,194	$1.40	7,551,296	$12,014,224	$1.59
Railroad ballast	594,539	717,787	1.21	740,132	898,738	1.21
Riprap	99,091	162,419	1.64	(1)	(1)	(1)
Other	366,137	278,693	.76	[2] 462,072	[2] 423,168	[2] .92
Total	7,756,520	10,533,093	1.36	8,753,500	13,336,130	1.52

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes riprap, and other miscellaneous uses.

TABLE 11.—Crushed limestone sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and road metal	417,748	$752,590	$1.80	389,425	$702,465	$1.80
Railroad ballast	41,050	59,522	1.45	3,796	5,505	1.45
Riprap	1,000	1,000	1.00			
Other[1]	714,830	1,126,280	1.58	760,103	1,266,706	1.67
Total	1,174,628	1,939,392	1.65	1,153,324	1,974,676	1.71

[1] Other includes agriculture, cement, and fertilizer filler.

TABLE 12.—Dimension granite sold or used by producers, by uses

Use	1957			1958		
	Cubic feet	Value		Cubic feet	Value	
		Total	Average per ton		Total	Average per ton
Rough monumental	801,108	$1,689,600	$2.11	798,333	$1,724,139	$2.16
Rubble	252,771	47,481	.19	(1)	(1)	(1)
Curbing and flagging	(1)	(1)	(1)	330,608	487,764	1.48
Dressed monumental	(1)	(1)	(1)	132,354	696,610	5.26
Rough construction	2,410	800	.33	1,205	400	.33
Rough architectural	15,500	18,000	1.16	1,000	1,400	1.40
Other	[2] 442,386	[2] 1,565,540	[2] 3.54	[3] 382,507	[3] 301,084	[3] .79
Total	1,514,175	3,321,421	2.19	1,646,007	3,211,397	1.95

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes paving blocks, dressed architectural, dressed monumental, and curbing and flagging.
[3] Includes rubble and dressed architectural.

Iron Ore.—Brown ore shipments were less than one-half of 1957, the record year, in both tonnage and value, and with the exception of 1950, the lowest tonnage of brown iron ore produced since 1940. The principal production center shifted from the Bartow-Polk County area in the northwest to the Stewart-Webster County area. All brown iron

ore was shipped to Birmingham and Gadsden, Ala., blast furnaces. Leading producers were Luverne Mining Co. and Dunbar & Layton.

Iron Oxide Pigments (Crude).—New Riverside Ochre Co. in Bartow County was the only producer. Crude production was up 9 percent in tonnage and value. Finished pigments by the same company increased 14 percent in both tonnage and value.

Manganese.—Manganese ore (plus 35 percent Mn) tonnage was higher than in 1957, but was below 1941, the record year. All production was purchased by GSA. Manganiferous ore (10 to 35 percent Mn) tonnage declined but its value was more than double the previous year. Seven producers shipped ore from Bartow and Polk Counties. The leading producer of manganese ore was Mosteller Bros., and of manganiferous ore was Lake Mining Co.

TABLE 13.—Shipments of brown iron ore by producers, by counties

County	1957		1958	
	Long tons	Value	Long tons	Value
Bartow	198,880	$853,772	37,135	$143,875
Polk	128,521	642,777	29,393	180,812
Stewart	110,110	583,172	116,984	549,657
Webster	5,161	29,631	25,881	134,112
Total	442,672	2,109,352	209,393	1,008,456

TABLE 14.—Shipments of iron ore in Georgia, 1870–1958

Year	Long tons	Value	Year	Long tons	Value
1870–1890	1,989,100	$1,578,900	1925	79,500	$231,700
1891	250,800	251,000	1926	51,600	149,200
1892	185,100	178,000	1927	50,300	147,100
1893	176,200	163,600	1928	73,100	209,900
1894	162,800	149,100	1929	59,300	175,100
1895	268,800	242,000	1930	52,200	148,000
1896	168,300	144,700	1931	20,700	51,500
1897	204,600	165,800	1932	900	1,500
1898	158,000	128,000	1933	300	600
1899	236,700	234,400	1934	1,100	1,800
1900	315,700	419,900	1935	2,900	7,700
1901	213,600	256,300	1936	5,700	11,400
1902	334,100	464,300	1937	14,600	19,100
1903	443,500	571,100	1938	9,200	11,400
1904	293,800	358,400	1939	25,800	51,100
1905	200,800	289,200	1940	100,300	182,600
1906	411,200	734,300	1941	258,900	598,500
1907	444,100	837,100	1942	298,400	722,000
1908	321,100	540,200	1943	413,500	950,200
1909	221,000	333,300	1944	285,500	687,500
1910	313,900	480,800	1945	276,100	616,500
1911	207,300	315,700	1946	284,600	613,700
1912	135,300	227,300	1947	296,000	693,500
1913	153,300	237,900	1948	273,700	746,800
1914	66,200	119,400	1949	228,700	692,600
1915	101,700	186,100	1950	202,400	677,200
1916	252,100	413,300	1951	357,800	1,339,200
1917	211,500	524,200	1952	320,000	1,439,300
1918	262,000	878,600	1953	260,000	1,100,700
1919	74,000	294,600	1954	221,600	871,900
1920	104,500	460,600	1955	[1]	[1]
1921	3,800	13,700	1956	356,700	1,609,100
1922	28,600	77,600	1957	442,700	2,109,400
1923	117,300	300,700	1958	209,400	1,008,500
1924	112,100	285,100			

[1] Figure withheld to avoid disclosing individual company confidential data.

MINERAL FUELS

Coal.—Three operators, excluding those producing less than 1,000 tons annually, mined bituminous coal from underground mines, all in Walker County. Tonnage and value were down respectively 31 percent and 30 percent below 1957.

Peat.—Humus peat production, used principally for agricultural and horticultural purposes, was lower in both tonnage and value. Only two producers were active during the year.

REVIEW BY COUNTIES

Mineral production was reported from 67 of Georgia's 159 counties. Eighteen counties each had production valued above $1 million and accounted for $65.3 million or 87 percent of the State's total mineral production. The top 10 counties in the order listed—Twiggs, Pickens, Washington, Wilkinson, Houston, Polk, De Kalb, Bartow, Richmond, and Gilmer, each had production valued above $2 million.

Bartow.—A sharp decline in brown iron ore production and lower barite production more than offset gains in iron oxide pigments, crushed limestone, manganese ores, and crushed slate, so that total value of mineral production was 21 percent lower than in 1957.

TABLE 15.—Value of mineral production in Georgia, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Baldwin	(2)		
Bartow	$3,906,146	$3,101,568	Barite, slate, limestone, iron ore, iron oxide pigments, manganese ore, manganiferous ore.
Bibb	942,888	770,880	Granite, sand and miscellaneous clay.
Brooks	(2)	(2)	Sand.
Butts	(2)		
Charlton	(2)		
Chatham	(2)	(2)	Sand.
Chattooga	7,009	9,376	Do.
Cherokee	(2)	(2)	Mica, marble.
Clayton		(2)	Granite.
Cobb	(2)	(2)	Do.
Colquitt	24,000		
Columbia		(2)	Miscellaneous clay.
Crawford	(2)	(2)	Sand, mica.
Dade	(2)	32,000	Limestone.
Decatur	(2)	(2)	Fuller's earth.
DeKalb	(2)	(2)	Granite.
Dougherty	88,645	(2)	Sand, limestone.
Douglas	(2)	(2)	Granite, sand.
Effingham	(2)	(2)	Sand.
Elbert	1,516,817	1,472,626	Granite, mica, sand.
Evans	10,194	4,434	Sand.
Fannin	167,579	15,600	Granite.
Fayette	(2)	(2)	Do.
Floyd	581,839	404,000	Limestone, bauxite, miscellaneous clay.
Fulton	(2)	(2)	Granite, sand and gravel, miscellaneous clay.
Gilmer	(2)	(2)	Marble.
Glascock	(2)	(2)	Kaolin.
Glynn	(2)	(2)	Sand.
Gordon	9,800	9,600	Miscellaneous clay.
Grady	(2)	(2)	Fuller's earth.
Gwinnett	(2)	(2)	Granite.
Hall		(2)	Do.
Hancock	(2)	(2)	Do.
Hart	(2)	(2)	Mica.
Henry	(2)	(2)	Granite.
Houston	(2)	(2)	Cement, limestone, miscellaneous clay.
Jasper	(2)	(2)	Feldspar, sandstone, mica.
Jefferson	136,800	246,791	Fuller's earth.
Jones		(2)	Granite.

See footnotes at end of table.

TABLE 15.—Value of mineral production in Georgia, by counties [1]—Continued

County	1957	1958	Minerals produced in 1958 in order of value
Long	(2)	(2)	Sand.
Lowndes	(2)	(2)	Peat.
Macon	(2)	(2)	Bauxite.
Madison	$449,994	$396,000	Granite.
Mitchell	(2)	(2)	Limestone.
Monroe	3,402		
Montgomery	(2)	1,350	Sand.
Murray	106,000	(2)	Talc, soapstone, slate.
Muscogee	939,138	1,103,747	Granite, sand and gravel
Oconee	(2)		
Oglethorpe	608,192	557,544	Granite.
Pickens	(2)	(2)	Marble, mica, sandstone.
Pike	(2)	29	Mica.
Polk	(2)	(2)	Cement, slate, limestone, iron ore, miscellaneous clay, manganese ore.
Rabun	(2)		
Richmond	2,059,515	(2)	Sandstone, kaolin, miscellaneous clay, sand.
Screven	(2)	(2)	Peat.
Spalding		(2)	Sand, mica.
Stewart	583,172	549,657	Iron ore.
Sumter	(2)	(2)	Bauxite, sand.
Talbot	224,245	(2)	Sand.
Taylor	60,750	77,937	Do.
Thomas	(2)	(2)	Sand, fuller's earth, miscellaneous clay.
Towns	10	100	Gem stones.
Troup	(2)		
Twiggs	17,213,584	17,292,760	Kaolin, fuller's earth.
Upson	133,316	8,710	Mica.
Walker	126,087	(2)	Coal, miscellaneous clay.
Walton		89,000	Granite.
Ware	41,341	(2)	Sand.
Warren	(2)	(2)	Granite.
Washington	4,739,856	7,148,097	Kaolin.
Webster	(2)	134,112	Iron ore.
Whitfield	12,800	(2)	Miscellaneous clay.
Wilkinson	[3] 5,620,704	4,575,024	Kaolin.
Undistributed	29,484,974	37,105,405	
Total [4]	69,799,000	75,106,000	

[1] The following counties are not listed because no production has been reported: Appling, Atkinson, Bacon, Baker, Banks, Barrow, Ben Hill, Berrien, Bleckley, Brantly, Bryan, Bullock, Burke, Calhoun, Camden, Candler, Carroll, Catoosa, Chattahoochee, Clarke, Clay, Clinch, Coffee, Cook, Coweta, Crisp, Dawson, Dodge, Dooly, Early, Echols, Emanuel, Forsyth, Franklin, Greene, Habersham, Haralson, Harris, Heard, Irwin, Jackson, Jeff Davis, Jenkins, Johnson, Lamar, Lanier, Laurens, Lee, Liberty, Lincoln, Lumpkin, McDuffie, McIntosh, Marion, Meriwether, Miller, Morgan, Newton, Paulding, Peach, Pierce, Pulaski, Putnam, Quitman, Randolph, Rockdale, Schley, Seminole, Stephens, Taliaferro, Tattnall, Telfair, Terrill, Tift, Toombs, Treutlen, Turner, Union, Wayne, Wheeler, White, Wilcox Wilkes, Worth.

[2] Figure withheld to avoid disclosing individual company confidential data.

[3] Revised figure.

[4] The total has been adjusted to eliminate duplicating the value of clays and stone.

Barite producers were Paga Mining Co. and New Riverside Ochre Co., the latter was also the only producer of crude and finished iron oxide pigments. Marquette Cement Mfg. Co. quarried limestone for use in its cement plant at Rockmart, and Funkhouser Co. operated its underground mine south of Fairmont to produce slate flour and roofing granules.

Only four operators produced brown iron ore compared with eight in 1957; the principal shippers were Hodge Mining Co. and Mosteller Bros. Manganese ore producers were Lake Mining Co., Mosteller Bros., and Oakland Heights Mining Co.

Bibb.—Burns Brick Co. and Cherokee Brick & Tile Co. mined clay for manufacture of clay products at plants in Macon. Structural and paving sands were produced by Cornell-Young Co., Macon Brick & Block Co., and Sand Suppliers, Inc. Hitchcock Corp. quarried and crushed granite; during the year the Beechwood quarry was abandoned, the New Carlton quarry taking its place.

Brooks.—Bannockburn Sand Co. produced paving sand at the Troupeville pit.

Chatham.—J. W. Fitzgerald Co. Inc. mined structural sand, and National Gypsum Co. calcined imported crude gypsum at the Savannah plant.

Chattooga.—Wolf Creek Sand Co. produced unwashed foundry sand.

Cherokee.—Thompson-Weinman & Co. mined scrap mica (sericite) from the Brady Mine for grinding at its Cartersville plant, and Glenn Young produced sheet mica at the Cochran mine. Teague Terrazo Co. quarried and crushed marble (serpentine).

Clayton.—Tyrone Rock Products Co. reported initial production of crushed granite from its new quarry.

Cobb.—Stockbridge Stone Division of Vulcan Materials Co. produced crushed granite for concrete and roadstone.

Columbia.—Georgia Vitrified Brick & Clay Co. mined clay (Campania mine) for use in manufacturing brick and clay products at Harlem.

Crawford.—Atlanta Sand & Supply Co. produced building, paving and other sands from the Rollo pit near Roberta. Middle Georgia Pottery Co. mined a small tonnage of clay for use in manufacture of clay products.

Dade.—The only mineral production recorded in Dade County in 1958 was crushed limestone for concrete and roads by Dave L. Brown Co.

Decatur.—Milwhite Co. Inc. mined and processed fuller's earth for insecticides, fungicides, and filtering and decolorizing oils and greases.

De Kalb.—Although quantity of dimension granite quarried was 34 percent higher than in 1957 its value declined 1 percent, due to larger tonnages of rubble and curbing produced. Crushed granite was down 13 percent in tonnage but 4 percent higher in value. Producers of crushed granite were Consolidated Quarries Corp., Davidson Granite Co., and Stone Mountain Grit Co. Davidson Granite Co. produced dressed stone, rubble, and curbing. Kelly Granite Co. Inc., J. T. Reagin Granite Co., and Stone Mountain Granite Corp. quarried granite for rubble and curbing.

Dougherty.—Six companies produced sand. New pits were opened by the Atlantic Coastline Railroad and Dawes Silica Mining Co. Albany Lime & Cement reported initial production of crushed limestone.

Douglas.—Consolidated Quarries Corp. increased crushed granite production at the new Douglasville quarry and J. Tom Bell produced structural sand for local use.

Effingham.—Dawes Silica Mining Co. mined sand at the Eden pit for building, blast, filter, molding, and other uses.

Elbert.—Elbert was the principal dimension granite producing county in the State. Twelve companies operated quarries compared with 10 in 1957. Comoli Granite Co. and Elberton Granite Industries, Inc., produced rough and dressed monumental stone; Blue Ribbon Granite Quarrying Co. Inc. (new producer in 1958), Elberton City Quarries, Inc., and M. W. Kantala & Sons produced dressed monumental stone only; American Granite Quarries, Inc., Coggins Granite Industries, Inc., Continental Granite Co., Elberton Granite

Finishing Co., Inc., Robin Blue Quarries, Inc., A. G. & M. H. Veal, and Worley Bros. Granite Co. (new producer in 1958) quarried rough monumental granite only. Milton Buchanan produced sheet mica and Henry Grindstaff hand-cobbed mica. Bond Sand & Gravel Co. mined a small tonnage of building sand.

Evans.—Evans Concrete Products Co. mined building sand.

Fannin.—Fannin County Highway Department quarried and crushed 22,000 tons of granite for roadstone.

Fayette.—Tyrone Rock Products Co. produced crushed granite for concrete, roadstone, and railroad ballast.

Floyd.—American Cyanamid Co. mined bauxite from the New Holland and Otts mines. Crushed limestone was produced by Ready-Mix Concrete Co. and Floyd County Highway Department near Rome for concrete, roadstone, and railroad ballast. Oconee Clay Products Co. mined clay for use in its clay products plant at Milledgeville.

Fulton.—Hitchcock Corp. and Stockbridge Stone Division of Vulcan Materials Co. quarried granite for concrete and roadstone. Atlanta Brick & Tile mined clay for use in the manufacture of brick. Five producers, compared with two in 1957, produced building and paving sand for local use. Alabama Vermiculite Co. operated an exfoliating plant at Atlanta.

Gilmer.—Willingham-Little Stone Division of Georgia Marble Co. produced crushed marble for terrazzo and other uses.

Glascock.—General Refractories Co. mined refractory kaolin.

Glynn.—Gray Towing Co. mined structural and filter sands.

Gordon.—Plainville Brick Co. mined shale for use in its brick plant at Plainville.

Grady.—Cairo Production Co. mined and processed fuller's earth near Cairo.

Gwinnett.—Stockbridge Stone Division of Vulcan Materials Co. and Georgia State Board of Corrections quarried and crushed granite for concrete and roadstone.

Hall.—Gainesville Stone Co. reported initial production of crushed granite from the Candler quarry.

Hancock.—Weston & Brooker Co. operated its Granite Hill quarry and produced crushed granite for concrete and roadstone.

Hart.—Funkhouser Co. produced scrap mica from mica schist. Duncan Minerals produced a small quantity of full trimmed mica; Arthur Mining Co., Southern Mining Co., and E. B. Wood mined hand-cobbed mica. Homer Boone explored the Taylor Prospect for strategic mica under a DMEA contract.

Henry.—Stockbridge Stone Division of Vulcan Materials Co. quarried crushed granite for concrete, roadstone, and railroad ballast.

Houston.—Penn-Dixie Cement Corp. mined clay and limestone and manufactured portland cement at Clinchfield. Georgia Limerock Co. mined and crushed limestone for agricultural use.

Jasper.—Appalachian Minerals Co. mined feldspar rock from several pits and produced flotation-grade feldspar and quartz in its plant near Monticello. Southern Mining Co. produced full-trim and scrap mica.

Jefferson.—Georgia-Tennessee Mining & Chemical Co. mined fuller's earth near Wrens for absorbent uses.

Jones.—Weston & Brooker Co. produced crushed granite from its new Ruby quarry for concrete and roadstone.

Long.—Dawes Silica Mining Co. mined building sand at Ludowici.

Lowndes.—Georgia Peat Moss Co. produced peat near Twin Lakes.

Macon.—American Cyanamid Co. mined bauxite from the Cavender and Pierce-Norris mines.

Madison.—Coggins Granite & Marble Industries, Inc., quarried rough monumental granite from the Piedmont quarry near Carlton.

Mitchell.—Bridgeboro Stone Co. Inc. quarried and crushed limestone for concrete, roadstone, and agricultural purposes.

Montgomery.—H. H. Van Dyke mined building sand for local use.

Murray.—Southern Talc Co. was merged with Georgia Talc Co.; the latter and Cohutta Talc Co. were the only producers of talc and soapstone in Georgia in 1958. Georgia Talc Co. also quarried and crushed slate for roofing granules.

Muscogee.—Broken and crushed granite for riprap, concrete, roadstone, and railroad ballast was quarried by Alabama Aggregates Co. Division of McCullough Industries and Stockbridge Stone Division of Vulcan Materials Co. J. J. Brown Sand & Gravel Co. and Calhoun Sand & Gravel Co. produced structural and paving sand and gravel.

Oglethorpe.—Dimension granite, rough monumental stone, was quarried by seven producers: American Granite Quarries, Inc. (new in 1958), Bennie & Harvey, Dixie Granite Quarriers, Enterprise Granite Co., Hoover Granite Quarries, Inc., Liberty Granite Co., and Oglethorpe Quarrying Co.

Pickens.—Pickens County ranked second in the State in terms of value of its mineral production. Georgia Marble Co. quarried and dressed marble for building and monumental use at Tate. Calcium Products Division of Georgia Marble Co. and Marble Products Co. of Georgia produced crushed marble for terrazzo and other uses. Thompson-Weinman & Co. mined scrap mica (sericite) at the Martin mine for grinding in its Cartersville plant. Glenn Young mined a small quantity of hand-cobbed mica. Carl Johnson, Hardy Johnson, and the North Georgia Stone Co. quarried dimension sandstone for flagging and rubble.

Pike.—Curtis Marable produced a small quantity of sheet mica.

Polk.—Mineral production in Polk County rose 10 percent above 1957. Increases in value of cement, crushed slate, and miscellaneous clay and resumption of production in manganese and limestone more than offset the heavy loss in brown iron ore production. Marquette Cement Mfg. Co. produced portland and masonry cement at Rockmart from clay mined in the vicinity of the mill and limestone mined in Bartow County. Stockbridge Stone Division of Vulcan Materials Co. opened a new quarry to produce crushed limestone. Georgia Lightweight Aggregates Co. mined slate and manufactured lightweight building aggregate at Rockmart.

Only four brown ore companies were active in the county compared with seven in 1957: Acree Mining Co., Albea-York Mining Co. Inc., Arrington Mining Co., and Mundy Mining Co. Manganiferous ore

(10–35 percent Mn) was produced by Arrington Mining Co., Graves Mining Co., J. L. Smith, and Smith & Ingram.

Richmond.—Increased production value of quartzite (sandstone) more than offset lower production in kaolin and sand with the value of miscellaneous clay virtually the same as in 1957. Superior Stone Co. quarried and crushed quartzite for concrete and roadstone. Building and other sands were mined by E. W. Payton Sand & Gravel Co. and Speer Sand & Gravel Co. Albion Kaolin Division of Interchemical Corp. mined refractory kaolin; miscellaneous clay for use in manufacturing clay products was mined by Georgia-Carolina Brick & Tile Co. and Merry Bros. Brick & Tile Co.

Screven.—Atlantic Peat Co. was the only mineral producer in the county.

Spalding.—Flint River Sand Co. mined building sand for local use. J. R. Berry produced a small quantity of sheet mica.

Stewart.—Five companies produced brown iron ore: H. E. Bowden, Brown-Nuggett Mining Co., Dunbar and Layton, Luverne Mining Co., and Pataula Mining Co.

Sumter.—American Cyanamid Co. mined bauxite from the Easterlin, Holloway, and Thigpen mines. American Sand & Gravel Co. produced paving sand.

Talbot.—Brown Bros. mined glass and building sands, and Taylor Sand Co. produced building sand.

Taylor.—Butler Sand Co. and Howard Sand Co. mined building sand.

Thomas.—Waverly Petroleum Products Co. mined fuller's earth near Meigs, and Arnold Brick Co. mined miscellaneous clay for manufacturing brick. Dawes Silica Mining Co. produced building, blast, filter, glass, molding and other sands at Thomasville.

Towns.—Roy Anderson and J. M. Steinoff collected a few pounds of corundum during the year.

Twiggs.—Twiggs County continued first in the State in terms of value of mineral production. Georgia Coating Clay Co., Georgia Kaolin Co., J. M. Huber Corp., and Southern Clays, Inc., mined and processed kaolin for whiteware, paper filler and coating, refractories and portland cement, linoleum, paint, plastic, rubber and other fillers, chemicals, and catalysts. The Diversey Corp. produced fuller's earth for insecticides, fungicides, absorbents, and fillers.

Upson.—Southern Mining Co. produced hand-cobbed and full-trimmed mica; Bertie & Pitman, J. & B. Mining Co., and L. M. Johnson produced full trim mica. Three DMEA contracts totaling $18,488, with Government participation of 75 percent, were completed during the year.

Walker.—Bituminous Coal was mined by W. T. Blevins Coal Co., Powell Coal Co., and Carl Daniel Coal Co.; Key James Brick Co. mined miscellaneous clay for the manufacture of brick at the Chattanooga, Tenn., plant.

Walton.—Stockbridge Stone Division of Vulcan Materials Co. operated a portable plant and crushed granite for concrete and roadstone.

Ware.—E. W. Pafford mined building sand near Waycross.

Warren.—Weston & Brooker Co. quarried and crushed granite at Camak for concrete, roadstone, and railroad ballast.

Washington.—Washington County ranked third in the State in terms of value of mineral production. Kaolin was mined principally for paper coating and filler followed by floor and wall tile, paint, refractories, whiteware, insecticides and fungicides, and other uses. Producers were: American Industrial Clay, Anglo-American Clay Corp., Champion Paper & Fiber Co., Minerals & Chemical Corp. of America, Thiele Kaolin Co., and United Clay Mines Corp.

Webster.—Brown-iron-ore producers were Brown-Nuggett Mining Co., E. L. Gammage, and Webster Mining Co.

Whitfield.—Dalton Brick & Tile Co. mined miscellaneous clay for manufacture of brick and other clay products.

Wilkinson.—Wilkinson County ranked fourth in the State in value of its mineral production. Kaolin was mined principally for paper filler and coating, refractories, and rubber by Evans Clay Co., Harbison-Walker Refractories Co., D. C. Hardie, M & M Clays Co., Minerals & Chemical Corp. of America, and Oconee Clay Products Co.

The Mineral Industry of Hawaii and Pacific Island Possessions

By L. E. Davis[1] and R. Y. Ashizawa[2]

HAWAII

THE VALUE of mineral production in the territory of Hawaii in 1958 was about 6 percent above that of 1957 and approached the alltime high reached in 1956. The increase was due entirely to the higher output of mineral building materials required to supply the Territory's booming construction industry. Rising construction activity resulted, in recent years, in the expansion of processing facilities for the mineral materials including plants for abrasive sand, transit-mix concrete, and prestressed-concrete beams.

Housing constituted the bulk of construction activity; building new apartment houses was important. Only 1,010 such dwelling units were built in 1956, but 2,090 units were constructed during the first 10 months of 1958. Business construction rose from approximately $10 million in 1953 to an estimated $40 million in 1958. Processing and manufacturing expanded, particularly on Oahu. Metal processing industries included plants for chrome plating, galvanizing, and lead refining. Metals were fabricated into cable rigging, corrugated pipe, corrugated-iron and aluminum sheets, wire fencing, aluminum beer cans, and aluminum shingles. A steel plant consisting of an electric scrap-melting furnace and rolling mill was under construction in Hawaii by Hawaiian Western Steel Ltd. Plans were to produce concrete reinforcing bars.

In April 1958 after mainland aluminum producers had displayed exploratory interest in bauxite, the Commissioner of Public Land of the Territory of Hawaii arranged with the Federal Geological Survey and the Bureau of Mines to investigate Hawaiian bauxite deposits.

Ground was broken in October for constructing the Territory's first oil refinery—a $40-million Standard Oil Co. of California plant at Barber's Point in southwest Oahu.

Markets.—The Territory's mineral production was limited primarily to certain construction materials used locally and supplied only

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a small part of the requirements for the construction and mineral-processing industries in the Islands. Shipments from the continental United States consisted chiefly of cements, petroleum products, natural asphalts, special construction materials, fertilizer materials and salt. According to figures compiled by the Department of Commerce, exports of iron and steel scrap to Japan totaled 31,204 short tons in 1958, compared with 33,963 in 1957. Some iron and steel scrap was also shipped to mainland United States, but the quantity has declined 50 percent each year since 1956.

Employment.—Statistics compiled by the Territorial Department of Labor and Industrial Relations, Bureau of Employment Security, revealed a drop in employment in the mineral mining and processing industries. In 1958 an average of 107 workers received an average weekly wage, including overtime, of $114.83. The corresponding averages for 1957 were (revised) 182 workers and $91.97 per week.

TABLE 1.—Mineral production in the Territory of Hawaii and Pacific Island possessions, 1957–58 [1]

Area and mineral	1957		1958	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
American Samoa: Stone (crushed)	33,731	$37,246	30,230	$59,196
Guam:				
Sand and gravel	688	1,450	8,580	23,100
Stone (crushed)	1,033,546	1,131,571	683,548	751,365
Total		1,133,021		774,465
Territory of Hawaii:				
Clays	2,488	3,110	(2)	(2)
Lime	8,469	270,686	8,106	260,050
Pumice (volcanic cinder)	266,222	492,553	259,782	480,672
Salt	194	15,239	(2)	(2)
Sand and gravel	286,493	538,432	438,495	1,111,789
Stone	2,584,508	4,631,932	2,377,073	4,446,069
Value of items that cannot be disclosed				13,240
Total [3]		5,930,057		6,298,380
Midway: Stone (crushed)	3,875,001	6,700,000	175,300	475,840
Wake: Stone (crushed)	5,000	6,340	9,560	36,782

[1] Supplemental production data for American Samoa furnished by the Government of American Samoa: Wake, by the U.S. Department of Commerce, Civil Aeronautics Administration; Guam, by the Government of Guam and the U.S. Department of the Navy; Midway by the U.S. Department of the Navy.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Total has been adjusted to eliminate duplicating the value of limestone used in lime.

REVIEW OF MINERAL COMMODITIES

NONMETALS

Clays.—The output of clay by Gaspro, Ltd., at Kailua, Oahu, increased substantially because of expanding use in structural clay products. Despite the overall production increase, demand for this clay used for pottery has steadily declined since 1956 and dropped to 300 tons in 1958.

Lime.—Gaspro, Ltd., began abandoning its Honolulu lime plant and remodeling and expanding its lime plant at Waianae, Oahu, near

Pokai Bay. The transition, including the conversion from shaft-type to rotary kiln, increased the company's annual lime-burning capacity from 9,900 to 16,500 tons. Sales of hydrated lime to pineapple canneries and quick and hydrated lime to the construction industry increased but a 4-month sugar-industry strike adversely reduced the company's total output. Coral limestone used in manufacturing lime was produced at the adjacent Waianae quarry. A lime kiln, operated intermittently on the Island of Maui, supplied local needs.

Pumice (Volcanic Cinder).—Crews and contractors of major sugar companies on the Island of Hawaii operated single and bench-faced pits or used direct stripping methods to produce volcanic cinder and ash for constructing and maintaining plantation roads and walkways.

Salt.—The Territory's only producer recovered salt from sea water by solar evaporation at Honouliuli on Oahu. Demand for this product, used chiefly in processing special foods, has been decreasing for several years. The 1958 output was appreciably below that of the preceding year.

Sand and Gravel.—Building and highway construction activities on the Islands of Oahu and Hawaii furnished the Territory's increased output of sand and gravel in 1958, compared with 1957. The Mokuleia and Waialua beach and dune sand deposits on Oahu were worked throughout the year and yielded large tonnages of sand used chiefly for building products. City and county ordinances that restricted removal of Oahu's beach sand compelled major producers to seek other islands in the Territory for their sand requirements by the end of the year.

Stone.—*Basalt.*—Over 1.9 million tons of basalt was quarried in the Territory during 1958, compared with 1.5 million tons in 1957. Quarries on the Island of Oahu were the source of 84 percent of the total output and supplied all of the increased tonnage; the Kapaa (Kailua), Halawa (Aiea), Kaena (Waialua), Palalai (Ewa), and Valley (Nanakuli) quarries were active during 1958. Other major quantities of basalt were quarried near Hilo on Hawaii, Puhi on Kauai, Kahului on Maui, and Kaunakakai on Molokai. The crushed basalt and the screenings were used principally for ready-mix and asphaltic concrete, and also for concrete block, tile, and pipes. Other uses included riprap, roofing granules, and stone fines (a substitute for blast sand).

Limestone.—Quarries near Kailua, Mikilua, Nanakuli, and Waianae on the Island of Oahu and near Koloa on Kauai produced 409,000 tons of limestone during 1958, compared with 265,000 tons in 1957. Building and paving requirements consumed 95 percent of the total limestone output; the rest was used for rubble, lime manufacture, agriculture, roofing granules, and foundry flux. During 1958, Kailua Limestone Co. sold the Mikilua Quarry to Western Rock Products, Ltd., and the Kailua Quarry to Pacific Concrete & Rock Co., Ltd.

Miscellaneous stone.—The quantity of unclassified stone produced during 1958 declined below 1957 figures principally because of lessened demand for crushed aggregate and fill material by military establishments and by Territorial and county highway departments.

Vermiculite.—A Honolulu County plant exfoliated crude vermiculite from Montana and processed the material for plaster aggregate, acoustic and thermal insulation, and agricultural use.

MINERAL FUELS

On Oahu the Standard Oil Co. of California, through its subsidiary Pacific Oil Co. (Delaware), continued to manufacture asphalt and special products from selected intermediate refinery products shipped from the mainland. Its new oil refinery under construction at Barber's Point and scheduled for completion by late 1960 or early 1961 was designed for crude-oil capacity of 32,000 barrels a day; production will include aviation and motor gasoline, jet fuel, diesel fuels, and light and heavy oils.

METALS

Bauxite.—During an investigation in cooperation with the Federal Geological Survey, the Bureau of Mines collected bauxite samples on the Islands of Kauai, Maui, and Hawaii, which samples were tested at the Bureau of Mines, Rolla, Mo., laboratories to determine whether they could be beneficiated or upgraded by simple methods. No products were obtained that could be considered economically competitive with those from commercial bauxite deposits, but the Bureau of Mines believed additional studies were justified in view of the immensity of the Hawaiian deposits.

PACIFIC ISLAND POSSESSIONS

American Samoa.—Basalt, coral, and crusher sand were produced by construction and maintenance crews of the government of American Samoa for riprap, building, and paving.

Guam.—Crews and contractors of government agencies and commercial producers quarried dimension coral for breakwater and retaining walls and prepared crushed coral and beach sand for use as concrete aggregate in buildings and roads.

Midway.—Dredged coral was screened and crushed by a contractor for the U.S. Department of the Navy for use in constructing concrete-block buildings, parking areas, runways, and roads.

Wake.—Coral was prepared for roofing granules and for use in building and road construction by crews and contractors of government agencies on Wake Island.

Other Pacific Island Possessions.—No mineral production was reported for 1958 on the Islands of Canton, Enderbury, Jarvis, Johnston, and Palmyra.

The Mineral Industry of Idaho

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the State of Idaho Bureau of Mines and Geology.

By Kenneth D. Baber,[1] Frank B. Fulkerson [1] and Norman S. Petersen [1]

Decreased production from the lead-zinc mines of Shoshone County as the result of lower metal prices reduced the Idaho mineral value from $73.5 million in 1957 to $64.5 million in 1958, the lowest in 10 years. The Shoshone County value dropped from $47.4 to $39 million. Output of lead declined by 18,000 tons (25 percent), and recovery of zinc dropped 8,100 tons (14 percent).

Idaho's latent mineral wealth was illustrated by the wide variety of metals produced or shipped from stocks in 1958. In addition to the major commodities (lead, zinc, and silver) the following were marketed: Antimony, cadmium, cobalt, columbium and tantalum,

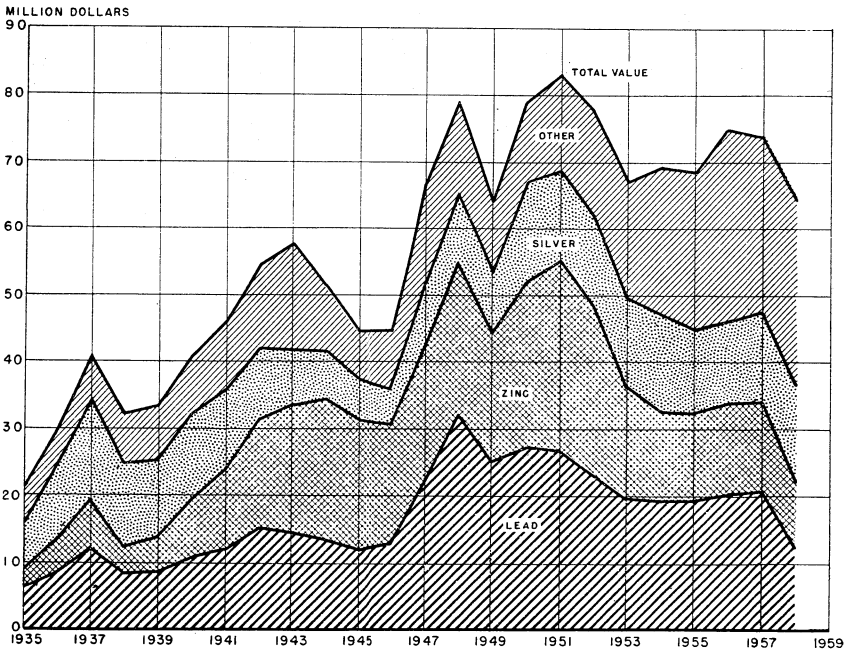

FIGURE 1.—Value of silver, lead, and zinc and total value of mineral production in Idaho, 1935–58.

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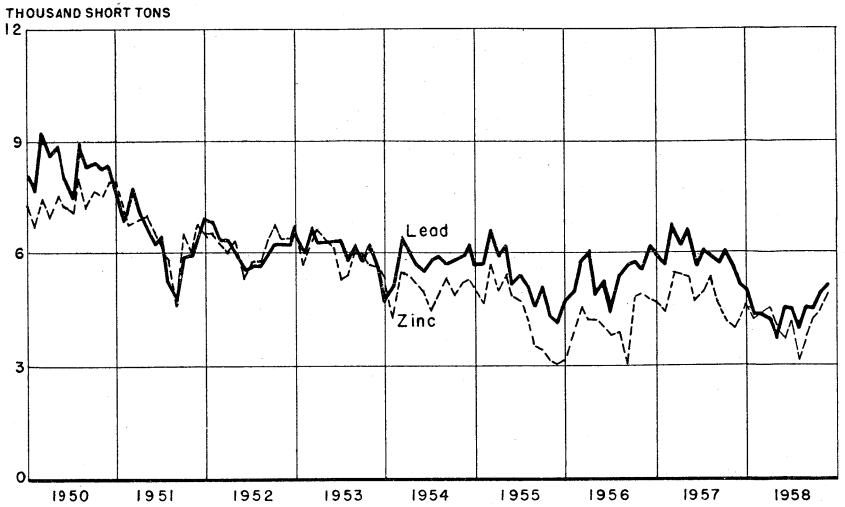

FIGURE 2.—Mine production of lead and zinc in Idaho, 1950–58, by months in terms of recoverable metals.

copper, gold, iron, mercury, nickel, thorium, titanium, tungsten, and uranium. Some of these metals represented one mine's production; others were recovered only on a small scale.

Contrary to the decline in lead-zinc mining most other mineral values increased or remained the same as in 1957. Output of silver increased by 886,000 ounces (6 percent), the quantity of gold recovered rose 3,600 ounces (29 percent), production of copper increased 1,900 tons (24 percent), and output of cobalt gained 460,000 pounds (18 percent). In nonmetal activity production of cement, clays, and sand and gravel increased by 19, 17, and 1 percent, respectively. Phosphate-rock industries were affected by the lower overall industrial activity of 1958, but the tonnage of rock sold or used by producers declined only 2 percent.

Silver was the principal commodity, followed in order by lead, zinc, sand and gravel, and phosphate rock.

Markets.—Increased stockpiling of unsold refined metals was necessary at metallurgical plants throughout the year because of poor markets. Lead and zinc import quotas put into effect by the Federal Government October 1 and an increased consumption rate resulted in higher metal prices and some improvement in the lead-zinc mining situation late in the year. Tungsten mining was inactive after suspension of Government stockpile purchases in 1957.

Sand and gravel, cement, and clay industries were stimulated by construction activity. Both private and public construction increased and reversed the downward trend of 1957. The value of building permits rose from $38.2 to $45.5 million (19 percent); contract-construction average employment advanced from 10,400 to 11,100 (7 percent); and cement shipments to Idaho destinations increased from 959,000 to 1,453,000 barrels (52 percent). The largest projects continued to be construction of two dams on the Snake

TABLE 1.—Mineral production in Idaho [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Antimony ore and concentrate—antimony content	664	[2]	677	[2]
Beryllium concentrate—gross weight	1	[2]		
Clays—thousand short tons	[3] 23	$16	[3] 27	$20
Cobalt (content of concentrate)—thousand pounds	2,618	[2]	3,078	[2]
Columbian-tantalum concentrate (oxide content)—do	365	[2]	397	[2]
Copper (recoverable content of ores, etc.)	7,912	4,763	9,846	5,179
Gold (recoverable content of ores, etc.)—troy ounces	12,301	431	15,896	556
Iron ore (usable)—thousand long tons	[2]	[2]	1	14
Lead (recoverable content of ores, etc.)	71,637	20,488	53,603	12,543
Mercury—76-pound flasks	2,260	558	2,625	601
Mica:				
Sheet—pounds	1,240	9	1,968	14
Scrap			1	[4]
Nickel (content of ore and concentrate)	37	55	29	[2]
Phosphate rock—thousand long tons	1,307	5,684	1,291	5,652
Pumice and volcanic cinder—thousand short tons	100	168	108	172
Rare-earth metals concentrate	408	[2]	692	[2]
Sand and gravel—thousand short tons	[5] 6,665	[5] 5,274	6,714	6,305
Silver (recoverable content of ores, etc.) thousand troy ounces	15,067	13,637	15,953	14,438
Stone—thousand short tons	1,542	2,759	1,122	1,710
Titanium concentrate—gross weight	28,397	[2]	2,223	[2]
Tungsten concentrate—60-percent WO_3 basis	35	[2]	[2]	[2]
Zinc (recoverable content of ores, etc.)	57,831	13,417	49,725	10,144
Value of items that cannot be disclosed: Barite, cement, bentonite (1958), fire clay (1957) abrasive garnet, gem stones, gypsum, peat, uranium, zirconium concentrate, and values indicated by footnote 2. Excludes value of limestone used in manufacturing cement		6,243		7,108
Total		[5] 73,502		64,456

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Excludes certain clays, value for which is included with "Items that cannot be disclosed."
[4] Less than $500.
[5] Revised figure.

River, the highway-building program, and expansion of the National Reactor Testing Station at Arco.

Trends and Developments.—The growing importance of nonmetal mining and processing in Idaho was emphasized by developments in clay and phosphate-rock industries. In Latah County The Anaconda Co. continued to evaluate clay deposits as a possible future source of alumina, and J. R. Simplot Co. prepared final plans for constructing a mill to process clay for ceramic, paper, and other manufacturing uses. In Bear Lake County Central Farmers Fertilizer Co. began mining operations and neared completion of a phosphate-rock processing plant. The J. R. Simplot Co. phosphate-fertilizer plant was being expanded in Power County, west of Pocatello, including facilities for production of sulfuric acid. The Bunker Hill Co. announced plans to enter the phosphate-products business. Sites at Kellogg, Shoshone County, and Kennewick, Wash., were under consideration.

Employment.—Average monthly employment in the metal-mining industry, centered at Wallace and Kellogg, was 3,600, according to the Idaho Employment Security Agency. This was 750 less than in 1957 and 1,200 less than the 1947–56 average. A 4-day week was in effect much of the year. In December most companies went

back on a 5-day week and resumed limited hiring. Wages paid by metal-mining companies dropped $4.4 million in 1958. Employment in primary-metals manufacturing, which had held up well in the previous 5 years, decreased from 1,200 to 1,000. Chemical- and allied-products plants, the third largest mineral-industry employer, averaged 100 workers fewer than in 1957.

TABLE 2.—Average employment and total wages (thousand dollars) in mining and mineral manufacturing, 1954–58, by industries [1]

Year	Mining							
	Metals		Nonmetals		Fuels		Total	
1954	4,206	$19,754	283	$1,204	9	$12	4,498	$20,969
1955	4,112	20,012	297	1,334	28	88	4,437	21,434
1956	4,498	23,161	268	1,210	26	94	4,792	24,466
1957	4,388	23,716	249	1,123	21	84	4,658	24,923
1958	3,633	19,359	259	1,281	27	149	3,918	20,789

Year	Mineral manufacturing							
	Stone and clay products		Primary metals		Chemical and allied products [2]		Total	
1954	385	$1,450	1,147	$5,214	779	$3,614	2,311	$10,278
1955	427	1,691	1,120	5,409	797	3,994	2,344	11,094
1956	458	1,894	1,173	6,399	861	4,655	2,492	12,948
1957	451	1,980	1,232	6,818	880	4,932	2,563	13,730
1958	579	2,760	1,034	5,314	781	4,518	2,394	12,592

[1] Idaho Employment Security Agency. Industry groups may not correspond to those in the Bureau of Mines canvass.
[2] Mainly phosphate fertilizers and elemental phosphorus.

TABLE 3.—Hours and earnings of production workers in mining [1]

Annual average	1954	1955	1956	1957	1958
Weekly earnings	$86.27	$89.69	$97.11	$101.02	$95.68
Hourly earnings	$2.13	$2.22	$2.34	$2.47	$2.53
Weekly hours	40.5	40.4	41.5	40.9	37.7

[1] Idaho Employment Security Agency.

Legislation and Government Programs.—Four projects were approved by the Defense Minerals Exploration Administration (DMEA) for exploration of copper-cobalt occurrences in Lemhi County, a lead-zinc deposit in Blaine County, and a mercury property in Owyhee County. On June 1 the DMEA program expired; however, Government assistance was continued by the new Office of Minerals Exploration (OME), U.S. Department of the Interior.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—Sunshine Mining Co. recovered antimony metal as a by-product from tetrahedrite ores processed at the company mill near Kellogg at a slightly higher rate than in 1957. Electrolysis of bulk-concentrate leach solution was followed by caustic treatment of the

cathode metal to remove arsenic. Sunshine reported production of about 677 short tons of the antimony; a small portion was from ores of the American Smelting and Refining Co. Galena mine—treated on a custom basis; the company shipped six lots of metal, totaling 343 tons, to the General Services Administration (GSA) under terms of a contract terminated in October. Markets were being sought for about 2.25 million pounds of metal on hand at yearend.

TABLE 4.—DMEA contracts active during 1958

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
BLAINE					
Silver Star-Queens Mines, Inc.	Queen of the Hills	Lead, zinc	Apr. 25, 1955	$235,780	50
Viking Mines, Inc.	Garfield	do	May 16, 1958	36,846	50
CUSTER					
Clayton Silver Mines	Clayton	do	July 19, 1957	130,840	50
Hecla Mining Co. (assignee of Idaho Custer Silver-Lead Mines).	Livingston	do	Mar. 25, 1957	91,790	50
Salmon River Scheelite Corp.	Tungsten Jim	Tungsten	Apr. 21, 1955	129,136	75
IDAHO					
Idaton, Inc. (assignee of Squaw Creek Mining Co.).	Smothers	Fluorspar	Apr. 12, 1957	10,000	50
LEMHI					
Calera Mining Co	Sunshine	Cobalt, copper	June 27, 1958	104,200	62½
Capital-Seaboard Corp	Long Dike	do	June 24, 1958	65,200	62½
Montana Coal & Iron Co.	Black Pine	Copper	Mar. 25, 1955	134,600	50
OWYHEE					
Mac D. Mining Corp	Lucky Boy	Mercury	June 6, 1958	6,748	50
SHOSHONE					
American Smelting and Refining Co.	East Page	Lead, zinc	Sept. 18, 1957	660,206	50
Day Mines, Inc.	Hercules	do	Dec. 6, 1956	415,250	50
Hecla Mining Co.	Silver Mountain	Lead, zinc, copper	Oct. 21, 1954	1,435,880	50
Polaris Mining Co.	Polaris East	Lead, zinc, copper, antimony.	Nov. 1, 1953	873,840	50
Sidney Mining Co.	Sidney	Lead, zinc	July 3, 1952	523,440	50

Antimony also was recovered as antimonial lead from concentrate shipped to lead smelters by Sunshine and other Coeur d'Alene region mining companies.

The Bunker Hill Co. reportedly produced a small quantity of high-purity antimony metal for use by the electronics industry for transistors and semiconductors.

Beryllium.—A small quantity of beryl ore was produced as a byproduct by Western Mica Corp. from the Muscovite mica mine near Deary, Latah County; however, no shipments of the material were made.

Cadmium.—The Bunker Hill Co. reported that output of byproduct cadmium, recovered from foreign and domestic concentrates and

ores processed at the lead smelter and electrolytic zinc plant at Kellogg, was at a record high. The greater production was made possible through improved metallurgical practices. Sales of cadmium during the year, according to the company annual report, were up 3 percent to 557,086 pounds.

Cobalt.—Output of cobalt-copper ore was continued at the Blackbird mine, Lemhi County, by Calera Mining Co. from underground workings and from an open pit begun in 1957. The company reported production of 9,636 short tons of concentrate and shipment of 9,747 short tons containing nearly 3.1 million pounds of cobalt—an increase of almost 18 percent over the previous year. The concentrate was processed to metal at the company refinery near Garfield, Utah. Uncertain market after expiration of the company contract with the Government in May 1959 led to partial reduction of operations in mid-November and to emphasis on lower cost open-pit mining. About 70 workers were affected.

Columbium-Tantalum.—Alluvial sand deposits in Bear Valley, Valley County, were worked by Porter Bros. Corp. dredges at about the same rate as in 1957. Dredge concentrate was trucked to Lowman, where concentrates of columbite, euxenite, monazite, magnetite, ilmenite, garnet, and zircon-quartz sands were produced. Columbite concentrate was shipped to the National Strategic Stockpile; and euxenite concentrate was shipped to Mallinckrodt Chemical Co., St. Louis, Mo., for recovery, under Government contract, of oxides of columbium-tantalum, rare earths, thorium, and uranium. The remaining sand concentrates were stockpiled at Lowman. Columbium-tantalum also was shipped to the Government Purchase Depot in Custer, S. Dak., from an operation in Elmore County.

Articles pertaining to the Porter Bros. Corp. operations were published.[2]

Copper.—Ore from the Blackbird cobalt-copper mine (Calera Mining Co.), Lemhi County, supplied much of the State production of copper. Total output was 24 percent (1,934 tons) higher than in 1957. The Calera operation largely was responsible for the increase; greater quantities of byproduct copper recovered from ores of the American Smelting and Refining Co. Galena mine and Sunshine Mining Co. Sunshine mine also contributed to the larger total. Small tonnages of the metal were produced at other operations in the State, primarily in the Coeur d'Alene region.

Gold.—Production of gold advanced about 29 percent (3,595 ounces), as a substantial increase in the quantity recovered from the Calera Mining Co. Blackbird mine, Lemhi County more than offset declines reported for other Idaho operations. The Calera company output, a byproduct of mining for cobalt-copper ore, was the largest in the State by a wide margin; the quantity of gold from the Blackbird mine jumped from 3,683 ounces in 1957 to 9,506 ounces in 1958. Silver-lead-zinc mines in Shoshone County contributed most of the remainder of the gold recovered at lode mines.

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[2] Mining World. Idaho Placer Is Source of 99 Percent of U.S. Columbium-Tantalum Output: Vol. 20, No. 1, January 1958, pp. 38–43.
Dayton, Stanley H., Radioactive Black Sand Is Yielding Columbite Concentrate at Idaho Mill: Mining World, vol. 20, No. 5, May 1958, pp. 36–41.

Placer gold output was slightly less than the previous year. The Gold Bar operation (Del Dewey) in Idaho County was the largest placer mine, supplying 1,777 ounces compared with 893 ounces in 1957. Production at the Crooked River placer, previously a large contributor, declined sharply.

Total quantity of gold recovered in Idaho was the highest since 1953.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1949–53 (average)	146	54	2,942	50,634	$1,772	14,092	$12,754
1954	101	23	1,961	13,245	464	15,867	14,361
1955	109	34	1,961	10,572	370	13,831	12,518
1956	104	21	2,071	9,210	322	13,472	12,193
1957	93	20	2,100	12,301	431	15,067	13,637
1958	85	31	1,681	15,896	556	15,953	14,438
1863–1958 [3]			136,882	8,279,000	192,890	686,931	509,673

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1949–53 (average)	2,411	$1,169	80,873	$24,379	77,807	$22,730	$62,804
1954	4,828	2,849	69,302	18,989	61,528	13,290	49,952
1955	5,618	4,191	64,163	19,121	53,314	13,115	49,315
1956	6,656	5,658	64,321	20,197	49,561	13,580	51,949
1957	7,912	4,763	71,637	20,488	57,831	13,417	52,735
1958	9,846	5,179	53,603	12,543	49,725	10,144	42,860
1863–1958 [3]	158,000	62,834	6,835,000	923,544	2,124,000	431,475	2,120,415

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings and old slag re-treated, and ore shipped to smelters during the calendar year indicated. Owing to rounding, the totals of individual items may not be additive.
[2] Does not include gravel washed.
[3] Partly estimated for years before 1901.

TABLE 6.—Gold produced at placer mines

Year	Mechanical and hydraulic methods			Small-scale hand methods			Total		
	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)
1949–53 (average)	19	1,958	10,793	[1] 36	10	147	55	1,968	10,940
1954	16	1,235	6,625	7	3	68	23	1,238	6,693
1955	22	546	3,858	12	6	88	34	552	3,946
1956	13	350	2,484	8	2	38	21	352	2,522
1957	16	250	2,916	4	2	49	20	252	2,965
1958	[2] 13	92	2,501	18	7	89	31	100	2,590

[1] Includes surface and underground (drift) placers.
[2] Includes 2 dragline dredges, 8 hydraulic operations, and 3 nonfloating washing plants; Bureau of Mines not at liberty to publish separately.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc by counties in terms of recoverable metals [1]

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
Blaine	7	----	27	$1	29,276	$26
Boise	10	6	175	6	3,529	3
Custer	7	1	327	11	193,428	175
Idaho	5	13	2,341	82	177	[2]
Lemhi	8	3	9,579	335	19,471	18
Shoshone	25	----	2,363	83	15,615,220	14,133
Undistributed [3]	23	8	1,084	38	91,695	83
Total	85	31	15,896	556	15,953,000	14,438

County	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
Blaine	2	$1	194	$45	115	$23	$97
Boise	----	----	----	----	----	----	9
Custer	228	120	773	181	65	13	501
Idaho	----	----	----	----	----	----	82
Lemhi	5,728	3,013	87	20	10	2	3,388
Shoshone	3,884	2,043	52,488	12,282	49,532	10,105	38,645
Undistributed [3]	4	2	61	14	3	1	138
Total	9,846	5,179	53,603	12,543	49,725	10,144	42,860

[1] Owing to rounding, the total of individual items may not be additive.
[2] Less than $500.
[3] Includes values and quantities that cannot be shown separately for Adams, Bonner, Boundary, Butte, Camas, Clearwater, Elmore, Gem, Jerome, Kootenai, Owyhee, Twin Falls, Valley, and Washington Counties.

Iron Ore.—Shasta Mining Co., organized in June to develop a property on Iron Mountain near Weiser, Washington County, reported shipment of iron-ore concentrate to a cement plant and to Pacific Northwest steel mills. Ore was beneficiated by wet and dry magnetic methods; shipments totaled 1,443 tons averaging 58 percent iron.

Lead.—The Bunker Hill Co. Bunker Hill mine, principal source of lead produced in the State, was operated on a curtailed basis through much of the year, owing to a generally weak base-metals market and consequent low prices. A 33-percent decrease in ore output from the mine largely was responsible for the State total decline of 25 percent in quantity of lead recovered. The total of 53,603 tons was the lowest since before 1900. Production at the Bunker Hill lead smelter and electrolytic zinc plant near Kellogg similarly was curtailed; complete closure was averted, although stocks continued to grow and prospects for marketing the metal were poor. However, the market situation eased, and in November the company returned to a 5-day-workweek schedule at its underground operations. Most of the other larger mines in the State, particularly those of Day Mines, Inc., American Smelting and Refining Co., and Sunshine Mining Co. also reported lower production.

A notable exception to the general trend of decreased output was the Lucky Friday Silver-Lead Mines Co. Lucky Friday mine, an operation that has assumed increasing importance in the Coeur

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore:							
Dry gold	19	1,352	564	2,004		2,000	
Dry gold-silver	3	13	40	3,497			
Dry silver	15	461,182	1,283	12,199,325	6,993,800	5,015,900	470,000
Total	37	462,547	1,887	12,204,826	6,993,800	5,017,900	470,000
Copper	8	300,277	9,800	24,600	11,865,300	500	12,500
Lead	19	87,874	592	1,114,409	258,700	14,540,400	1,496,300
Lead-zinc	13	733,116	980	2,553,808	561,900	83,124,500	80,877,500
Zinc	1	12,424	8	11,387	8,900	643,000	2,215,900
Total	41	1,133,691	11,380	3,704,204	12,694,800	98,308,400	84,602,200
Other "lode" material:							
Dry gold: Mill cleanings	4	302	37	13			
Dry silver: Old tailings	1	71	1	294		2,000	6,000
Copper: Precipitates	1	2		4	2,000		
Lead-zinc: Old tailings	1	1,000	1	1,565	600	37,400	38,600
Zinc:							
Old tailings	1	50		55		1,300	6,200
Old slag fumed	1	20		2		900	5,400
Old slag smelted	2	82,968		41,620	800	3,838,100	14,321,600
Total	11	84,413	39	43,553	3,400	3,879,700	14,377,800
Total "lode" material	85	1,680,651	13,306	15,952,583	19,692,000	107,206,000	99,450,000
Gravel (placer operations)	31	[2]	2,590	213			
Total	116	1,681,000	15,896	15,953,000	19,692,000	107,206,000	99,450,000

[1] Detail will not necessarily add to total, because some mines produce more than 1 class of material.
[2] 99,835 cubic yards.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc, by types of material processed and methods of recovery, in terms of recoverable metals

Method of recovery and type of material processed	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation	235	116			
Concentration, and smelting of concentrates:					
Ore	12,169	15,792,122	19,418,900	102,591,500	84,991,800
Old tailings	1	1,620	600	38,700	44,800
Total	12,170	15,793,742	19,419,500	102,630,200	85,036,600
Direct smelting:					
Ore	882	116,799	269,700	734,800	80,400
Old tailings	1	294		2,000	6,000
Old slag		41,622	800	3,839,000	14,327,000
Mill cleanings	18	6			
Copper precipitates		4	2,000		
Total	901	158,725	272,500	4,575,800	14,413,400
Placer	2,590	213			
Grand total	15,896	15,953,000	19,692,000	107,206,000	99,450,000

d'Alene region since shortly after World War II. Once virtually abandoned because of poor results from near-surface exploration, the Lucky Friday deposit has gained consistently in size and grade with development at depth.

Mercury.—Resumption of output at the Hermes mine (Valley County) by Holly Minerals Corp. largely was responsible for a 16-percent increase in the State total (2,625 76-pound flasks). Destruction by fire of a portion of the plant at the Hermes property (also called the Cinnabar mine) in August 1956 had necessitated a shutdown throughout 1957. The company mined 33,845 tons of ore and treated 20,036 tons in its flotation plant; recovery of mercury was 239 flasks by an unusual electrolytic-deposition process, which followed leaching of the flotation concentrates, and 251 flasks by the more conventional retorting of concentrate.

The Rare Metals Corporation of America open-pit operation at the Idaho-Almaden mine in Washington County continued to supply most of the State total. The company mined and treated slightly more than 56,000 tons of ore averaging 0.173 percent mercury and recovered 2,114 flasks of metal in a 175-ton-per-day Gould rotary furnace.

Nickel.—Cobalt concentrate produced at the Blackbird mine, Lemhi County, by Calera Mining Co. also contained nickel. The concentrate was shipped to the company refinery at Garfield, Utah, for processing.

Rare-Earth Metals.—Monazite, a rare-earth mineral containing thorium, was recovered by Baumhoff-Marshall, Inc., at a plant at Boise during re-treatment of stockpiled titanium concentrate; the material was shipped to eastern firms for processing. Monazite also was a byproduct from the columbium-tantalum dredging operations of Porter Bros. Corp. in Bear Valley, Valley County.

Rare-earth and thorium oxides were extracted by Mallinckrodt Chemical Works, St. Louis, Mo., from euxenite (a columbium-tantalum mineral) shipped by Porter Bros. Corp.

Exploration for thorium and rare-earth minerals gained considerable attention in Idaho. Several companies, including Phillips Petroleum Co., Rare Metals Corporation of America, Sidney Mining Co., and Western Fluorite Corp., were active in Custer County. In Lemhi County, Salmon River Uranium Development Co. reportedly purchased a former tungsten mill and erected it near a deposit of thorite that the company was developing.

Silver.—Substantial increases in silver recovered at the Sunshine, Galena, Lucky Friday, and Silver Summit mines, all in Shoshone County, totaled over 1.7 million ounces and resulted in an advance of 6 percent (nearly 900,000 ounces) in the State total. The Sunshine Mining Co. Sunshine mine continued as the largest silver producer in the State, followed by the American Smelting and Refining Co. Galena mine. These mines and the Bunker Hill (The Bunker Hill Co.), Lucky Friday (Lucky Friday Silver-Lead Mines Co.), and Silver Summit (Polaris Mining Co.), yielded slightly less than 90 percent of the total silver output.

Titanium.—Baumhoff-Marshall, Inc., at Boise reprocessed and shipped a small quantity of ilmenite (titanium-iron oxide). The material was obtained from the remainder of ilmenite concentrate

stockpiles accumulated during monazite dredging and processing operations from 1951 to 1955. The material shipped was for use as roofing granules and as an aggregate in making heavy cement slurry for oil-well cementing.

Tungsten.—No tungsten production was reported. Bradley Mining Co. shipped the remainder of hübnerite (manganese tungstate) concentrate stockpiled during previous mining at its Ima property, Lemhi County.

Uranium.—Uranium contained in euxenite concentrate produced by Porter Bros. Corp. in Valley County was recovered during processing by Mallinckrodt Chemical Works at St. Louis, Mo. The material was delivered under contract to the Atomic Energy Commission (AEC).

Uranium ore was mined and shipped to AEC at Salt Lake City by Western Fluorite Co. and Phillips Petroleum Co. from properties in Custer County.

Zinc.—Market conditions that adversely affected lead also applied to zinc, and output of this metal from the largest mine in the State, the Bunker Hill, was curtailed sharply. Other operations in Shoshone County having substantial reductions in output were the Morning (American Smelting and Refining Co.), Sidney (Sidney Mining Co.), Hercules (Day Mines, Inc.), and dump-slag reprocessing by The Bunker Hill Co. Outside the Coeur d'Alene region, large decreases in tonnage produced were reported for the Triumph mine (Blaine County) and the Clayton mine (Custer County), and for the dump-slag recovery activity at the Nicholia smelter site in Lemhi County. The American Smelting and Refining Co. Page mine increased production of zinc slightly and The Bunker Hill Co. Star mine yielded a substantially greater output of the metal. The Star mine was the largest zinc operation in the State, followed by the Page and Bunker Hill mines. Total output in Idaho was 14 percent (8,106 tons) less than in 1957.

Zirconium.—Re-treatment of a portion of stockpiled zircon-quartz sand was reported by Baumhoff-Marshall, Inc. A concentrate containing about 85 percent zircon was obtained by tabling the nonmagnetic fraction of sand processed during previous monazite dredging operations.

NONMETALS

Barite.—A small quantity of crude barite was produced. The J. R. Simplot Co. Sun Valley mine, Blaine County, usually the principal source of this mineral in Idaho, was idle during the year; however, shipments of crude barite from stocks were made to the Simplot company grinding plant in Power County near Pocatello. The ground product, used in oil-well drilling muds, was marketed to consumers in Montana, Utah, and the Midwest. Due to a decline in oil-well drilling, shipments of ground barite were less than in 1957.

Cement.—Production and shipments of cement increased 21 and 19 percent, respectively, over 1957 and were the highest reported since 1954. Output was from the plant of Idaho Portland Cement Co., Inkom, Bannock County. Shipments of portland and masonry cements were made chiefly to destinations within the State; shipments also were made to consumers in other Rocky Mountain States. Trucks

were the principal mode of transport; smaller quantities were reported moved by rail.

Clays.—Output of clays increased 17 percent in quantity and 23 percent in value compared with 1957. Miscellaneous clay for manufacturing heavy clay products, principally building brick, was produced in Ada, Bonneville, Cassia, and Minidoka Counties. Output was 17 percent greater than in the previous year. Fire clay mined near Helmer, Latah County, was processed to fire-clay refractories at the Troy plant of A. P. Green Firebrick Co. Production of fire clay increased 9 percent. A small quantity of bentonite for use in rotary-drilling muds was produced in Owyhee County; output was less than in 1957.

The Anaconda Co. continued to test clay deposits near Moscow, Latah County, as a possible source of alumina raw material. During the year a series of shafts was sunk to explore these deposits. Shipments of clay were made to Anaconda, Mont., where the material was to be used to test on a pilot-plant scale the company process for extracting alumina from high-alumina clays. Preparations were under way by J. R. Simplot Co. for construction of a clay beneficiation plant near Bovill, Latah County. The facility, scheduled for completion in 1959, would process local clays to a product suitable for ceramic, paper, and other quality clay uses. Silica sand, for use as a raw material for glass manufacture, also would be produced as a coproduct at the operation.

Garnet (Abrasive).—Production of abrasive garnet remained substantially the same as in 1957; however, shipments were 48 percent higher. Output was from operations of the Idaho Garnet Abrasive Co. (Benewah County); Spokane Garnet Sand & Sales Co. (Shoshone County); and Baumhoff-Marshall, Inc. The latter firm recovered garnet at its Boise plant during processing of stockpiled ilmenite concentrate obtained from material previously dredged in Valley County.

Gypsum.—Output of gypsum was substantially greater than in 1957. Pivot Rock Mining Co. operated a surface mine near Weiser, Washington County; the product was marketed as agricultural gypsum.

Mica.—Sheet mica sold or used (comprised mostly of mica derived from hand-cobbed material) increased 59 percent over output for the previous year. Production (all muscovite) was from pegmatite deposits near Deary, Latah County. Major output was from the Muscovite mine of Western Mica Corp.; a small quantity also was produced at two other operations. Output was shipped to the GSA Government stockpile at Custer, S. Dak. One ton of scrap mica was marketed to a commercial grinder.

Phosphate Rock.—Production of marketable phosphate rock was 1.29 million long tons—a decline of 1 percent from the 1.31 million long tons produced in 1957; however, mine production of crude phosphate-rock ore increased 7 percent over the previous year. Output was from five mines—two in Caribou and one each in Bear Lake, Bingham, and Clark Counties.

Phosphate rock sold or used by producing companies in 1958 was 1.4 million long tons—2 percent less than in 1957. Phosphate rock mined in the State continued to be used mostly for manufacturing elemental phosphorus; production of rock for this purpose increased

slightly in 1958. Phosphate rock used for making triple superphosphate and superphosphate fertilizers declined 25 percent from the previous year; however, the quantity of rock used to manufacture wet-process phosphoric acid was 14 percent greater. Shipments of rock for export declined moderately.

Central Farmers Fertilizer Co. began open-pit mining of phosphate rock at the Georgetown Canyon operation in Bear Lake County. Although some shipments of rock were made to Midwestern cooperatives, most of the production was stockpiled awaiting completion of other facilities. A beneficiation plant and an elemental-phosphorus furnace were under construction.

The phosphate-fertilizer industry in Idaho was scheduled for further expansion according to announcements made by two companies. J. R. Simplot Co. began to implement plans for expansion of its Pocatello fertilizer plant in a program that would include greater production capacity and construction of a plant to manufacture sulfuric acid for use in making phosphate fertilizers and wet-process phosphoric acid. Construction of the new facilities was scheduled for completion in 1959. The Bunker Hill Co., Kellogg, Shoshone County, announced plans for constructing a $4-million fertilizer plant to produce ammonium phosphate and triple superphosphate fertilizers, and wet-process phosphoric acid. Initial annual capacity of the plant, scheduled for completion in 1960, would be 100,000 tons of fertilizer products. Byproduct sulfuric acid produced from waste stack gases at the company Kellogg electrolytic zinc plant would be used to acidulate phosphate rock. The site for the proposed plant was not announced, but locations at Kellogg, Idaho, and Kennewick, Wash., reportedly were under consideration. The company in December reported purchase of the Jack Pine phosphate lease near Elliston, Powell County, Mont.

Pumice and Volcanic Cinder.—Pumice and volcanic cinder sold or used by producers increased 8 percent compared with the previous year. The bulk of the production was supplied from three operations in Bonneville County; volcanic cinder also was produced in Canyon County, and a small quantity of crude pumice was mined in Twin Falls County. Pumice and cinder output was used chiefly for manufacturing lightweight concrete building blocks. A small quantity of crude pumice was used for surfacing roads.

Sand and Gravel.—Output of sand and gravel at operations in the State remained substantially the same as in 1957. A 29-percent increase in the tonnage used as road material during the year was caused chiefly by expanded requirements at road-construction projects; sand and gravel production for the State highway department was 70 percent greater than in 1957. Eighty-eight percent of the sand and gravel produced in the State during the year was used for road construction and maintenance (69 percent in 1957), 10 percent for building and construction projects (30 percent in 1957), and the remaining 2 percent for miscellaneous uses (1 percent in 1957). Output was from operations in 36 of the 44 counties in the State. Bonneville County ranked as the largest producing area; Ada and Elmore Counties ranked second and third, respectively.

Stone.—Total output of stone for all purposes was 27 percent lower than in 1957. The decline was caused by a sharp decrease in the quantity of crushed roadstone used at State-highway-department construction projects. Production of stone at commercial operations increased 13 percent; however, output for noncommercial uses (Government-and-contractor production) declined 49 percent compared with 1957. Basalt was the principal stone quarried and was utilized chiefly for road construction and maintenance. Limestone production continued at quarries in Bannock and Lewis Counties. Output, which increased 6 percent, was consumed chiefly in manufacturing cement; other uses included sugar refining, paper manufacturing, metallurgical flux, and agricultural applications. Quartzite, used as a flux at electric-furnace elemental-phosphorus facilities, was produced in Bear Lake, Caribou, and Power Counties. Production of stone was reported from 14 of the 44 counties in the State.

TABLE 10.—Sand and gravel sold or used by producers, by classes of operations and uses

	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand and gravel:				
Building	595	$780	633	$863
Road material	[1] 1,732	[1] 1,373	2,235	1,740
Railroad ballast	16	12	3	2
Other	[1] 63	[1] 35	78	34
Total [2]	[1] 2,405	[1] 2,200	2,949	2,639
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand and gravel:				
Building	1,388	426	54	74
Road material	2,872	2,648	3,712	3,592
Total	4,259	3,074	3,766	3,666
ALL OPERATIONS				
Sand and gravel:				
Building	1,982	1,206	686	937
Road material	[1] 4,603	[1] 4,020	5,947	5,332
Railroad ballast	16	12	3	2
Other	[1] 63	[1] 35	78	34
Grand total [2]	[1] 6,665	[1] 5,274	6,714	6,305

[1] Revised figure.
[2] Owing to rounding, total of individual items may not be additive.

Sulfuric Acid.—Output by The Bunker Hill Co. acid plant at Kellogg, Shoshone County, remained substantially the same as in 1957; in its 1958 annual report to shareholders the company reported sales of 96,775 tons of sulfuric acid. The facility used waste sulfur dioxide gases produced from roasting zinc concentrates at the Kellogg electrolytic zinc plant. Owing to curtailed zinc-plant operations during the year, elemental sulfur was burned in newly installed equipment to enrich and supplement the production of zinc-plant stack gases to maintain acid production at a high rate.

J. R. Simplot Co. began constructing a 400-ton-per-day sulfuric acid facility adjacent to the company fertilizer plant in Power

County west of Pocatello. Elemental sulfur recovered at natural-gas processing plants in Wyoming was to be used as the raw material for acid manufacture. Completion of the plant was scheduled for mid-1959.

REVIEW BY COUNTIES

The Shoshone County share of the State mineral-production value dropped from 65 percent in 1957 to 60 percent in 1958 as the result of greatly reduced output of lead and zinc. Combined value produced by other areas remained the same as in the previous year, although Lemhi and Washington Counties recorded substantial increases. Bonneville and Custer Counties had much lower values. The principal counties besides Shoshone were Bannock (cement) and Caribou (phosphate rock) in southeastern Idaho and Lemhi (cobalt and copper) in the central part of the State.

Although metals were mined in 20 of the 44 counties in the State, the values were small except for Custer, Lemhi, Shoshone, and Valley. Sand and gravel was the principal or only product in 25 counties. Oneida and Payette reported no mineral production.

Information concerning significant activities of mineral industries, by counties, is given below.

Ada.—Reprocessing stockpiled ilmenite sand to recover ilmenite, monazite, and garnet concentrates was continued at Boise by Baumhoff-Marshall, Inc.; the company also produced a quantity of zircon concentrate from stockpiled zircon-quartz sands.

Output of sand and gravel at operations in the county increased 38 percent, largely as a result of expanded requirements for road materials by the State highway department. Clay used to manufacture building brick was produced by Pullman Brick Co., near Boise.

Bannock.—Production of portland and masonry cements at the Inkom plant of Idaho Portland Cement Co. continued as the principal mineral-industry activity in the county. Limestone, the major raw material for the plant, was obtained at the company-operated Inkom quarry at an increased rate. Output of humus peat was continued at an operation near Downey. Sand and gravel for road and construction purposes also was produced.

Bear Lake.—Mining and processing of phosphate rock was the principal mineral activity. Central Farmers Fertilizer Co. during the year began production at the Georgetown Canyon phosphate property. Most of the mine output was stockpiled. The company beneficiation plant, under construction most of the year, was completed and began operation in December. A small quantity of beneficiated material was shipped to Midwestern firms for fertilizer use. There was no production of phosphate rock at the Waterloo mine of the San Francisco Chemical Co.; however, shipments from stocks were marketed to West Coast plants for manufacturing superphosphate fertilizers. Quartzite for electric-furnace (elemental-phosphorus) flux was produced at a quarry near Georgetown. Decreased requirements for road materials by the State highway department resulted in a decline of 43 percent in output of sand and gravel.

Bingham.—In terms of tonnage the county continued as the leading phosphate-producing area in the State. Production was at a mod-

TABLE 11.—Value of mineral production in Idaho, by counties [1]

County	1957 (thousands)	1958 (thousands)	Minerals produced in 1958 in order of value
Ada	$380	$611	Sand and gravel, clays.
Adams	202	(2)	Copper, silver.
Bannock	(2)	(2)	Cement, sand and gravel, stone, peat.
Bear Lake	250	133	Sand and gravel, stone, phosphate rock.
Benewah	(2)	(2)	Garnet.
Bingham	(2)	(2)	Phosphate rock, sand and gravel.
Blaine	(2)	289	Stone, barite, lead, silver, zinc, copper, gold, sand and gravel.
Boise	(2)	34	Sand and gravel, gold, silver.
Bonner	355	(2)	Silver, sand and gravel, gold, lead.
Bonneville	1,084	735	Sand and gravel, pumice, clays.
Boundary	30	57	Sand and gravel, stone, lead, silver.
Butte	----------	(2)	Sand and gravel, zinc, silver, lead, gold.
Camas	(2)	192	Sand and gravel, gold, silver.
Canyon	185	170	Sand and gravel, pumice.
Caribou	(2)	(2)	Phosphate rock, stone, sand and gravel.
Cassia	68	295	Sand and gravel, clays.
Clark	331	(2)	Phosphate rock, sand and gravel.
Clearwater	271	10	Stone, sand and gravel, gold, silver.
Custer	1,104	568	Lead, silver, copper, stone, uranium, zinc, gold.
Elmore	402	689	Sand and gravel, gold, columbium-tantalum, silver.
Franklin	48	174	Sand and gravel.
Fremont	208	65	Stone, sand and gravel.
Gem	95	44	Sand and gravel, gold, silver.
Gooding	130	113	Sand and gravel.
Idaho	311	399	Stone, sand and gravel, gold, silver.
Jefferson	----------	91	Sand and gravel.
Jerome	396	294	Sand and gravel, gold.
Kootenai	425	163	Sand and gravel, copper, silver.
Latah	484	495	Stone, sand and gravel, mica, clays.
Lemhi	5,839	6,738	Cobalt, copper, gold, tungsten, nickel, lead, silver, sand and gravel, zinc.
Lewis	(2)	(2)	Stone.
Lincoln	----------	(2)	Sand and gravel.
Madison	133	23	Do.
Minidoka	59	(2)	Sand and gravel, clays.
Nez Perce	134	37	Sand and gravel.
Owyhee	(2)	8	Gold, clays, silver, lead.
Payette	(2)	----------	----------
Power	209	351	Sand and gravel, stone.
Shoshone	47,447	38,973	Silver, lead, zinc, copper, antimony, gold, stone, garnet.
Teton	----------	(2)	Sand and gravel.
Twin Falls	331	274	Sand and gravel, pumice, gold.
Valley	1,182	1,213	Columbium-tantalum, mercury, monazite, titanium (ilmenite), rare earths, sand and gravel, garnet, thorium, gold, silver.
Washington	578	1,056	Sand and gravel, mercury, iron ore, gypsum, gold silver.
Undistributed [3]	10,832	10,162	
Total [4]	73,502	64,456	

[1] Oneida County not listed because no production was reported.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Includes value of sand and gravel, stone, gem stones, mercury, and barite that cannot be assigned to specific counties and values of minerals for counties indicated by footnote 2. (Adjusted to eliminate duplicating the value of stone).
[4] 1957 total revised; owing to rounding, total may not be additive.

erately increased rate at the J. R. Simplot Co. Gay mine near Fort Hall. Output of phosphate rock was used at the company Pocatello fertilizer plant to manufacture phosphate fertilizers and wet-process phosphoric acid; phosphatic shale production was marketed for manufacturing elemental phosphorus. The Fort Hall open-pit phosphate mine of Westvaco Mineral Products Division, Food Machinery & Chemical Corp., remained idle throughout 1958.

Blaine.—The Silver Star-Queens Mines, Inc., operation was the largest base-metals mine in the county. Although the company output of lead-zinc ore was substantially less than in 1957, the grade of ore at the property was reported to be improving as development at greater depth progressed. Silver Sun Mines, Inc., began ship-

ments of concentrates from the Apache group after completing rehabilitation of the old Apache mill in April. Lead concentrate and a small quantity of lead ore were shipped to smelters in Utah for processing. The company mill was completely destroyed by a brush fire early in September. Urite Mining Co. produced lead-zinc ore at the Edress property, and small quantities of silver and lead were produced from two other operations in the Mineral Hill and Camas district.

Old slag shipped to the Bunker Hill smelter from the Ketchum slag dump by Gundersen and Stocks yielded silver, copper, lead, and zinc.

George C. Castle, lessee, shipped lead-zinc ore from the Triumph mine. Before cessation of activity by Triumph Mining Co. in 1957 the property had been one of the leading producers of lead and zinc outside Shoshone County. Mine and mill equipment from the property was sold by the company during the year.

The Sun Valley barite mine of J. R. Simplot Co. was not operated; however, shipments of crude barite were made from stocks to the company processing plant in Power County near Pocatello.

Bonner.—Near Lakeview, Austin-Meyer Corp., continued production of silver ore at the Weber mine; the ore, which also contained recoverable gold and lead, was shipped to the Tacoma (Wash.) smelter. Exploration and development was continued at the Conjecture silver mine by Federal Uranium Corp. under an operating agreement with Conjecture Mines, Inc. The major undertaking by the operating company during the year resulted from a decision to sink a 1,000-foot three-compartment shaft. After construction of a headframe and other auxiliary facilities, work on the vertical shaft was begun the latter part of September, and the project was about one-fourth completed by year end. Federal Uranium Corp. also did some exploration of properties adjacent to the Conjecture mine.

Bonneville.—The county continued as the leading sand and gravel producing area in the State despite a sharp drop in output, caused by completion of the construction phase at the Bureau of Reclamation Palisades project east of Idaho Falls. Pumice operations in the county supplied most of Idaho production. Clay for use in manufacturing building brick was produced near Idaho Falls at more than double the 1957 rate.

Caribou.—Mine production of phosphate rock declined 16 percent from 1957. Output at the Ballard surface mine of Monsanto Chemical Co. near Soda Springs was lower than in 1957. The rock was reduced to elemental phosphorus in electric furnaces at the company Soda Springs elemental-phosphorus plant. The Anaconda Co. beneficiated phosphate rock produced at the Conda mine. Output was at a reduced rate. The concentrated product was shipped to Anaconda, Mont., for use by the company in manufacturing phosphate fertilizers. Quartzite for electric-furnace (elemental-phosphorus) flux was produced at a quarry north of Soda Springs.

Clark.—Phosphate-rock production at the J. R. Simplot Co. Centennial mine, on the Idaho-Montana border, was moderately lower than in 1957. The rock was trucked to Monida, Mont., for rail shipment to a Canadian fertilizer plant. Sand and gravel produced during the year was used at county and State road projects.

Custer.—Considerable activity was reported at uranium prospects in the Stanley area. Two companies, Western Fluorite Co. and Phillips Petroleum Co., shipped substantial tonnages of uranium ore to processors outside the State. Rare Metals Corporation of America and Sidney Mining Co. also were investigating deposits in the area.

Idaho Alta Metals Corp. and Mackay Exploration Co. shipped copper ore with values in gold, silver, lead, and zinc from the Empire mine; output was substantially less than in 1957.

Clayton Silver Mines reported normal operation at the Clayton mine during the first 8 months of the year. Declining base-metal prices forced suspension of production early in September; however, exploration under a DMEA contract continued. The company had stockpiled its output of lead concentrate from June through August; the concentrate was marketed in November after lead prices rose to a more favorable level. Production by the company totaled 1,636 tons of lead concentrate from 24,876 tons of ore; recoverable lead content of the concentrate was over 1.5 million pounds of lead.

Idaho.—Most of the placer gold mined in Idaho was from workings in Idaho County. Largest of these placer operations was that of Del Dewey at the Gold Bar placer; stream gravels at the property yielded nearly 1,800 ounces of gold.

Latah.—Mica, sand and gravel, stone, and clays were the nonmetal commodities produced in the county. Western Mica Corp. produced mica at the Muscovite mine north of Deary for shipment to the Government stockpile at Custer, S. Dak. Mica also was recovered from the Winthro and Olsen properties near Deary. A. P. Green Firebrick Co. processed clay mined near Helmer to refractory brick at the company Troy plant. The Anaconda Co. continued investigation of high-alumina clay deposits near Moscow. Shipments of clay were made to Anaconda, Mont., during the year for test purposes. J. R. Simplot Co. continued development at clay deposits west of Bovill. Construction of a clay beneficiation plant at the deposits was scheduled to begin in 1959.

Lemhi.—The Calera Mining Co. Blackbird mine near Cobalt continued as the principal domestic source of cobalt ore. Operations by the company during the year resulted in production of 295,852 tons of ore from which 20,862 tons of copper concentrate and 9,636 tons of cobalt concentrate were produced. The Blackbird operation was the largest source of copper in the State; production was over 11 million pounds of recoverable copper (about 58 percent of the State total). Ore was obtained from an open pit being developed under contract by Isbell Construction Co. and from underground workings. Copper concentrate was shipped from the Blackbird mill to the Tacoma (Wash.) smelter, and cobalt concentrate to the Calera refinery at Garfield, Utah, for conversion to cobalt metal and subsequent delivery under contract to the Government stockpile. Nickel contained in the cobalt concentrate also was recovered at the Garfield refinery. The Bradley Mining Co. Ima tungsten mine near Patterson remained closed throughout the year. Before shutdown of the mine in 1957 because of suspension of Government purchases of tungsten ore for stockpiling, the mine had been the

principal source of tungsten in the State and a substantial contributor to the State total value of mineral production.

Power.—Two phosphate-products plants were operated west of Pocatello. Phosphatic shale mined in Bingham County was processed to elemental phosphorus by Westvaco Mineral Products Division, Food Machinery & Chemical Corp. J. R. Simplot Co. continued production of phosphate fertilizers and wet-process phosphoric acid from rock produced at the company-operated Gay mine, Bingham County. Expansion of the Pocatello fertilizer facility and construction of an adjacent sulfuric acid plant was begun by the Simplot company. After completion of the expansion and construction program, scheduled for 1959, the company would have integrated facilities for manufacturing fertilizer products. Quartzite was produced at a quarry near Pocatello for use as flux in electric-furnace manufacture of elemental phosphorus. Sand and gravel for construction and road purposes also was produced in the county.

Shoshone.—Lower prices for base metals through much of 1958 was responsible for the decline of more than $8 million (18 percent) in value of mineral commodities produced in Shoshone County. The county's contribution to the total value of minerals produced in the State declined from 65 percent in 1957 to 60 percent in 1958. Silver was the leading commodity produced in terms of value.

The Bunker Hill Co. operations, which included the large Bunker Hill and Star mines as well as milling, smelting, and refining facilities, continued as the largest mineral-industry establishment in the county and State. The company lead smelter and electrolytic zinc plant near Kellogg received ore and concentrate from domestic and foreign sources. Sharp curtailment of smelter operations was required during the last half of the year because of lower demand and the continuing decrease in prices for lead, according to the company annual report to stockholders. From August to November the

TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, in terms of recoverable metals

Year	Mines producing		Material sold or treated (thousand short tons)	Gold, lode and placer (troy ounces)	Silver, lode and placer (thousand troy ounces)
	Lode	Placer			
1949–53 (average)	57	1	2,267	2,678	13,046
1954	37	--	1,630	2,047	14,899
1955	41	--	1,637	1,777	12,984
1956	36	2	1,675	1,963	12,663
1957	31	--	1,701	2,254	14,398
1958	25	--	1,337	2,363	15,615
1884–1958	--	--	(1)	423,000	587,911

Year	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value (thousands)
1949–53 (average)	1,780	75,327	74,885	$57,301
1954	2,566	64,812	58,736	45,515
1955	2,637	59,820	50,527	44,037
1956	2,889	60,221	46,738	45,701
1957	3,473	67,125	54,825	47,117
1958	3,884	52,488	49,532	38,645
1884–1958	92,000	6,369,000	1,995,000	1,741,840

[1] Complete data not available: 1904–1958, 102,669,000 short tons.

smelter was operated on a 5-day-week basis; improved markets late in the year permitted an increase in output to about 80 percent of capacity. Slag from the lead smelter was processed at the company slag-fuming plant throughout the year; the rate of crude zinc oxide output corresponded to the level of operations at the smelter. Lead production at the smelter was about 94,000 tons compared with 106,000 tons in 1957; smelter sales were 85,708 tons of lead, 17,460 tons of zinc in fume, 5,281,387 ounces of silver, 634 tons of antimony, 870 tons of copper, and 7,094 ounces of gold.

The Bunker Hill Co. electrolytic zinc plant was operated at 80 percent of capacity for 9 months of the year and at 62 percent of capacity during August, September, and October. About 55,000 tons of slab zinc was produced compared with nearly 69,000 tons in 1957. The company reported that installation of facilities for manufacturing zinc-base alloys for die casting, zinc anodes for cathodic protection, and other specification zinc alloys was largely completed.

The Bunker Hill Co. sulfuric acid plant was operated at near capacity most of the year. Sulfur-burning equipment was installed to permit enriching the gases evolved as required in roasting sulfide ores and concentrates.

Spokane Garnet Sand & Sales Co. began production of garnet at an operation near Fernwood. The ore was washed, screened, jigged, and tabled; and the garnet obtained was marketed to out-of-State consumers for abrasive uses.

Beaver District.—Zinc-lead-silver ore was produced at the Day Mines, Inc., Monitor group of mines (Mountain Goat, Silver Tip, and Sitting Bull) by lessees, according to the Day Mines company annual report. Total output from the three properties was 16,987 tons of ore. Ore production at the Sunset lease, 70 percent owned by Day Mines, dropped from 10,532 tons in 1957 to 2,010 in 1958.

Evolution District.—Production of a greater tonnage of ore with a higher average silver content and at a lower cost per ton was reported by Sunshine Mining Co. for the Sunshine mine in 1958 as compared with 1957. Production was 231,964 tons of ore from the Sunshine mine and adjoining properties operated by the company on a profit-sharing basis. Most of the ore produced was from unit operations begun the first of the year by the company. Under this plan several adjacent holdings, including most of the Sunshine area and the Omega, Rotbart, Polaris, and American areas, were combined as a single operating unit; the Sunshine company, which received 57.14 percent of the production and shared similarly in costs, was the operator for the unit area. According to the company annual report, the new operating method provided greater efficiency and lower costs with a higher degree of extraction, and was a principal factor in reducing overall operating costs by more than $1 per ton. The company milled 231,964 tons of ore from the properties it worked, compared with slightly less than 207,000 tons in 1957. Metal production was about 3.6 million pounds of lead, 2.3 million pounds of copper, 1.8 million pounds of antimony, and 6.1 million ounces of silver.

The Silver Summit mine, including the adjacent Rainbow area, yielded 48,393 tons of ore during the year. The mine was operated

by the Polaris Mining Co. until its merger with Hecla Mining Co. in October. Production was slightly less than in 1957; however, the grade of ore increased from about 23 to more than 26 ounces of silver per ton.

Hunter District.—The Bunker Hill Co. Star mine, operated by Hecla Mining Co., was on a 4-day-week basis for most of the year, according to The Bunker Hill Co. annual report. For this reason, tonnage of ore milled was at the lowest level in 10 years; however, grade of ore was higher. The quantity of metals recovered from ore produced at this mine was 7,085 tons of lead, 17,595 tons of zinc, and 230,829 ounces of silver.

Ore output from the Lucky Friday Silver-Lead Mines Co. Lucky Friday mine was up substantially; the quantity of ore milled was 55,176 tons compared with 39,893 tons in 1957. Gross metal content of 7,211 tons of lead concentrate and 243 tons of zinc concentrate produced was about 928,000 ounces of silver, 9.8 million pounds of lead, and 1.3 million pounds of zinc.

Ore output from the American Smelting and Refining Co. Morning mine again was considerably less than in the previous year. A 50-percent reduction in the working force at the mine in March affected about 50 men.

Lelande District.—Ore output from the Day Mines, Inc., Hercules mine declined about 50 percent from 1957. According to the company annual report, exploration on the 1900 level of the mine was disappointing, and workings below the 1600 level were allowed to fill with water. Stoping was continued between the 1000 and 1600 levels throughout the year.

Placer Center District.—Ore output from the Galena mine, leased jointly by American Smelting and Refining Co. and Day Mines, Inc., from Callahan Mining Corp., was 118,880 tons of silver-copper ore and 942 tons of lead-silver ore, according to the Day Mines annual report to stockholders. Output was slightly less than in 1957, but metal content was higher. Operation of the Day Mines, Inc., Dayrock property was held at about one-quarter of capacity throughout the year, pending increased metal prices. Block-leasing activities at the company Tamarack property resulted in completing extraction of all known commercial ore in the lower levels of the mine.

Yreka District.—Curtailment of operations because of low lead-zinc prices resulted in a 33-percent decline in tonnage of ore mined at The Bunker Hill Co. Bunker Hill mine. According to the company annual report, a total of 352,575 tons of ore from the mine was milled; recoverable metal content was 26,199 tons of lead, 9,638 tons of zinc, and about 1,740,000 ounces of silver. The ore reserve declined from 3.3 to 3.0 million tons, primarily because of reduced development.

Development at The Bunker Hill Co. Crescent mine was encouraging. The company reported recovery of 347,836 ounces of silver as well as some copper, lead, and zinc from development ore.

Ore production at the American Smelting and Refining Co. Page mine was about the same as in 1957. Operations were on a 4-day-week basis from May through October. The mine was the second-ranking zinc producer and the third-ranking source of lead in the State during the year.

The quantity of ore extracted at the Sidney Mining Co. Sidney mine declined from about 44,000 tons in 1957 to 27,400 tons in 1958. The company reported production of 2,567 tons of lead concentrate and 4,509 tons of zinc concentrate containing about 2.9 million pounds of lead and 5.4 million pounds of zinc. According to the company annual report, equipment below the 1700 level of the mine was removed, and water was allowed to flood workings to that level. No new ore bodies were discovered during the year, and the ore reserve was nearing exhaustion.

Valley.—With the sale or other disposition of over $1 million worth of mining and milling equipment and supplies and a large number of housing units, the town of Stibnite became virtually a modern-day ghost town. Mines in the vicinity had supplied much of the Nation's wartime requirements of antimony and tungsten ore and substantial quantities of mercury.

During 1958 euxenite and columbite from placer deposits in Bear Valley were mined by Porter Bros. Corp. Concentration of dredged sands was accomplished at the company plant at Lowman. Baumhoff-Marshall, Inc., continued reprocessing ilmenite sand derived from previous dredging operations for monazite near Cascade; ilmenite, monazite, and garnet sands were the products recovered and sold. Output of mercury was resumed at the Holly Minerals Corp. Hermes mine in the Yellow Pine district. No production had been reported for the mine since a fire destroyed the company plant in 1956. A flotation process was used to concentrate the ore before subsequent treatment. About half of the company output of 490 flasks was recovered by an electrolytic process; the remainder was produced by retorting the flotation concentrate.

Washington.—The Rare Metals Corporation of America Idaho-Almaden mine continued as the largest producer of mercury in the State. Production was at about the same rate as in the previous year. Slightly more than 56,000 tons of ore averaging 0.173 percent mercury was treated in the company 175-ton-per-day Gould rotary furnace. Shasta Mining Co. shipped about 14,000 tons of ore for consumption by the cement and iron and steel industries in the Pacific Northwest from its operation at Iron Mountain near Weiser.

The Mineral Industry of Illinois

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Illinois State Geological Survey.

By Matthew G. Sikich [1]

VALUE of minerals produced in Illinois in 1958 reached a new high of $582.4 million, a 1-percent increase over 1957, the previous record year. Substantial increases in output of petroleum and portland cement and higher unit values of natural gas and natural-gas liquids offset marked decreases in total values of coal, fluorspar, and lime. Other minerals for which increases in total value over 1957 were reported were clays, sand and gravel, and stone. The quantity of sand and gravel produced, however, was slightly less than in 1957.

Mineral fuels continued as the major commodity group, representing 77 percent of the total value of State mineral output. Nonmetals furnished 22 percent, and metals supplied 1 percent of the total.

Employment and Injuries.—Excluding office workers and the entire petroleum industry, nearly 35 million man-hours was worked in the mineral industry, according to preliminary data. The 10-percent decrease from 1957 was chiefly attributable to lower coal production. Certain mineral industries are excluded from table 2 to avoid disclosing individual company confidential data.

A total of 18 fatal and 1,000 nonfatal lost-time injuries were reported for the mineral industries (excluding the petroleum industry), compared with 23 fatalities and 1,096 nonfatal injuries in 1957. The injury-frequency rate was 29.67, compared with 29.17 in 1957. A marked improvement was made in the safety record of the coal industry. On the contrary, the cement industry had a less favorable injury experience compared with its injury-free record in 1957.

The Thornton quarry of Material Service Corp. won the Sentinels of Safety trophy, the highest award, in the quarry group of the 1958 National Safety Competition. The quarry was operated over 437,000 man-hours without sustaining one lost-time injury.

Other companies also achieved the notable distinction of having injury-free operations.

Legislation and Government Program.—Government purchases of Metallurgical-grade fluorspar ceased June 30, 1958. Purchases of domestic Acid-grade fluorspar under Public Law 733 were terminated at the end of 1958.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.

TABLE 1.—Mineral production in Illinois [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland—thousand 376-pound barrels	8,097	$24,560	9,205	$29,308
Masonry—do	478	1,796	413	1,551
Clays—thousand short tons	1,917	5,155	2,335	5,910
Coal [2]—do	46,993	187,908	43,912	176,614
Fluorspar	169,939	8,827	152,087	7,931
Gem stones	[3]	2	[3]	1
Lead (recoverable content of ores, etc.)	2,970	849	1,610	377
Natural gas—million cubic feet	9,647	1,495	12,983	1,921
Natural-gas liquids:				
Natural gasoline and cycle products—thousand gallons	[4]	[4]	22,380	1,645
LP-gases—do	[4]	[4]	353,129	20,866
Peat	11,480	106	11,588	72
Petroleum (crude)—thousand 42-gallon barrels	77,083	240,499	[5] 82,125	[5] 246,375
Sand and gravel—thousand short tons	30,151	32,572	29,866	33,453
Stone—do	31,861	41,835	35,016	44,245
Zinc (recoverable content of ores, etc.)	22,185	5,147	24,940	5,088
Value of items that cannot be disclosed: Lime and tripoli and values indicated by footnote [4]		[6] 27,898		9,573
Total Illinois [7]		[6] 576,324		582,412

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Exclusive of mines producing less than 1,000 net tons.
[3] Weight not recorded.
[4] Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."
[5] Preliminary figure.
[6] Revised figure.
[7] Total adjusted to eliminate duplicating value of clays and stone.

TABLE 2.—Summary of employment and injuries for selected mineral industries in Illinois [1]

Year and commodity	Average number of men working	Total man-hours	Total number of lost-time injuries		Total number of days lost or charged	Injury frequency rate	Injury severity rate
			Fatal	Nonfatal			
1957							
Cement [2]	952	2,373,303					
Clays [3]	845	1,536,837		41	822	26.68	535
Coal	12,104	19,588,712	21	820	168,881	42.93	8,621
Coke ovens	893	2,572,158	2	5	[4]	2.72	[4]
Fluorspar	740	1,563,746		35	3,010	22.38	1,925
Limestone [5]	2,319	4,719,386		126	[4]	26.70	[4]
Sand and gravel	729	1,667,656		23	5,408	13.79	3,243
Smelters	1,463	3,773,859		46	1,369	12.19	363
1958							
Cement [2]	966	2,451,621	3	4	[4]	2.86	[4]
Clays [3]	755	1,235,720	1	45	7,662	37.23	6,200
Coal	10,802	17,715,619	10	710	88,324	40.59	4,986
Coke ovens	768	1,797,721		14	[4]	7.78	[4]
Fluorspar	331	706,472	1	25	8,464	36.80	11,981
Limestone [5]	2,468	4,760,808	2	100	[4]	21.42	[4]
Sand and gravel	1,077	2,204,221	1	49	7,074	22.68	3,209
Smelters	1,313	3,263,220		53	3,162	16.24	969

[1] Data exclude office workers; are final for 1957 and preliminary for 1958.
[2] Includes cement plants and quarries or pits producing raw material used in manufacturing cement.
[3] Excludes pits producing clay used exclusively in manufacturing cement.
[4] Data not available.
[5] Excludes quarries producing limestone used exclusively in manufacturing cement and lime.

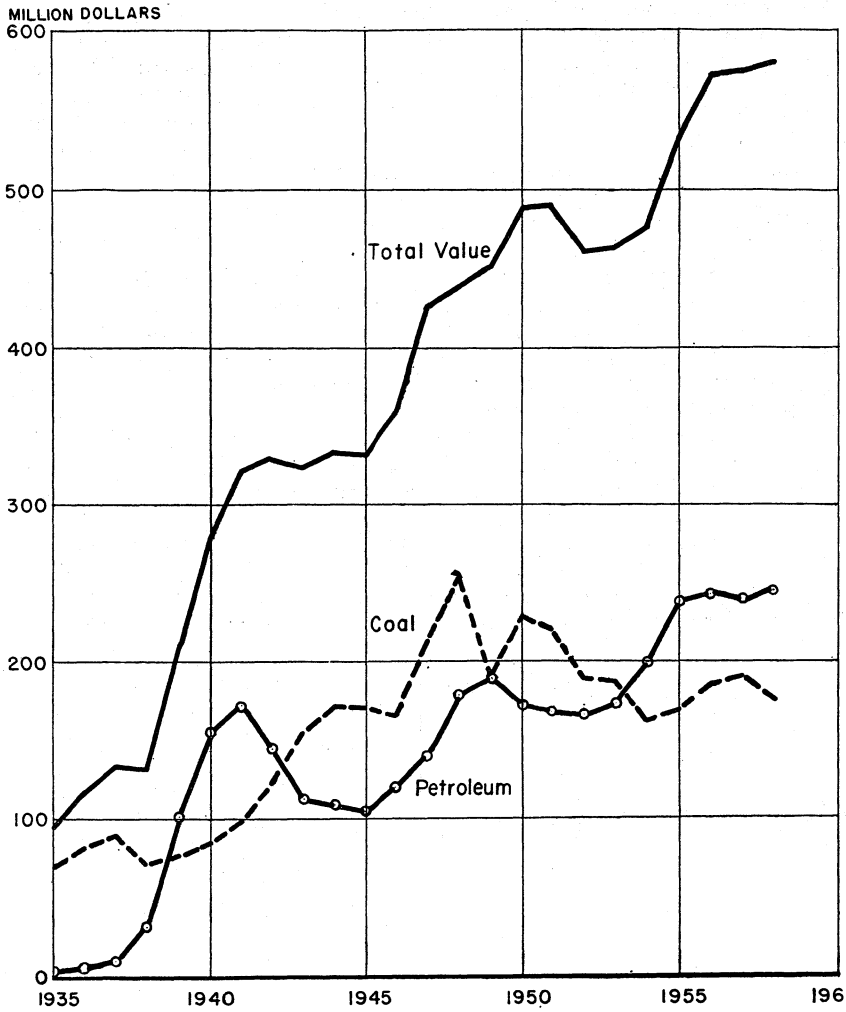

FIGURE 1.—Value of coal, petroleum, and total value of mineral production in Illinois, 1935–58.

One contract between the Defense Minerals Exploration Administration (DMEA) and the New Jersey Zinc Co. covering fluorspar exploration in Pope County was in effect the latter half of 1958. On September 11, 1958, the DMEA was succeeded by the Office of Minerals Exploration.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Illinois ranked fourth in the Nation in the production of bituminous coal. Output declined 7 percent in quantity and 6 percent in total value from 1957. The average mine value per ton increased slightly over the preceding year.

Mines were operated in 34 counties. Major producing counties, in order of rank, were Williamson, St. Clair, Fulton, Franklin, Perry, Jefferson, and Christian. Underground mines furnished 53 percent of the total production; strip and auger mines the remainder. The output from underground mines decreased 13 percent from 1957, whereas strip-mine production increased nearly 3 percent over the previous year. This increase was partly due to the first full year of operation of the Peabody Coal Co. River King mine, in St. Clair County. Twelve companies furnished 80 percent of the production.

Approximately 52 percent of the coal output was for use in electric power utilities compared with 51 percent in 1957. However, the quantity of coal produced for this use declined nearly 1.3 million tons from 1957 because of lesser use of electrical energy. General manufacturing and processing industries in the Upper Mississippi Valley area consumed a substantial portion of the output. Another market was for space-heating purposes, particularly in areas where other sources of heat were not available. A growing use for Illinois coal was in manufacturing metallurgical coke.

TABLE 3.—Bituminous coal production, value, and number of mines operated in 1958, by counties

(Exclusive of mines producing less then 1,000 net tons)

County	Production (net tons)			Total value	Number of mines operated		
	Underground	Strip and auger [1]	Total		Underground	Strip	Auger
Adams		37,995	37,995	$259,232		1	
Bureau		(2)	(2)	(2)		1	
Christian	(2)		(2)	(2)	1		
Clinton	56,181		56,181	292,537	2		
Douglas	477,006		477,006	2,176,833	1		
Franklin	4,651,455		4,651,455	19,758,759	4		
Fulton	54,432	4,638,473	4,692,905	19,288,703	3	11	
Gallatin	37,592	(2)	(2)	(2)	3	5	1
Greene		7,229	7,229	36,145		1	
Grundy		(2)	(2)	(2)		1	
Henry	93,194		93,194	415,787	2		
Jackson	(2)	501,563	(2)	(2)	2	3	
Jefferson	(2)	17,720	(2)	(2)	1	1	
Kankakee		(2)	(2)	(2)		1	
Knox		2,155,771	2,155,771	8,819,210		4	
La Salle		(2)	(2)	(2)		2	
Logan	(2)		(2)	(2)	1		
Macoupin	436,110		436,110	1,752,354	2		
Madison	646,586		646,586	2,702,832	3		
Marion	16,608		16,608	72,230	1		
Menard	15,377		15,377	92,927	3		
Mercer	17,580	2,390	19,970	100,491	1	1	
Montgomery	(2)		(2)	(2)	1		
Peoria	29,454	300,033	329,487	1,605,794	5	6	
Perry	753,994	3,193,830	3,947,824	13,774,584	2	5	
Randolph	628,297	31,176	659,473	2,173,223	2	1	
St. Clair	2,186,033	(2)	(2)	(2)	5	4	
Saline	(2)	1,444,512	(2)	(2)	2	6	4
Sangamon	(2)		(2)	(2)	2		
Schuyler	11,189	(2)	(2)	(2)	1	2	
Vermilion	58,437	1,046,048	1,104,485	4,893,064	4	5	
Washington	(2)		(2)	(2)	2		
Will		(2)	(2)	(2)		2	
Williamson	3,701,195	2,319,896	6,021,091	23,922,743	18	15	
Undistributed	9,502,627	4,842,422	18,543,658	74,476,181			
Total	23,373,347	20,539,058	43,912,405	176,613,629	74	78	5

[1] Strip and auger production combined in order to avoid disclosing individual company confidential data.
[2] Included with "Undistributed" to avoid disclosing individual company confidential data.

About 732,000 tons was produced for use in coke and gas plants in 1958, compared with 622,000 tons in 1957. This was the only use for which an increase was recorded over 1957, in spite of the marked drop in coke production. Sales for railroad fuel declined to three-quarters of a million tons. Approximately 67 percent of the coal consumed in Illinois in 1957 and 1958 was mined in Illinois.

About 94 percent of the coal production was cleaned at 61 plants. Four new plants were opened. All but a fraction of 1 percent of the total underground production was cut by machines and only about 1 percent of the total underground production was hand-loaded into mine cars. Mechanical loading methods were utilized at 51 underground mines. Approximately 75 percent of the mechanical loading at underground mines was done by mobile loaders, nearly 25 percent by continuous-mining machines, and a small portion by duckbills or self-loading conveyors.

Coke.—Coke was produced at seven plants. Total production was about 1.9 million short tons valued at $37.4 million, compared with 2.9 million tons valued at $55.5 million in 1957. Of the output, approximately 1.75 million tons was used in blast furnaces by the producing companies. Coke-oven facilities of United States Steel Corp. in Will County were closed at the end of February.

About 124,000 short tons of coke breeze valued at $646,000 was recovered at coke plants. Other byproducts of coke-oven operations included coke-oven gas, ammonia, and crude coal tar and light oil and their derivatives.

Peat.—Although classed as a mineral fuel, Illinois peat was used chiefly for soil conditioning. Output increased slightly over 1957 in quantity but decreased in total value. Over 93 percent of the production was sold in bulk form. The remainder was packaged. The three general types of peat—moss, reed sedge, and humus—were produced. Output was reported by four companies in Cook, Kane and Lake Counties.

Petroleum, Natural Gas, and Natural Gas Liquids.—Crude-petroleum output increased nearly 7 percent in quantity and over 2 percent in total value over 1957. Petroleum composed 42 percent of the value of Illinois mineral output. Secondary recovery practices continued to play an important role, accounting for about half the production.

The Illinois State Geological Survey has estimated that ultimate recovery of oil in Illinois from waterflooding alone may exceed 1 billion barrels. The first two of a series of three reports on hydraulic fracture theory were published.[2] Another report concerned waterflooding.[3] According to the Division of Oil and Gas of the Illinois Department of Mines and Minerals, 1,303 producing oil wells were completed in 39 counties in 1958. At the end of the year there were approximately 32,000 producing oil wells in the State.

Natural gas marketed increased 35 percent in quantity and 28 percent in total value compared with 1957. The output of natural gas

[2] Cleary, James, Hydraulic Fracture Theory, Part I, Mechanics of Materials: Illinois State Geol. Surv. Circ. 251, 1958, 24 pp.; Hydraulic Fracture Theory, Part II, Fracture Orientation and Possibility of Fracture Control: Illinois State Geol. Surv. Circ. 252, 1958, 19 pp.

[3] Rose, Walter, Studies of Waterflood Performance. IV, Influence of Curtailments on Recovery: Illinois State Geol. Surv. Circ. 262, 1958, 32 pp.

liquids decreased 3 percent in quantity from 1957. The value, however, increased 30 percent.

NONMETALS

Cement.—Portland and masonry cements were produced by four companies at plants in La Salle and Lee Counties. The high level of road construction activity was the principal reason for the 14-percent increase in output of portland cement over 1957. Total value of sales increased 19 percent over the preceding year. Sales of masonry cement, however, decreased 14 percent in quantity and total value from 1957.

Portland cement produced was chiefly types I and II (general use and moderate heat) and type III (high early strength). Over 86 percent of the portland cement and nearly 54 percent of the masonry cement shipped from Illinois plants went to consumers in the State. Most of the remainder was shipped to adjoining States.

Estimated annual finished-cement capacity in Illinois was nearly 10 million barrels. Over 229 million kw.-hr. of electrical energy, most of which was generated by two companies, was used at the plants. These companies quarried over 2.6 million tons of limestone for use in manufacturing cement. Other raw materials consumed included nearly 200,000 tons of clay or shale and smaller quantities of sand, gypsum, slag, iron ore, and other materials, such as grinding aids and air-entraining compounds.

TABLE 4.—Finished portland cement produced and shipped

Year	Active plants	Production (thousand barrels)	Shipped from mills	
			Barrels (thousands)	Total value (thousands)
1949–53 (average)	4	8,384	8,315	$19,196
1954	4	8,842	9,109	23,148
1955	4	8,810	8,655	22,886
1956	4	8,823	8,629	24,866
1957	4	8,794	8,097	24,560
1958	4	9,433	9,205	29,308

Average mill value of portland cement was $3.18 a barrel, compared with $3.03 in 1957. Average value a barrel of masonry cement remained approximately the same as the previous year.

Clays.—The total production of clays increased 22 percent in quantity and 15 percent in value over 1957. Substantial increases in output for manufacturing heavy clay products, lightweight aggregates, and cement were recorded.

Fire-clay output was reported by 10 producers in Greene, Grundy, Knox, La Salle, McDonough, and Rock Island Counties. The material was used principally for refractory purposes and for manufacturing heavy clay products and pottery.

Miscellaneous clay was produced in 21 counties, chiefly for manufacturing heavy clay products, cement, lightweight aggregates, and pottery.

Material Service Corp. began operating a new expanded shale plant in La Salle County early in 1958.

TABLE 5.—Clays sold or used by producers, by kinds

Year	Fire clay		Miscellaneous clay		Total	
	Short tons (thousands)	Value (thousands)	Short tons (thousands)	Value (thousands)	Short tons (thousands)	Value (thousands)
1949–53 (average)	420	$1,462	1,967	$2,262	[1] 2,388	[1] $3,747
1954	314	675	1,713	2,807	2,027	3,482
1955	363	748	1,975	3,231	2,339	3,979
1956	441	870	1,817	3,136	2,258	4,005
1957	438	2,345	1,479	2,810	1,917	5,155
1958	725	2,733	1,610	3,177	2,335	5,910

[1] Includes nearly 2,000 tons of fuller's earth valued at approximately $24,000.

Construction of a new research laboratory of National Clay Pipe Manufacturers, Inc., at Crystal Lake was completed.

The Illinois State Geological Survey continued research in the field of clay mineralogy. The State agency began a detailed study of the clay underlying the No. 2 coal seam, which varies widely in refractory characteristics. The agency also investigated deposits of clay and shale that had possible use for manufacturing lightweight aggregate.

Fluorspar.—Illinois led the Nation in fluorspar production, furnishing 48 percent of the total domestic output. Shipments decreased 11 percent in quantity and 10 percent in total value from 1957, in spite of increased sales to the Government. A drop in consumption of all grades was the chief reason for the decrease in output. Government purchases of Acid-grade fluorspar under Public Law 733 were terminated at the end of 1958. Stockpile purchases of Metallurgical-grade ceased on June 30. These actions may seriously reduce fluorspar production, as nearly 46 percent of the 1958 output was sold to the Government.

About 76 percent of the total shipments was classified as Acid grade; 13 percent, Ceramic; and 11 percent, Metallurgical. Government purchases comprised 48 percent of the Acid-grade shipments and nearly 87 percent of the Metallurgical grade.

Major fluorspar producers were Aluminum Company of America, Minerva Oil Co., Ozark-Mahoning Co., and Southern Illinois Mining Co. These companies also produced lead and/or zinc concentrates as byproducts of fluorspar mining. Several smaller companies mined fluorspar ore. Most of them shipped the crude material to other companies for processing. All finished fluorspar produced was credited to Hardin County, although some crude material was mined in Pope County.

A contract between the DMEA and the New Jersey Zinc Co. covering exploration of a fluorspar deposit in Pope County was in effect during the latter half of the year. Work was begun on the contract on July 17, 1958, and was still in progress as of the end of the year. The proposed total cost of the project was approximately $39,000, the Government share being 50 percent of the actual cost.

Gem Stones.—Several individuals collected fluorite specimens in Hardin County, principally near Rosiclare. The material was used chiefly for private gem collections.

Lime.—Illinois ranked fifth in the Nation in lime production. Five plants were operated in Adams and Cook Counties. Lime production at East St. Louis was discontinued by the Aluminum Company of America late in 1957. Total shipments of quick and hydrated lime in 1958 decreased 10 percent in quantity and value from 1957. Over 62 percent of the total output was for refractory purposes, 31 percent for chemical and other industrial uses, and the remainder for building purposes.

Perlite.—Perlite-processing plants were operated in Champaign, Cook, Lake, and Will Counties. Sales of expanded perlite totaled over 23,000 short tons, valued at $1,373,000—an increase of 2 percent in quantity and 13 percent in value over 1957. Crude material processed at the plants was mined in Western States. Nearly 86 percent of the expanded product was used as lightweight aggregate in plaster and concrete. The remainder was used for loose-fill insulation, soil conditioning, and other purposes.

Sand and Gravel.—Illinois was one of the leading States in production of sand and gravel and ranked fifth in 1958. Output decreased slightly in quantity from 1957 but increased 3 percent in total value. A 2.4-million-ton increase for paving use was offset by substantial declines in consumption of industrial sands and material for building purposes. The expanded highway program had a favorable effect on the sand and gravel industry, whereas depressed economic conditions in certain industrial areas affected the industry adversely.

Nearly 53 percent of the output was for paving use and 32 percent for building purposes. Substantial quantities were used in manufacturing glass, for molding purposes, grinding and polishing, sandblasting, engine use, and railroad ballast. Other uses were for filler, enamel, filter sand, foundry use, and pottery, porcelain, or tile.

Over 73 percent of the commercial production was transported by truck, 25 percent by rail, and the remainder by water.

Production was reported from 72 counties. Counties from which over 1 million tons was produced during the year were: Cook, DuPage, Kane, La Salle, McHenry, McLean, Peoria, Tazewell, Will, and Winnebago. Major producers included Chicago Gravel Co., Consumers Co., Elmhurst-Chicago Stone Co., Larson Bros. Sand & Gravel, McGrath Sand & Gravel Co., Inc., Material Service Corp., McHenry Sand & Gravel Co., Ottawa Silica Co., Rowe Construction Co., and Wedron Silica Co.

Stone.—Illinois was the third-ranking producing State in 1958, exceeded only by Pennsylvania and Texas. Output reached an alltime high and was 10 percent greater than in 1957. The value of production increased 6 percent. The high road-construction activity was the chief reason for the record output. Production for concrete aggregate and roadstone increased 3.2 million tons (14 percent) over 1957. A 4-percent increase in the output of crushed limestone for agricultural use was also recorded. Quantities of crushed limestone for railroad ballast and flux decreased from the preceding year. All stone produced was limestone, except for nearly 900 tons of sandstone produced for refractory purposes in Alexander County.

Limestone was produced in 60 counties. Major producing counties were Cook, Kankakee, La Salle, St. Clair, and Will. Approximately 75 percent of the limestone production was used for concrete aggregate and roadstone. Substantial quantities were also used for agri-

TABLE 6.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1957		1958	
	Short tons (thousands)	Value (thousands)	Short tons (thousands)	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:[1]				
Glass	1,322	$3,216	1,197	$2,904
Molding	834	2,184	570	1,509
Building	5,875	4,909	4,937	4,698
Paving	3,911	3,135	4,040	3,480
Grinding and polishing	(2)	(2)	(2)	(2)
Blast	191	1,116	(2)	(2)
Fire or furnace	(2)	(2)	(2)	(2)
Engine	86	130	75	133
Filter	(2)	(2)	(2)	(2)
Railroad ballast	5	4	(2)	(2)
Fill	432	259	441	245
Ground	212	2,179	171	1,683
Undistributed	498	1,835	583	2,457
Total	13,366	18,968	12,014	17,108
Gravel:				
Building	5,628	5,117	4,487	4,556
Paving	7,765	6,376	10,206	9,360
Railroad ballast	659	432	537	352
Fill	363	242	455	307
Other	738	697	681	678
Total	15,153	12,864	16,366	15,253
Total sand and gravel	28,518	31,832	28,380	32,361
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	2	(3)	1	(3)
Paving	156	55	217	155
Total	158	55	218	156
Gravel:				
Building	36	14	44	25
Paving	1,439	670	1,223	911
Total	1,475	684	1,267	936
Total sand and gravel	1,633	740	1,486	1,092
ALL OPERATIONS				
Sand	13,524	19,023	12,232	17,264
Gravel	16,628	13,549	17,633	16,190
Grand total	30,151	32,572	29,866	33,453

[1] Includes friable sandstone.
[2] Combined with "Undistributed" to avoid disclosing individual company confidential data.
[3] Less than $1,000.

cultural purposes, railroad ballast, flux, and manufacturing cement and lime. Dimension limestone was produced in McHenry, Ogle, St. Clair, and Union Counties. Output was chiefly for architectural purposes.

The principal limestone producers included Allied Chemical & Dye Corp., Columbia Quarry Co., Consumers Co., Dolese & Shepard Co., East St. Louis Stone Co., Elmhurst-Chicago Stone Co., Lehigh Stone Co., Marquette Cement Mfg. Co., Material Service Corp., and Mississippi Lime Co.

Sulfur.—Elemental sulfur was recovered by the Pure Oil Co. as a byproduct at its Lemont Refinery in Cook County. Quantity and total value of output in 1958 increased over 1957.

TABLE 7.—Limestone sold or used by producers, by uses [1]

Use	1957		1958	
	Quantity (thousands)	Value (thousands)	Quantity (thousands)	Value (thousands)
Dimension: [2]				
Rubble, rough construction, (and rough architectural—1957)—short tons	1	$3	(3)	$2
House-stone veneer, cut stone, (curbing—1957) and flagging—cubic feet	29	64	25	104
Total dimension—equivalent short tons [4]	3	67	3	106
Crushed and broken:				
Riprap—short tons	180	232	266	357
Flux—do	363	709	(5)	(5)
Refractory—do	(5)	(5)	(5)	(5)
Concrete aggregate and roadstone—do	23,081	31,057	26,315	33,359
Railroad ballast—do	1,093	1,374	504	705
Agriculture—do	3,237	4,387	3,371	4,726
Other uses—do	3,902	4,002	4,557	4,984
Total crushed and broken—do	31,857	41,761	35,013	44,130
Grand total—do	31,860	41,828	35,015	44,236

[1] Includes both commercial and Government-and-contractor production.
[2] Uses as shown combined to avoid disclosing individual company confidential data.
[3] Less than 1,000 tons.
[4] Average weight of 170 pounds per cubic foot used to convert cubic feet to short tons.
[5] Combined with "Other uses" to avoid disclosing individual company confidential data.

Tripoli.—Tripoli (amorphous silica), was produced from two underground mines in northern Alexander County. The output of crude material decreased 5 percent in quantity and 4 percent in total value from 1957. Sales of prepared material decreased slightly in quantity but increased in total value because of higher unit value. A notable development in the sales pattern has been the increasing consumption of amorphous silica by the fiberglass industry.

Vermiculite.—Crude vermiculite mined in other States was exfoliated at plants operated by three companies in Cook, Macoupin, and Will Counties. The processed material was used for insulation purposes, as lightweight aggregate in plaster and concrete, and for other uses.

METALS

Lead and Zinc.—Lead and zinc were produced as primary products from mines in Jo Daviess County (Northern Illinois district) and as byproducts of fluorspar mining in Hardin County (Southern Illinois district). The output of lead, in terms of recoverable metal, decreased 46 percent in quantity and 56 percent in total value from 1957, chiefly because of lower lead consumption and prices. The production of zinc, however, increased 12 percent in quantity over 1957 but decreased slightly in total value. In Northern Illinois both major producers (the Eagle-Picher Co. and Tri-State Zinc, Inc.) operated their mines throughout the year. Tri-State Zinc, Inc., returned to a 6-day work week early in December. The chief reason for the increase in zinc output in Southern Illinois was the rise in average zinc content of ores mined. The principal producers in Southern Illinois were Aluminum Company of America, Minerva Oil Co., and Ozark-Mahoning Co.

TABLE 8.—Mine production of silver, lead, and zinc, in terms of recoverable metals

Year	Mines producing	Materials sold or treated [1] (short tons)	Silver		Lead		Zinc		Total value
			Fine ounces	Value	Short tons	Value	Short tons	Value	
1954	21	603,675	1,160	$1,050	3,232	$885,568	14,427	$3,116,232	$4,002,850
1955	13	839,555	3,075	2,783	4,544	1,354,112	21,700	5,338,200	6,695,095
1956	23	851,285	1,580	1,430	3,832	1,203,248	24,039	6,586,686	7,791,364
1957	23	853,661	--	--	2,970	849,420	22,185	5,146,290	5,996,340
1958	19	1,003,020	--	--	1,610	376,740	24,940	5,087,760	5,464,500

[1] Data include fluorspar ore from which lead and/or zinc was recovered as follows: 1954—202,478 tons; 1955—309,311 tons; 1956—336,635 tons; 1957—360,406 tons; and 1958—401,562 tons.

TABLE 9.—Mine production of lead and zinc in 1958, by months, in terms of recoverable metals, in short tons

Month	Northern Illinois		Southern Illinois		Total Illinois	
	Lead	Zinc	Lead	Zinc	Lead	Zinc
January	80	1,415	80	470	160	1,885
February	70	1,270	50	440	120	1,710
March	85	1,425	75	625	160	2,050
April	85	1,510	35	475	120	1,985
May	170	1,570	45	430	215	2,000
June	70	1,570	60	515	130	2,085
July	30	1,235	30	575	60	1,810
August	65	1,675	30	620	95	2,295
September	65	1,690	30	540	95	2,230
October	65	1,740	30	550	95	2,290
November	115	1,720	85	575	200	2,295
December	70	1,720	90	585	160	2,305
Total	970	18,540	640	6,400	1,610	24,940

The average weighted yearly prices used to calculate total values of lead and zinc production in 1958 were 11.7 cents a pound for lead and 10.2 cents a pound for zinc. Comparable prices for 1957 were 14.3 cents and 11.6 cents a pound, respectively. The New York price of lead was quoted at 13 cents a pound at the beginning of 1958. It declined to a low of 10.75 cents in August and returned to 13 cents in October, remaining at that level throughout the remainder of the year. Zinc market prices (East St. Louis) opened in 1958 at 10 cents a pound and held there through October 1, when the price rose to 10.5 cents. Further increases of one-half cent a pound on October 8 and November 7 brought the price to 11.5 cents, where it remained for the balance of 1958.

Pig Iron.—Approximately 4.2 million short tons of pig iron valued at nearly $259 million was sold or used, a decrease of 32 percent in quantity and 28 percent in total value from 1957. Blast furnaces were operated in Chicago and Granite City by five companies. Operations at many furnaces were either curtailed or suspended because of lower demand. The three blast furnaces of Youngstown Sheet & Tube Co. were idle. According to the American Iron and Steel Institute, the annual capacity of the 22 blast furnaces in Illinois, as of January 1, 1958, was 7,519,700 tons but increased to 7,894,200 tons by the end of the year.

Approximately 6.6 million tons of domestic iron and manganiferous ores (excluding iron-ore agglomerates), largely from the Lake Supe-

rior district, was consumed in agglomerating plants and blast and steel furnaces. A small quantity of foreign iron ore also was consumed. Other materials consumed in blast furnaces included 3.4 million tons of coke and 1.2 million tons of limestone.

Steel.—Steel production was 6,946,100 short tons (approximately 60.1 percent of capacity), according to the American Iron and Steel Institute. Steel furnaces were operated in Alton, Chicago, Chicago Heights, Granite City, Peoria, and Sterling by 10 companies.

Thorium.—Refined thorium compounds were manufactured from monazite concentrate by the Lindsay Chemical Division of American Potash and Chemical Corp. at West Chicago, the world's largest producer of these compounds. Material processed was chiefly from the Union of South Africa. Major nonenergy uses of thorium and its compounds were in magnesium-thorium alloys, gas mantles, refractories, medicines, and alloys for lamp filaments and vacuum tubes. Magnesium-thorium alloys have become increasingly important in the manufacture of supersonic aircraft and missiles.

Other Metals.—Small but valuable quantities of certain metals are recovered from Illinois ores in later processing stages. Cadmium was recovered at three zinc smelters. Gallium was produced by Aluminum Company of America at East St. Louis. The American Zinc Co. of Illinois produced germanium at its Fairmont City smelter. The value of these byproduct metals is not included in mineral-production data.

REVIEW BY COUNTIES

Mineral production (excluding liquid fuels and natural gas), was reported in 93 counties. The five leading counties, ranked according to the value of mineral output, were La Salle, Cook, Williamson, St. Clair, and Fulton. Ten counties reported total values of mineral production exceeding $10 million. Mineral values increased over 1957 for 53 counties; 39 counties had decreases from the preceding year; and 1 county reported no changes. Excluded from the county-review section are details on liquid-fuel and natural gas operations, for which county breakdowns were not available.

Adams.—Quick and hydrated lime for building, chemical, and industrial uses were produced at plants near Marblehead by Marblehead Lime Co. and near Quincy by Menke Stone & Lime Co. These companies and the Black White Limestone Co. operated underground limestone mines in the county. Missouri Gravel Co. quarried limestone near Richfield. Western Illinois Stone Co. produced crushed limestone from three quarries, near Loraine, Marcelline, and Quincy. Limestone was produced for various purposes, including concrete aggregate and roadstone, agricultural use, flux, mineral food, various fillers, riprap, manufacturing lime, and other uses.

Quincy Sand Co. produced sand and gravel for building, fill, and other uses at a dredging operation near Quincy. Blick's Construction Co. produced sand near Quincy for railroad ballast and paving use. The Illinois Highway Department contracted for paving sand.

Triple S Mines began operating a strip coal mine near Augusta. The output was cleaned by jigging and sold for local consumption.

Alexander.—Tripoli was produced by Ozark Minerals Co. and Tamms Industries, Inc., near Elco and Tamms, respectively. The

output of both companies was mined underground by room-and-pillar methods. Mining for Ozark Minerals Co. was handled by an independent contractor. The crude material was crushed, ground, sized, and dried at mills operated by both companies. Most processed material was shipped by rail. Demand for the product has been fairly steady for several years.

H. H. Halliday Sand Co. operated a dredge on the Ohio River near Cairo and produced sand and gravel for building and road construction and engine use. Road gravel was produced for the State Highway Department under contract.

Sandstone was produced near Elco by the Western Fire Brick Co. The crude material was shipped to the company plant at East St. Louis for grinding. Output was sold for refractory use.

Bond.—Clay was mined near New Douglas by the Richards Brick Co. The output was used by the company for manufacturing building brick at its plant in Edwardsville, Madison County.

The Bond Stone Co. produced crushed and broken limestone for roadstone, agricultural use, and riprap.

Sand and gravel for road use was produced by Cyril Munie near Keyesport. Greenville Gravel Co., Inc., continued operation of its fixed plant near Greenville and produced sand and gravel for building. The State highway department contracted for paving sand.

Boone.—Belvidere Lime Quarry and Charles Lee & Sons operated portable crushing plants near Belvidere and Kirkland, respectively, and produced crushed limestone for roadstone and agricultural use.

Christensen & Smith produced gravel for road use near Capron. Vincent Spencer Sand & Gravel operated a fixed plant near Belvidere and produced sand and gravel for building use and fill. Road gravel was produced under contract for the State and county highway departments.

Munson Bros. & Co. mined clay near Capron. The entire output was used by the company for manufacturing draintile.

Brown.—T. F. Hollembeak & Sons produced limestone for agricultural and road purposes and sand and gravel for road use, fill, and other purposes near Mount Sterling. Road gravel was also produced near Versailles.

The Frederic Brick & Tile Co. produced clay near Mount Sterling. The company used the material for manufacturing building brick and draintile.

Bureau.—Coal was produced by Midland Electric Coal Corp. from its strip mine near Mineral—the only active coal mine in the county.

Clay was mined near Sheffield by the Sheffield Shale Products Co. for use in manufacturing building brick and other heavy clay products.

Sand and gravel was produced by six commercial operators near Bureau, Manlius, Princeton, Spring Valley, Walnut, and Wyanet. Output was used for building and road construction, fill, molding sand, and other purposes. Sand and gravel was also produced under contract for the State and county highway departments.

A zinc smelter was operated near Depue by the New Jersey Zinc Co.

Champaign.—Expanded perlite was produced by the Ryolex Corp. at its Champaign plant for use chiefly as lightweight aggregate in plaster and concrete.

TABLE 10.—Value of mineral production in Illinois, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Adams	$1,462,997	$1,773,784	Stone, lime, coal, sand and gravel.
Alexander	188,438	219,853	Tripoli, sand and gravel, stone.
Bond	125,325	215,029	Sand and gravel, stone, clays.
Boone	136,959	109,010	Do.
Brown	38,500	77,164	Sand and gravel, clays, stone.
Bureau	4,138,270	2,533,212	Coal, sand and gravel, clays.
Calhoun	17,250	38,753	Stone, sand and gravel.
Carroll	199,164	342,657	Do.
Cass	400		
Champaign	192,685	187,926	Sand and gravel.
Christian	20,340,169	(2)	Coal, stone.
Clark	597,862	(2)	Stone, sand and gravel.
Clay	25,000	25,000	Stone.
Clinton	484,627	394,819	Coal, stone, sand and gravel.
Coles	555,733	(2)	Stone, sand and gravel.
Cook	(3) (3)	26,618,246	Stone, lime, clays, sand and gravel, peat.
Crawford	117,805	(2)	Sand and gravel.
Cumberland	(2)	(2)	Do.
De Kalb	428,899	226,893	Sand and gravel, stone.
De Witt	(2)	(2)	Sand and gravel.
Douglas	(2)	2,176,833	Coal.
Du Page	(2)	(2)	Stone, sand and gravel.
Edwards	27,900	33,513	Clays.
Effingham	68,750	54,986	Stone, sand and gravel.
Fayette	39,984	42,795	Sand and gravel, clays.
Ford	61,797	109,250	Sand and gravel.
Franklin	19,958,656	19,758,759	Coal.
Fulton	22,667,998	19,766,933	Coal, sand and gravel.
Gallatin	642,525	284,286	Do.
Greene	417,598	185,939	Stone, clays, coal.
Grundy	3,728,589	(2)	Clays, sand and gravel, coal.
Hancock	562,094	321,525	Stone.
Hardin	10,873,284	9,785,734	Fluorspar, zinc, stone, lead, sand and gravel.
Henderson	222,884	255,066	Stone, sand and gravel.
Henry	438,979	525,771	Coal, sand and gravel.
Jackson	(2)	5,027,639	Coal, stone, sand and gravel.
Jefferson	(2)	(2)	Coal, stone.
Jersey	38,625	40,800	Stone, sand and gravel.
Jo Daviess	(2)	(2)	Zinc, lead, stone.
Johnson	(2)	549,090	Stone.
Kane	1,394,238	1,592,776	Sand and gravel, stone, peat.
Kankakee	4,595,586	3,982,257	Coal, stone, clays, sand and gravel.
Kendall	(2)	(2)	Stone, sand and gravel.
Knox	8,257,750	9,451,051	Coal, stone, clays, sand and gravel.
Lake	551,327	749,958	Sand and gravel, clays, stone, peat.
La Salle	33,985,762	35,137,126	Cement, sand and gravel, stone, clays, coal.
Lawrence	(2)	89,404	Sand and gravel.
Lee	(2)	(2)	Cement, stone, sand and gravel.
Livingston	1,828,344	1,946,254	Stone, clays, sand and gravel.
Logan	718,806	829,301	Sand and gravel, stone, coal.
McDonough	305,591	495,491	Stone, clays.
McHenry	2,481,806	2,949,613	Sand and gravel, stone.
McLean	(2)	1,128,949	Sand and gravel.
Macon	(2)	(2)	Do.
Macoupin	1,913,180	1,752,354	Coal.
Madison	4,732,133	4,298,470	Coal, stone, sand and gravel, clays.
Marion	77,361	72,230	Coal.
Marshall	514,786	392,658	Sand and gravel, clays.
Mason	(2)	3,629	Sand and gravel.
Massac	(2)	(2)	Stone, sand and gravel.
Menard	433,676	470,377	Stone, coal, clays.
Mercer	73,583	270,903	Stone, coal, clays, sand and gravel.
Monroe	(2)	(2)	Stone, sand and gravel.
Montgomery	(2)	(2)	Coal, stone.
Ogle	1,387,038	1,404,396	Sand and gravel, stone.
Peoria	3,779,092	3,918,147	Sand and gravel, coal, stone.
Perry	(2)	13,774,584	Coal.
Pike	234,183	299,569	Stone, sand and gravel.
Pope	(2)	9,273	Sand and gravel.
Pulaski	(2)	(2)	Stone, sand and gravel.
Putnam	10,100	3,544	Sand and gravel.
Randolph	3,447,015	3,374,146	Coal, stone. sand and gravel.
Rock Island	989,523	985,652	Stone, sand and gravel, clays.
St. Clair	17,725,105	22,636,012	Coal, stone, sand and gravel, clays.
Saline	11,383,410	(2)	Coal.
Sangamon	1,161,146	1,210,819	Sand and gravel, coal, clays.
Schuyler	134,474	(2)	Coal, sand and gravel, stone.
Scott	(2)	(2)	Stone, sand and gravel.
Shelby	35,750	43,500	Do.
Stark	6,000	(2)	Sand and gravel.
Stephenson	305,073	285,155	Stone, sand and gravel.
Tazewell	997,770	(2)	Sand and gravel, clays.
Union	(2)	746,560	Stone, sand and gravel.
Vermilion	5,702,325	5,832,257	Coal, stone, clays, sand and gravel.

TABLE 10.—Value of mineral production in Illinois, by counties [1]—Con.

County	1957	1958	Minerals produced in 1958 in order of value
Wabash	$183,133	$259,654	Sand and gravel.
Warren	99,753	(2)	Stone.
Washington	157,541	201,426	Coal, stone.
White	(2)	171,331	Sand and gravel.
Whiteside	465,047	330,513	Stone, sand and gravel.
Will	7,241,187	7,166,402	Sand and gravel, stone, coal.
Williamson	24,281,374	23,955,243	Coal, stone.
Winnebago	1,990,691	2,239,984	Sand and gravel, stone.
Woodford	115,989	(2)	Sand and gravel.
Undistributed	[3] 343,827,193	336,270,265	
Total	[3] 576,324,000	582,412,000	

[1] County figures exclude gem stones, petroleum, natural gas, natural gas liquids, and some stone and sand and gravel for which data by counties are not available: these are included with "Undistributed." The following counties are not listed because no production was reported: Edgar, Hamilton, Iroquois, Jasper, Morgan, Moultrie, Piatt, Richland, and Wayne.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.

Sand and gravel was produced by four commercial operators, from pits near Champaign and Mahomet for building and road purposes and fill. Sand and gravel for road use was produced under contract for the State highway department.

Christian.—Output of bituminous coal was solely from Peabody Coal Co. No. 10 underground mine near Pawnee. The mine was the third largest producer in the United States in 1958. The coal was cleaned by jigging and a portion oil-treated.

Limestone was quarried near Edinburg and Nokomis by Edinburg Quarries and the Tri-County Stone Co., respectively. Output was crushed and sold for agricultural and road purposes.

Clinton.—Bituminous coal was produced by Citizens Coal Co. and Marion County Coal Mining Corp. from underground mines near Breese and Centralia, respectively. The mine of Marion County Coal Mining Corp. extended into Marion County.

Crushed limestone was produced for concrete aggregate and roadstone.

Gravel was produced by W. D. Lindsey for road use and by the county highway department for building purposes.

Cook.—Crushed limestone was produced in the county for concrete aggregate and roadstone, agricultural use, railroad ballast, flux, asphalt filler, and other purposes. Material Service Corp. continued operating its Federal, Riverside, Stearns, and Thornton quarries. The last won top honors in the quarry group of the 1958 National Safety Competition. Other quarries were operated by Consumers Co. near La Grange and Hillside and by Dolese & Shepard Co. near Hodgkins. Consumers Co. began constructing new primary and secondary crushing plants at its McCook quarry near La Grange.

Marblehead Lime Co. produced quick and hydrated lime at plants in South Chicago and Thornton for building use and various chemical and industrial uses. Quicklime for refractory use was produced by the Standard Lime & Cement Co. at its La Grange plant.

Sand and gravel was produced by several companies near Elgin, La Grange, and Worth for building and road construction, railroad ballast, and fill. Paving sand was produced under contract for the State highway department.

Clays were produced in the county for manufacturing building brick and other heavy clay products. Producers during this year were Brisch Brick Co., Carey Brick Co., Chicago Brick Co., Illinois Brick Co., and Tuthill Building Materials Co.

Peat was produced by Henry Frenzer for soil conditioner.

The Pure Oil Co. recovered sulfur as a byproduct at its Lemont Refinery.

Expanded perlite was produced by the Silbrico Corp. at Chicago. The crude material was mined in Western States. The expanded product was used for lightweight aggregate in plaster and concrete, insulation, soil conditioner, and other purposes.

Exfoliated vermiculite was produced at Chicago by the Zonolite Co.

Blast and steel furnaces and coke-oven plants were operated in the Chicago area. Pig-iron producers were Interlake Iron Corp., International Harvester Co., Republic Steel Corp., and United States Steel Corp. Blast furnaces of Youngstown Sheet & Tube Co. were idle throughout the entire year. All companies except United States Steel Corp. produced coke.

Steel was produced from open-hearth, bessemer, and electric furnaces in the Chicago area. Operating companies were A. Finkl & Sons Co., Columbia Tool Steel Co., Ingersoll Products Div. of Borg-Warner Corp., International Harvester Co., Republic Steel Corp., and United States Steel Corp.

The Portland Cement Association added a new Structural Development Laboratory and a special research center for making fire tests to its research and development center at Skokie.

Douglas.—Bituminous coal was produced by Moffat Coal Co. from an underground mine near Murdock. The entire output was cleaned by jigging.

Edwards.—The Albion Brick Co. produced miscellaneous clay near Albion and used the material chiefly for manufacturing building brick.

Fayette.—Diller Shale Products Co. acquired the properties formerly operated by the St. Elmo Brick & Tile Co. near St. Elmo. In 1958 the company mined clay from a pit one-half mile from the plant and used the material chiefly for manufacturing draintile sold principally to farmers in the area.

Burtschi Sand & Gravel Co. operated a fixed sand and gravel plant near Vandalia and produced material for building and road construction and fill. Chas. D. Lutz & Sons produced molding sand near Mulberry Grove.

Franklin.—Franklin County ranked fourth in the State in production of bituminous coal. Underground mines near West Frankfort were the No. 2 mine of Chicago, Wilmington, & Franklin Coal Co. and the No. 9 mine of Old Ben Coal Corp. The latter company worked two other mines in the county—the No. 14 at Buckner and the No. 22 at Valier. Virtually all coal output in Franklin County was cleaned by washing, jigging, and pneumatic methods. Late in the year Old Ben Coal Corp. began developing a new underground mine near Sesser. Planned capacity was to be about 10,000 tons a day. Production was expected to begin early in 1960.

Fulton.—Bituminous coal was produced by 12 companies from 3 underground and 11 strip mines. Fulton County continued to be a

major coal-producing county, ranking third in 1958. The principal producers included Fairview Collieries Corp., Little Sister Coal Corp., Truax-Traer Coal Co., and The United Electric Coal Cos., all operating strip mines. Approximately 72 percent of the marketable production was shipped to consumers by rail, nearly 24 percent by barge, and the remainder by truck. In January Peabody Coal Co. abandoned its Key strip mine near Astoria. Lump Coal Co. abandoned its No. 2 strip mine and opened a new one—the No. 3—in May. Both mines were near Cuba.

Sand and gravel was produced by three commercial operators, at fixed plants near Canton and a dredging operation near Havana, for building and road construction and other purposes. Contract work was done on State, county, and township roads.

Gallatin.—Coal was produced by seven companies, operating three underground mines, five strip mines, and one auger mine. No mechanical coal cleaning was done. Barge shipments constituted over 70 percent of the coal shipped to consumers. Nearly all of the remainder was sold to local trade. Several small strip mines were opened. Barbie Dee Mines, Inc., began operating an auger mine in 1958.

The county highway department produced sand and gravel near Shawneetown for building purposes. The Illinois Highway Department contracted for sand and gravel for road use.

Greene.—American Vitrified Products Co. produced clay near White Hall and used the material chiefly for manufacturing vitrified sewer pipe. Clay was produced near Roodhouse for use in manufacturing building brick.

Crushed and broken limestone was produced for agricultural and road purposes and riprap.

The only producer of bituminous coal was the Birch Creek Coal Co., which operated a strip mine near Roodhouse. The output was for local consumption; a portion was oil-treated.

Grundy.—Clay was mined by Illinois Clay Products Co. near Coal City and Morris for refractory use and for heavy clay products. A fire at the Coal City plant caused damage estimated at $100,000.

Sand and gravel was produced by Material Service Corp. near Morris for building use and other purposes.

Peabody Coal Co. produced coal from a strip mine near Wilmington. The mine extended into Kankakee and Will Counties.

Hardin.—Fluorspar was the principal mineral produced. The major producing companies were Aluminum Company of America, Minerva Oil Co., Ozark-Mahoning Co., and Southern Illinois Mining Co. The last company purchased the interests of Mackey-Humm Mining Co. and Hicks Creek Mining Co. at the end of 1957. During 1958 Southern Illinois Mining Co. installed a new crusher and expanded its flotation mill near Golconda. The company processed ores from its own mines, as well as custom ores from several smaller producers. The company ceased all mining and processing activities at the end of 1958.

Aluminum Company of America continued to operate its group of mines and mill near Rosiclare. Operations during the latter part of the year were on a 4-day-week basis, with some reductions also in the labor force. The company processed some ores purchased

from other producers. Fluorspar, lead, and zinc concentrates were produced at the company mill.

Minerva Oil Co. operated its Crystal and No. 1 mines. A new ball mill was installed at the No. 1 plant. The company produced fluorspar and zinc concentrate at both mills, as well as lead concentrate at the Crystal mill. With the reduced demand for Metallurgical-grade fluorspar, part of the crew at the Crystal mine was released.

Ozark-Mahoning Co. produced fluorspar and zinc concentrate at its flotation mill near Rosiclare. Ores were produced at the company mines near Cave-in-Rock.

Operations at fluorspar properties of Rosiclare Lead & Fluorspar Mining Co. were resumed under contract leases. Lessee of the Eureka mine was Tamora Mining Co. The Interstate property was leased to Conn & Joiner and Omar Austin. The latter also leased the Rosiclare flotation plant, which had been inactive since 1954.

Several smaller companies mined fluorspar ore that was processed by other companies.

Crushed limestone was produced by four commercial operators, chiefly in the vicinity of Cave-in-Rock and Elizabethtown. Output was for concrete aggregate and roadstone, agricultural use, and flux.

Road gravel was produced by George Glass and under contract for the State highway department.

Henry.—Underground coal mines were operated near Alpha and Coal Valley. Over 90 percent of the output was shipped to consumers by rail. The Alpha Coal Co. underground mine was idle the entire year.

Sand and gravel output for building and road construction was reported by two commercial operators operating portable plants. The county highway department contracted for paving sand.

Jackson.—Bituminous coal was produced by four companies, operating two underground and three strip mines. Truax-Traer Coal Co. operated both an underground and a strip mine. Three cleaning plants were active. In February operations were suspended at the strip mine of Sand Hill Co., with no production reported for 1958. In July the C. & M. Coal Co. suspended operations at its strip mine.

Crushed limestone for agricultural and road purposes was produced near Ava by the Illinois Quarry Co.

Lawder Sand Co. produced sand and gravel near Grand Tower for building and road construction, railroad ballast, and fill.

Jefferson.—Coal was produced by Freeman Coal Mining Corp. and the Belle Rive Mining Co. near Waltonville and Belle Rive, respectively. The Orient No. 3 underground mine of the former company was the second largest producing mine in the Nation in 1958. A heavy-medium washery was installed at the Orient No. 3 plant for rewashing jig-washed coal at a rate of 200 tons an hour, bringing the preparation plant capacity to 350 tons an hour of rewashed jig coal.[4]

Crushed limestone for concrete aggregate and roadstone was produced near Dix by the Randall Stone Co.

Jo Daviess.—Three companies mined lead-zinc ores. Eagle-Picher Co. operated its group of properties throughout the year. Ore was

[4] Keystone Coal Buyers Manual, Monthly News Bulletin Service: April 1958.

concentrated by flotation, jigging, and tabling at the company Graham mill, which also treated ore mined by the company in Wisconsin. Tri-State Zinc, Inc., operated its Gray and Amelia mines. Ore from both mines was treated at the company Gray mill. Hickory Hill Mining Co. operated the Hartwig and Smith mines. Ore from these properties was concentrated at plants of other companies. Both mines were closed during November and December.

Crushed limestone was produced by four companies, operating portable plants chiefly near Galena, Elizabeth, and Stockton. Output was for concrete aggregate and roadstone and agricultural use.

Kankakee.—The only producer of coal was the Peabody Coal Co., operating a strip mine near Braidwood. The mine extended into Grundy and Will Counties.

Crushed limestone was produced by two companies near Lehigh and Manteno. Output was for agricultural and road use and railroad ballast.

Clay was mined near Kankakee and St. Anne for manufacturing building brick and other heavy clay products.

Paving sand was produced under contract for the State highway department.

Knox.—Bituminous coal composed over 93 percent of the value of mineral output. Production was from four strip mines, operated by Midland Collieries, Inc., Stonefort Corp., and Midland Electric Coal Corp. The last company operated two mines. The entire county coal output was cleaned at two plants.

Crushed limestone for agricultural and road use was produced by Abingdon Rock Co. from a quarry near Abingdon.

The Purington Brick Co. produced clay near Galesburg and used the material for manufacturing building brick.

L. K. Bandy Construction Co. produced sand and gravel for road use and fill near Maquon.

Lake.—Sand and gravel was produced by six commercial operators, chiefly in the vicinity of Antioch and Waukegan. Output was used for building and road construction, railroad ballast, and fill. Road gravel was produced by the county highway department and under contract for both the State and county highway departments.

The National Brick Co. mined clay near Deerfield for manufacturing building brick.

Crushed limestone for road use was produced by the Economy Crushed Gravel Co., Inc., operating a portable plant near Gurnee.

The Milburn Peat Co. and Marvin Walker Peat Co. produced peat near Lake Villa. The output was used chiefly for soil conditioning.

Coke for foundry use was produced at Waukegan by the Chevrolet & Saginaw Grey Iron Foundry Division of General Motors Corp.

The Lake Zurich Concrete Products Co. processed perlite at its plant in Lake Zurich. Crude material processed was mined in New Mexico. The expanded product was used chiefly as lightweight aggregate in plaster and concrete.

La Salle.—Portland and masonry cements were produced by three companies at plants near La Salle and Oglesby. Approximately 1 month's production was lost at one plant because of floods. All three companies quarried limestone for use in manufacturing ce-

ment. Crushed limestone for agricultural use and roadstone was also produced near Troy Grove, Utica, and Sheridan.

Alpha Portland Cement Co. and Marquette Cement Mfg. Co. produced shale for use in manufacturing cement. La Clede-Christy Co. produced clay near Ottawa for refractory use. Clay used in manufacturing building brick was produced by the Conco-Meier Co. and Arthur Mart near La Salle and Utica, respectively. Arthur Mart sold his business to Streator Brick Co., Division of Hydraulic-Press Brick Co., near the end of 1958. Mathiesen & Hegeler Zinc Co. mined clay which it used chiefly for manufacturing zinc retorts for the company zinc smelter at La Salle.

Early in 1958 Material Service Corp. began operation of a new expanded-shale plant near Ottawa. Three sizes of aggregates were produced in 2 kilns from the local Canton shale, ¾ x ⅜ in., ⅜ x 3/16 in., and 3/16 x 0. The plant is on the Illinois River, enabling the company to ship the products economically to markets throughout the Midwest.

The La Clede-Christy Co. and Arthur Mart produced coal for their own use in conjunction with their clay-pit operations.

Sand and gravel was produced by 10 companies. Output was for building and construction, fill, and special uses such as glass manufacture, molding, grinding and polishing, sandblasting, foundry use, filter purposes, filler, enamel, pottery, engine use, and other purposes. Producers of silica sands included: The American Silica Sand Co., Inc., E. C. Bellrose Sand Co., La Salle Silica Co., Ottawa Silica Co., and Wedron Silica Co. The Ottawa Silica Co. acquired the interests of Standard Silica Co.

Lee.—The Medusa Portland Cement Co. produced portland and masonry cements at its Dixon plant. Two new bulk-loading silos, 84 feet high and 26 feet in diameter, were added to the shipping section of the plant. The company also quarried limestone, which it used for manufacturing cement. Crushed limestone was also produced by five other companies near Dixon, Franklin Grove, and Steward for agricultural and road purposes. Sand and gravel was produced near Dixon and Steward for building and road construction and other uses. The State highway department contracted for sand and gravel for road use.

Livingston.—The Hydraulic-Press Brick Co. produced clay near Streator for use in manufacturing building brick. Diller Tile Co., Inc., mined clay near Chatsworth and used the material for manufacturing building brick. The company enlarged its plant facilities. Streator Drain Tile Co. produced clay near Streator for manufacturing draintile and other heavy clay products. The company mined less than 1,000 tons of coal in conjunction with its clay pit operations, and used it in its principal activity as manufacturing clay products. The strip mine of Baiett & Talbot Coal Co. had been abandoned in 1957.

Several companies produced crushed limestone near Chenoa, McDowell, and Pontiac. The output was used for agricultural and road purposes, railroad ballast, and asphalt filler. The Chenoa Stone Co. added a hammer mill for secondary crushing, and increased the plant screen capacity.

Paving gravel was produced near Manville.

Logan.—Coal was produced from an underground mine operated near Lincoln by Lincoln Coal Mining Co. for local consumption.

Crushed limestone for agricultural and road use was produced near Lincoln by the Rocky Ford Limestone Co.

Sand and gravel for building and road construction, engine use, and fill was produced at a dredging operation of the Lincoln Sand & Gravel Co., near Lincoln.

McDonough.—Clay was produced near Colchester by several companies. This output was used for manufacturing pottery, stoneware, and heavy clay products. At the end of 1958 facilities of Baird Clay Mines were purchased by Western Stoneware Co. Booz & Co. prepared to open a clay pit near Colchester, planning to begin production in 1959.

Crushed and broken limestone for agricultural and road purposes and riprap was produced near Colchester.

Macoupin.—Coal was produced at underground mines of Little Dog Coal Co. and Virden Mining Corp. near Gillespie and Virden, respectively. The entire output of Little Dog Coal Co. was cleaned by jigging and tabling. A portion was treated with oil to allay dust.

Exfoliated vermiculite was produced by International Vermiculite Co. at Girard from crude material mined in Montana. Output was used chiefly for loose fill and high-temperature insulation.

Madison.—Coal was produced from three underground mines operated by Livingston-Mt. Olive Coal Co., Lumaghi Coal Co., and Glen Carbon Mines, Inc. The mine of the latter company was closed in August.

Limestone was quarried near Godfrey and Alton. Material was used for agricultural and road use, riprap, and other purposes.

Sand and gravel was produced at dredging operations near Alton and Granite City. Output was for building and road construction, engine use, fill, and other purposes. Paving sand was produced under contract for the State highway department.

The Alton Brick Co. produced clay near Alton for use in manufacturing building brick. Western Fire Brick Co. operated a plant in Granite City, manufacturing firebrick from clay produced in Missouri. The company operated three kilns, two rectangular periodic kilns, and one beehive type. All kilns were coal-fired. The plant is near the furnaces of Granite City Steel Co., a large consumer. Sandstone produced by Western Fire Brick Co. in Alexander County was shipped to the Granite City plant and crushed. The material was used chiefly for patching furnaces.

The Granite City Steel Co. operated coke ovens and blast and steel furnaces at Granite City. Contrary to the marked drop in output from other plants in the State, production at these facilities was maintained at a fairly high level throughout the entire year. Laclede Steel Co. produced steel from open-hearth furnaces at Alton.

The American Smelting & Refining Co. operated its Federal lead smelter at Alton.

Marion.—The only producer of coal was the Marion County Coal Mining Corp., operating an underground mine at Centralia. The mine extended into Clinton County. Tonnage produced in the Marion County portion decreased nearly 7 percent below 1957.

Marshall.—Miscellaneous clay used in manufacturing building brick was produced near Sparland by the Hydraulic-Press Brick Co.

Consumers Co. produced sand and gravel for building and road construction at a dredging operation near Lacon. The operation was abandoned in 1958. Road gravel was produced near La Rose by Vernon Henry.

Menard.—Bituminous coal was produced from three underground mines near Petersburg. Output, all for local consumption, increased slightly over 1957. The mine formerly operated by Indian Creek Coal Co. was acquired by Storey Coal Co. in September.

Crushed limestone for agricultural and road purposes was produced near Athens by Athens Stone Quarry and Indian Point Limestone Products.

Clay was mined in the county by Springfield Clay Products Co. Material was used by the company for manufacturing building brick and other heavy clay products.

Mercer.—Two coal mines, one strip and one underground, were opened during the year. The strip mine was operated by Eddington Coal Co.; the underground, by Hazel Dell Coal Corp.

Crushed limestone for road use was produced by Linn Materials, Inc. near Viola.

The Hydraulic-Press Brick Co. mined clay near Aledo and used the material for manufacturing building brick.

Road gravel was produced under contract for the State highway department.

Montgomery.—The sole producer of coal was the Freeman Coal Mining Corp., operating an underground mine near Farmersville. The entire output was cleaned by jigging and pneumatic methods.

Crushed limestone was produced by two companies near Litchfield and Nokomis for roadstone and agricultural use.

Peoria.—Coal production from five underground and six strip mines was used locally. Two jig cleaning plants were operated. Mining at the underground mine of Lee Coal Mining Co. was discontinued in March. A strip mine operated by Lingenfelter Coal Co. was also closed.

Production of sand and gravel was reported by five companies at plants near Chillicothe and Peoria. Output was used for building and road construction, railroad ballast, and other uses. Sand and gravel for road purposes was produced under contract for the city of Peoria and the State highway department.

Crushed limestone for agricultural use and roadstone was produced by three companies near Princeville.

Steel was produced from open-hearth furnaces operated by Keystone Steel & Wire Co. at Peoria.

Perry.—Perry County ranked fifth in production of coal. Output was from five strip and two underground mines. Major producers were Southwestern Illinois Coal Corp., Truax-Traer Coal Co., Union Colliery Co., and The United Electric Coal Cos. The New Kathleen underground mine, formerly operated by Union Colliery Co., was acquired by Truax-Traer Coal Co. in June. In September the mine was closed. White Bros. Coal Co. abandoned its strip mine near Pinckneyville in March.

Pope.—Crude fluorspar ore mined in the county was processed at plants in Hardin County. Work began in July on a contract between the DMEA and the New Jersey Zinc Co. for exploration of a fluorspar deposit. Work was still in progress at the end of 1958.

Gravel for building use was produced by the county highway department. Road gravel was produced under contract for the State highway department.

Randolph.—Coal was produced from one strip and two underground mines. Ritter Coal Co. and Zeigler Coal & Coke Co. also operated cleaning plants. In November the Miner's Coal Co. acquired the Beveridge underground mine, formerly operated by Sparta Coal Co.

Crushed limestone was produced by four companies near Chester, Menard, and Prairie du Rocher. Output was for concrete aggregate and roadstone, agricultural use, chemical purposes, and other uses.

Sand for building and road construction, engine use, filter purposes, and fill was produced by Southern Illinois Sand Co. at a dredging operation near Chester.

Rock Island.—Crushed limestone for agricultural and road purposes was quarried by three companies near Cordova, Hillsdale, and Milan.

Sand and gravel was produced by six commercial operators near Albany, Cordova, Milan, and Moline. Several companies produced material at dredging operations. Output was used for building and road construction, molding use, fill, and other purposes. Road gravel was produced under contract for the State Highway Department.

Van-Packer Co. Division of The Flintkote Co. produced clay near Carbon Cliff and used the material for manufacturing flue liners.

St. Clair.—St. Clair County ranked second in bituminous coal production. Output increased 33 percent over 1957, chiefly because of the first full year's operation of the Peabody Coal Co. River King mine near Freeburg. Coal was mined from five underground and four strip mines, operated by six companies. Peabody Coal Co. was the largest producer operating one underground and three strip mines. Over 98 percent of the county coal output was cleaned at eight preparation plants, among which was a plant opened in 1958 by the Shiloh Valley Coal Co.

Limestone was quarried for agricultural use, roadstone, railroad ballast, rough architectural purposes, flagging, riprap, and other uses. Producers included Columbia Quarry Co., East St. Louis Stone Co., Hecker Quarry, Inc., and Casper Stolle Quarry & Construction Co.

The Missouri-Illinois Material Co. produced sand near East St. Louis for building and road construction and engine use.

The Hydraulic-Press Brick Co. produced clay near East St. Louis and used the material chiefly for manufacturing lightweight aggregate. The Hill Brick Co. mined clay near Belleville for use in manufacturing building brick.

The American Zinc Co. of Illinois operated zinc smelters at Fairmont City and Monsanto. Germanium was recovered at the Fairmont City plant. The Monsanto plant was closed for 3 weeks early in 1958 to complete necessary repairs and for 4 weeks in October because of a labor strike.

The Aluminum Company of America produced gallium, fluoride, and various chemicals at its East St. Louis plant. Lime-producing operations at the plant were discontinued by the company late in 1957.

Saline.—Saline County was a major coal-producing county. Coal was produced from two underground, six strip, and four auger mines. Principal producers during the year were Sahara Coal Co.,

Inc., and Saxton Coal Corp. Six other companies also mined coal. The Central Preparation Plant of Sahara Coal Co., Inc., processed coal from the company No. 6 strip mine and No. 5 and No. 16 underground mines in the county. Coal produced by Saxton Coal Corp. was cleaned by jigging methods at its plant near Harrisburg. Auger-mining methods were employed by Barbie Dee Mines, Inc., operating two mines, one of which extended into Gallatin County; Fink Coal Co.; and Paddock Auger Mining Co. The latter conducted auger-mining operations at the Walnut Grove property of Saxton Coal Corp. Operations of the Fink Coal Co. were suspended in December.

Sangamon.—Coal for local consumption was produced by Cantrall Coal Co. and Eddy Coal Co., operating underground mines near Cantrall.

Poston Brick & Concrete Products Co. produced clay near Springfield. Output was used by the company chiefly for manufacturing building brick and lightweight aggregate. Springfield Clay Products Co. mined clay near Springfield for use in manufacturing heavy clay products.

Sand and gravel for building and road construction, fill, and other uses was produced near Springfield.

Schuyler.—Production of bituminous coal increased substantially over 1957. Peabody Coal Co. began production at the Key strip mine, a new operation near Rushville, in February. The company also started a new preparation plant at the mine. Other coal producers during the year were the D. & D. Coal Co., operating an underground mine near Rushville, and the Green Coal Co., operating a strip mine near Camden.

Western Illinois Stone Co. sold crushed limestone from stockpile for roadstone.

Sand and gravel was produced, partly under contract for the State highway department.

Tazewell.—The Peoria Brick & Tile Co. produced clay near East Peoria and used the material principally for manufacturing building brick.

Sand and gravel for building and road construction, railroad ballast, engine use, filter purposes, and fill was produced from plants near East Peoria, Mackinaw, Pekin, and Washington.

Vermilion.—Production of coal increased nearly 3 percent over 1957. Fairview Collieries Corp. and The United Electric Coal Cos. continued to furnish the bulk of the output from their strip mines. All active mines were in the vicinity of Danville. Nearly 96 percent of the coal output was cleaned at three preparation plants.

Clay was produced by the Western Brick Co. near Danville. The material was used by the company for manufacturing building brick and lightweight aggregate.

Material Service Corp. produced crushed limestone for road use at its Fairmount quarry.

Sand and gravel for road use, fill, and other purposes was produced near Danville and Westville.

Washington.—Coal for local consumption was produced at underground mines operated by the Bois Coal Co. and Venedy Coal Co.

Crushed limestone was produced in the county for roadstone.

Will.—Two strip mines near Braidwood, operated by Peabody Coal Co. and Wilmington Coal Mining Corp., furnished the entire coal

output. The mine of the latter company was abandoned in April.

Limestone was produced in the county for roadstone, railroad ballast, agricultural use, riprap, and other purposes. Sand and gravel was produced for building and road construction, railroad ballast, fill, and other uses.

F. E. Schundler & Co., Inc., processed crude perlite and vermiculite, mined in Western States, at Joliet. The processed material was used chiefly as lightweight aggregate in plaster and concrete and for insulation purposes.

The United States Steel Corp. produced coke at its Joliet Works. Coke-oven facilities at this location were retired February 28.

Williamson.—The county continued to rank first in the State in coal production. Output was from 18 underground and 15 strip mines. Major producers included Bell & Zoller Coal Co., Carmac Coal Co., Freeman Coal Mining Corp., Peabody Coal Co., and Stonefort Corp. Over 5.4 million tons of coal was cleaned at 13 preparation plants in 1958. Utility Coal Co. opened a strip mine near Marion in April.

The county highway department produced limestone for road use and riprap.

The Mineral Industry of Indiana

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey, Indiana Department of Conservation.

By Donald F. Klyce [1] and John B. Patton [2]

MINERALS valued at $197.7 million were produced in Indiana in 1958, nearly equaling the 1957 record of $198 million. Increased demand for building materials (cement, gypsum, sand and gravel, and crushed stone) offset a drop in fuel production. An exception was a substantial decrease in the demand for dimension stone. The increased use of building materials, such as glass and metallic panels and facings, continued to affect the market for cut and sawed stone.

During 1958 large-scale modernization and expansion of several Indiana cement plants continued. The program, when completed, will provide the most efficient type of operation with a high degree of automation.

The scheduled opening of the St. Lawrence Seaway in 1959 stimulated interest in the areas along the shores of Lake Michigan in Lake County, particularly for industrial expansion in the steel industry. This interest was indicated by preliminary plans for plant construction. Major steel companies acquired land in the area.

According to estimates reported by the U.S. Army Corps of Engineers,[3] steel capacity in the Chicago area will expand about 29 percent in the next 50 years. To supply the raw material for such expansion, increased quantities of iron ore, coal, limestone, and other materials used in steel manufacture will be required and the mineral economy of the entire region will be stimulated.

Employment and Injuries.—Preliminary data indicated a total of 24 million man-hours worked in the State mineral industry, decreasing about 9 percent from 1957.

Reduced employment in coal mining and in industries affected by lower pig iron and steel production (coke ovens, smelters) furnished much of the loss. Nine fatalities were recorded compared with 6 in 1957. In addition to the fatalities indicated in the table 2, one fatal injury in 1958 was reported by a clay producer.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.
[2] Acting State Geologist, Geological Survey, Indiana Department of Conservation, Bloomington, Ind.
[3] U.S. Army, Engineers Division, Corps of Engineers, Iron Ore Traffic Analysis: Chicago, 1958, pp. 56, 66.

All employment and injury data for the mineral industry of the State were collected from active companies on a voluntary basis. Data represents virtually complete coverage of cement, coal, and coke production and a high percentage of stone output.

TABLE 1.—Mineral production in Indiana [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasives (whetstones)	4	$8	10	$10
Cement (Portland) ____thousand 376-pound barrels____	12,598	40,742	14,730	48,858
Clays____thousand short tons__	1,475	2,569	1,370	2,477
Coal [2]____do____	15,841	62,055	15,022	58,506
Natural gas____million cubic feet__	671	88	378	59
Peat	13,805	130	12,106	145
Petroleum (crude) thousand 42-gallon barrels	12,662	39,632	[3] 11,864	[3] 35,711
Sand and gravel____thousand short tons__	16,750	14,206	16,862	15,045
Stone____do____	14,460	33,094	15,394	31,974
Value of items that cannot be disclosed: Masonry and natural Cement and gypsum		[4] 7,675		7,539
Total Indiana [5]		[4] 198,034		197,677

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Related only to mines that produce 1,000 tons annually or more.
[3] Preliminary figure.
[4] Revised figure.
[5] Total adjusted to eliminate duplicating value of clays and stone.

TABLE 2.—Summary of employment and injuries for selected mineral industries [1]

Year and industry	Average number of men working	Total man-hours	Total lost-time injuries		Total days lost or charged	Injury-frequency rate	Injury-severity rate
			Fatal	Non-fatal			
1957							
Cement [2]	1,567	4,299,628	2	12	(3)	3.26	(3)
Coal	3,953	6,383,232	3	334	36,503	52.79	5,719
Coke ovens	2,314	6,753,204	----	15	(3)	2.22	(3)
Limestone [4]	2,981	5,816,208	1	197	(3)	34.04	(3)
Marl	16	25,280	----	----	----	----	----
Sandstone	117	231,610	----	15	(3)	64.76	(3)
1958							
Cement [2]	1,599	4,359,268	----	9	(3)	2.06	(3)
Coal	3,688	5,881,223	3	275	33,338	47.10	5,669
Coke ovens	1,996	5,824,122	1	12	(3)	2.23	(3)
Limestone [4]	2,693	5,414,042	4	179	(3)	33.80	(3)
Marl	11	20,240	----	----	----	----	----
Sandstone	107	209,787	----	21	(3)	100.10	(3)

[1] Data exclude officeworkers. Preliminary figures for 1958.
[2] Includes cement plants and quarries or pits that produce raw material for cement.
[3] Figure not available.
[4] Excludes quarries that produce limestone exclusively for cement.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Materials.—Whetstones were quarried from the Hindostan quarry in Orange County by the Hindostan Whetstone Co. of Bedford. Only in Indiana and Arkansas was commercial production of whetstones reported.

Cement.—Portland and masonry cements were produced at Limedale by Lone Star Cement Corp., at Mitchell by Lehigh Portland Cement Co., at Speed by the Louisville Cement Co., and at Buffington by Universal Atlas Cement Co. Natural cement was also produced at Speed by the Louisville Cement Co.

Universal Atlas Cement Co. completed a separate and fully integrated plant at Buffington. The new plant, which augmented the existing plant, has two kilns, five ball mills, and two raw mix and three clinker grinding units. Separate packing, loading, and storage facilities were provided.

Late in 1958 Louisville Cement Co. completed another phase of plant improvement at Speed. Construction included an 11- by 390-foot kiln, a mill, blending system, clinker cooler, bulk-loading system, and 12 cement storage silos (capacity of 200,000 barrels).

Lehigh Portland Cement Co. started a plant reconstruction program at Mitchell. Orders were placed for two 11.6- by 440-foot kilns that will equal the capacity of 10 kilns now in use. The new kilns were to be in operation late in 1959.

The Indiana Geological Survey investigated sources of cement raw materials.[4]

Nearly 3.1 million tons of limestone, over 300,000 tons of clay and shale, and large quantities of slag, gypsum, and sand were used in manufacturing cement. Over 300 million kilowatt-hours of electrical energy was used by the cement plants.

Clays.—Fire clay was produced in five counties and was used for pottery and stoneware, floor and wall tile, architectural terra cotta, fire brick, and heavy clay products.

Miscellaneous clays were mined in 22 counties. The material was used in manufacturing heavy clay products (building and paving brick, drain tile, sewer pipe), cement, lightweight aggregates, and stoneware.

TABLE 3.—Clays sold or used by producers, in thousands

Year	Fire clay		Miscellaneous clays		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	473	$835	971	$992	1,444	$1,827
1954	374	700	1,572	2,291	1,946	2,991
1955	529	1,021	1,200	1,917	1,729	2,938
1956	645	1,202	1,405	2,255	2,051	3,457
1957	398	748	1,077	1,821	1,475	2,569
1958	315	518	1,056	1,959	1,370	2,477

[4] McGregor, Duncan J., Cement Raw Materials in Indiana, Indiana Dept. of Conservation, Geol. Survey, Bull. 5, December 1958, 88 pp.

The value of products manufactured from Indiana clay was estimated at $29,783,000 by the Indiana Geological Survey.

A report was published on lightweight aggregate potentialities of some Indiana shales.[5]

Gypsum.—Gypsum mines in Martin County were operated by National Gypsum Co. and United States Gypsum Co. At mills adjoining the mines the crude gypsum was processed and used to manufacture lath, wallboard, prepared plasters, and other products. Production of both crude ore and finished products was larger than in 1957.

Mineral Wool.—Mineral wool was manufactured at plants in Madison, Starke, Wabash, and Wayne Counties from blast furnace slag produced in Lake County steel mills.

Perlite.—Crude perlite, mined in Western States, was expanded at plants in Hammond (Lake County) and Vienna (Scott County). The processed material was used as lightweight aggregate for plaster and special types of concrete.

Roofing Granules.—Roofing granules were produced from slag at Hammond by H. B. Reed & Co., Inc.

Sand and Gravel.—The Indiana Geological Survey issued a map that showed widespread distribution of sand and gravel deposits.[6] Commercial production was reported from 65 counties by 179 operators.

County highway departments in 14 counties reported prodution of sand and gravel, mostly for road use. These were the only noncommercial operations reported as the State highway department, city governments, and most of the counties purchase building and road materials from commercial producers.

Major sand and gravel production came from Marion, Tippecanoe, Vermillion, Vigo, St. Joseph, Wayne, and Miami Counties. The 10 leading producers, in alphabetical order, were: American Aggregates Corp., Indianapolis; Irving Bros. Gravel Co., Inc., Marion; Irving Materials, Inc. No. 2, Fortville; Kickapoo Sand & Gravel Corp., Peru; Koch Sand & Gravel Co., Evansville; Material Service Corp., Chicago, Ill.; Neal Gravel Co., Inc., Covington; Portage-Manley Sand Co., Rockton, Ill.; Standard Materials Corp., Indianapolis; and Western Indiana Gravel Co., Lafayette.

Demand for materials for building construction increased over 20 percent, reversing a trend set in 1957. Requirements for road materials dropped about 5 percent because of a slowdown in the highway construction program.

The Indiana State Highway Department reported 51.4 miles of interstate highway under construction. In the State system of primary, urban, and secondary roads 33.5 miles of concrete roads was completed and 312.5 miles was resurfaced. The State highway department experimented with soil aggregates in highway construction. Results of the tests indicated that the material can be successfully used if rigid controls are employed in mixing, spreading, and compacting.

A directory of sand and gravel producers was published.[7]

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[5] Murray, Haydn H., and Smith, John M., Lightweight Aggregate Potentialities of Some Indiana Shales: Indiana Dept. of Conservation, Geol. Survey, October 1958, 42 pp.

[6] Wayne, W. J., Glacial Geology of Indiana: Atlas Min. Res. Indiana, 1958, Map 10.

[7] McGregor, Duncan J., Directory of Sand and Gravel Producers in Indiana: Indiana Dept. of Conservation, Geol. Survey Directory 6, November 1958, 53 pp.

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses, in thousands

Class of operation and use	1957		1958	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Molding	(1)	(1)	345	$428
Building	2,775	$2,086	3,049	2,473
Paving	3,158	2,669	3,078	2,489
Blast	1	1		
Fire or furnace	159	159	(1)	(1)
Engine	101	73	79	75
Filter			3	4
Railroad ballast	(1)	(1)	4	2
Fill	165	89	(1)	(1)
Ground	2	2		
Other	71	56	23	18
Undistributed [2]	524	598	564	432
Total sand	6,957	5,732	7,145	5,921
Gravel:				
Building	2,532	2,418	2,782	2,995
Paving	5,561	5,121	4,802	4,835
Railroad ballast	503	394	433	346
Fill	553	292	1,093	612
Other	48	41	81	78
Total gravel	9,196	8,266	9,189	8,865
Total sand and gravel	16,153	13,998	16,334	14,786
GOVERNMENT-AND-CONTRACTOR				
Sand:				
Building	81	20		
Paving	4	1	61	40
Total sand	85	22	61	40
Gravel:				
Building	130	38	47	19
Paving	382	149	420	200
Total gravel	513	187	467	219
Total sand and gravel	597	209	528	259
ALL OPERATIONS				
Sand	7,042	5,753	7,206	5,961
Gravel	9,709	8,453	9,656	9,084
Grand total	16,751	14,206	16,862	15,045

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes molding and railroad ballast (1957) and glass, fire or furnace, and fill (1958).

Stone.—Limestone and sandstone were quarried.

Virtually the entire limestone production (over 95 percent) was crushed for various uses including cement manufacture, concrete aggregate and roadstone, filler, flux, railroad ballast, and agricultural purposes.

Crushed limestone was produced in 37 counties. Largest production came from Putnam, Clark, Lawrence, Allen, Newton, and Wells Counties. Major producers of crushed stone included Louisville Cement Co. in Clark County, May Sand & Gravel Corp. in Allen County, Mulzer Bros. in Crawford and Perry Counties, Newton County Stone Co., Inc., in Newton County, and The Ohio & Indiana Stone Corp. in Putnam County.

A study showing the distribution in part of southern Indiana of limestone suitable for crushed stone was published by the Indiana Geological Survey.[8]

Although a relatively small tonnage of the limestone quarried was used for building stone, dimension stone represented over two-fifths of the total stone value. About 75 percent of the dimension stone was milled in plants operated by the producers. Most of the remainder was sold as rough architectural block to independent finishing mills or to contractors. Limestone for building use was produced in five counties. The major quantity came from quarries in Lawrence and Monroe Counties. Leading producers of dimension limestone were: Indiana Limestone Co., Ingalls Stone Co., and Heltonville Limestone Co., Bedford; Bloomington Limestone Corp., Empire Stone Co., B. G. Hoadley Quarries, Inc., and Victor Oolitic Stone Co., Bloomington.

Sandstone was produced in four counties. With the exception of one producer, who quarried quartz conglomerate for use in refractory materials, the companies sawed or dressed sandstone for use as a building stone.

Sandstone was quarried for building purposes by Indiana Sandstone Co., Inc., and Leonard Sandstone Co., Inc., in Lawrence County, Hinkle Sandstone Co. in Monroe County, and Colored Sandstone Co. in Orange County. The French Lick Sandstone Co., Inc., quarried in Lawrence and Martin Counties and milled in Orange County.

General Refractories Co. quarried a quartz conglomerate in Martin County.

TABLE 5.—Limestone sold or used by producers, by uses, in thousands

Use	1957		1958	
	Short tons	Value	Short tons	Value
Dimension: Building:				
Rough construction, short tons	1	$1		
Rough architectural (block), cubic feet	2,937	2,928	2,941	$2,967
Dressed (cut and sawed), do	4,297	12,151	3,822	9,699
Flagging and rubble, do	965	156	931	188
Total (short tons approximate) [1]	595	15,236	558	12,854
Crushed and broken:				
Riprap, short tons	106	127	51	87
Flux, do	140	176	(2)	(2)
Concrete aggregate, roadstone, etc., do	9,063	11,384	9,916	12,559
Railroad ballast, do	271	326	233	286
Agriculture, do	2,229	2,947	2,304	3,047
Other [3], do	1,852	1,837	2,199	2,190
Total crushed and broken, do	13,661	16,797	14,702	18,170
Grand total, do	14,256	32,033	15,260	31,023

[1] 145 pounds per cubic foot.
[2] Included with "Other" to avoid disclosing individual company confidential data.
[3] Includes limestone for poultry grit and scrap for miscellaneous use (1957); other crushed stone (1958); and calcium-carbide plants, filter beds, glass factories, paint and rubber filler, asphalt, fertilizer, dust for coal mines, mineral food, mineral wool, and cement (1957–58).

[8] Smith, N. M., and Perry, T. G., The Meramec-Chester and Intra-Chester Boundaries and Associated Strata in Indiana: Indiana Dept. of Conservation, Geol. Survey Bull. 12, May 1958, 110 pp.

TABLE 6.—Production of calcareous marl

Year	Number of producers reporting	Short tons	Value	Year	Number of producers reporting	Short tons	Value
1953	4	13,540	$6,398	1956	8	99,561	$65,755
1954	6	28,536	18,515	1957	7	103,452	65,011
1955	5	17,080	10,543	1958	7	60,196	39,637

Calcareous marl was produced from pits in seven counties. The leading output came from Kosciusko, LaPorte, and Elkhart Counties. The material was sold for soil conditioning.

Slag.—Large quantities of slag were produced in Lake County as a byproduct of pig-iron production. It was used in manufacturing cement. It was also crushed for use as aggregate, expanded for lightweight aggregate, and sold as raw material for manufacturing mineral wool and roofing granules.

Sulfur.—Byproduct sulfur was recovered from crude petroleum at the Whiting refinery (Standard Oil Co. of Indiana). The Matheson-Fluor process was used.

MINERAL FUELS

Coal.—Coal production continued to decline to 5 percent less than in 1957. Operations dropped to 82 mines compared with 90 in 1957. Three mines were under development: The Squaw Creek mine near Boonville (to produce captive coal for the Aluminum Company of America Warrick works at Newburgh), the Thunderbird mine in Sullivan County (to supply the Breed Generating Station of the Indiana and Michigan Electric Co.), and the Hoosier Gem strip mine at Dugger. These mines were scheduled for operation in 1959. About 84 percent of the coal marketed was shipped to consumers by rail or water. Most of the balance was moved by truck. A small percentage was handled by special methods such as conveyors.

Nearly 10.1 million net tons of coal was cleaned mechanically at 19 plants. The Tri-K Mining Co., Terre Haute, contracted for new bituminous preparation facilities. Mining equipment sales to Indiana coal producers included three mobile loading machines, one continuous miner, eight shuttle cars, and eight gathering and haulage conveyors.

The Indiana Geological Survey issued a publication on the use of spores in correlating Indiana coals.[9]

A report described the methods of recovering roof bolts from mined-out areas for reuse in active sections at 12 coal mines in Illinois, Indiana, and Kentucky.[10]

The Federal Bureau of Mines began studying the effects of storage time and conditions on the heating values of laboratory samples of

[9] Guennel, G. K., Miospore Analysis of the Pottsville Coals of Indiana 1958: Indiana Geol. Survey Bull. 13, September 1958, 101 pp.
[10] Kelly, L. W., Roof-Bolt Recovery in the Middle West: Bureau of Mines Inf. Circ. 7826, 1958, 17 pp.

four high-volatile bituminous coals from Colorado, Indiana, Ohio, and Pennsylvania.[11]

Peat.—Peat was produced from bogs in Benton, Blackford, Grant, Hamilton, and Wells Counties. The output was sold for soil conditioning.

Petroleum and Natural Gas.—According to the Indiana Geological Survey[12] 902 wells were completed compared with 727 in 1957. Of this total, 585 were development wells and 317 were wildcats. Wells drilled for secondary-recovery or gas storage were not included.

A third of the wells drilled were successful (299 oil producers, 14 gas producers, 589 dry holes). Thirty-nine wildcat wells were successful, resulting in 12 new-field discoveries, 16 extensions, and 11 additional pay-zone discoveries.

TABLE 7.—Bituminous coal production, value, and number of mines operated in 1958, by counties

(Excluding mines that produce less than 1,000 short tons)

County	Production (short tons)			Total value	Number of mines operated	
	Underground	Strip	Total		Underground	Strip
Clay	2,847	765,135	767,982	$3,188,974	1	10
Daviess		18,000	18,000	68,400		1
Dubois	27,576		27,576	104,219	4	
Fountain		37,820	37,820	255,097		1
Gibson	460,030		460,030	2,069,378	2	
Greene	8,980	1,546,710	1,555,690	6,476,286	2	6
Knox	(1)	(1)	1,277,234	4,909,404	3	2
Owen		(1)	(1)	(1)		2
Parke		(1)	(1)	(1)		2
Pike	46,352	2,150,284	2,196,636	8,301,692	5	7
Spencer	5,674	(1)	(1)	(1)	1	1
Sullivan	(1)	(1)	525,102	2,297,419	4	1
Vermillion	23,662	113,484	137,146	631,003	3	1
Vigo	2,436,676	477,648	2,914,324	11,962,085	6	2
Warrick	396,771	4,469,690	4,866,461	17,194,576	7	8
Undistributed	1,294,266	740,619	238,223	1,047,171		
Total	4,702,834	10,319,390	15,022,224	58,505,704	38	44

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.

TABLE 8.—Production of peat

Year	Number of producers reporting	Short tons	Value	Year	Number of producers reporting	Short tons	Value
1949	7	7,949	$28,537	1954	8	12,041	$59,149
1950	5	5,793	18,966	1955	6	9,053	49,924
1951	5	5,699	22,824	1956	7	11,383	78,594
1952	9	10,115	49,775	1957	8	13,805	129,750
1953	6	6,919	41,049	1958	5	12,106	144,974

[11] Abernethy, Roy F., and Tarpley, E. C., Change in Calorific Value and Certain Other Properties of High-Volatile Bituminous Coal Samples During Storage: Bureau of Mines Rept. of Investigations 5386, 1958, 13 pp.

[12] Dawson, T. A., and Carpenter, G. L., Oil Development and Production in Indiana During 1958: (In process) vol. 13, Soc. Petrol. Eng., AIME; Mineral Econ. Ser. 5 of Indiana Geol. Survey.

Although drilling was carried on in 46 counties, 760 of the completed wells were in 6 counties—Gibson, Spencer, Posey, Pike, Vanderburgh, and Sullivan. The greatest drilling success was in Gibson and Spencer Counties, where 30 of 39 successful wildcat wells were completed. Successful wildcat well completion stimulated development drilling in this area and the total well completions for Gibson and Spencer Counties was 206 more than in 1957.

The Indiana Geological Survey indicated [13] that many successful wildcats were completed in narrow, long sandstones of the Chester formation. Areas where lenticular sandstones exist between closely spaced dry holes have generally been considered poor prospects for oil. Because much of the successful drilling was completed in dry hole areas, the Survey concluded the "dry-hole approach" was not valid for condemning oil possibilities in any area of Chester rocks in southwestern Indiana. It was believed that the incident of oil discovery should be high in areas of numerous dry holes as drilling data and core analysis can be a basis for sound subsurface mapping of sand trends.

Secondary-recovery methods continued to be important, furnishing an estimated 35 percent of the 1958 production.

The Indiana Geological Survey published Petroleum Exploration Maps Nos. 5A and 5B for Vigo County, No. 53 for Gibson County, and No. 54 for Posey County, and issued revisions of numerous earlier maps.

TABLE 9.—Production of crude oil, 1958, by major fields [1]

Field	County	Year discovered	Area (acres)	1958 production (barrels)	Number of wells, 1958	
					Producing	Completed
Bufkin West	Posey	1950	260	109,026	24	(2)
Caborn Consolidated	do	1940	1,440	241,004	116	(2)
College Consolidated	do	1941	620	206,095	53	7
Fairbanks	Sullivan	1950	420	106,962	19	
Grandview	Spencer	1940	350	209,150	35	(2)
Griffin Consolidated	Gibson and Posey	1938	6,250	2,134,279	630	(2)
Heusler Consolidated	Posey and Vanderburgh	1938	1,430	127,026	84	3
Inman East	Posey	1943	360	207,780	32	
Lamott Consolidated	do	1941	1,250	206,072	95	3
Mackey West	Gibson	1951	450	202,895	42	(2)
Monroe City Consolidated	Knox	1950	1,730	110,960	108	1
Mount Carmel Consolidated	Gibson and Knox	1941	1,660	151,242	159	
Mount Vernon Consolidated	Posey	1941	1,920	395,828	164	8
Mumford Hills	Gibson and Posey	1940	740	151,340	57	3
Owensville Consolidated	Gibson	1940	1,630	490,282	147	8
Plainville	Daviess	1950	350	116,993	56	
Rochester	Gibson	1948	430	124,807	43	
Rock Hill (new)	Spencer	1953	430	128,556	31	
Spencer	Posey	1948	510	195,276	51	
Springfield Consolidated	do	1946	2,270	675,305	269	(2)
Union-Bowman Consolidated (new).	Gibson, Knox, and Pike	1941	13,240	1,447,456	530	47
Vienna	Vanderburgh	1933	310	250,258	49	
Welborn Consolidated	Posey	1941	1,490	232,461	131	3
Undistributed				3,589,947	1,674	216
Total				11,811,000	4,599	299

[1] Petroleum section, Indiana Geol. Survey.
[2] Data not available.

[13] Work cited in footnote 12.

The Survey studied the composition of oil field brines[14] and reviewed deeper oil and gas prospects.[15]

An interpretation of an aeromagnetic survey of Indiana was published by the Federal Geological Survey in cooperation with the Indiana Geological Survey.[16]

The proved oil reserves, as of December 31, 1958, was 71,469,000 barrels, and the total liquid hydrocarbon reserve was 71,588,000 barrels.[17]

METALS

Aluminum.—The Aluminum Company of America constructed a new aluminum reduction plant at the Warwick works near Evansville. The powerplant was scheduled for completion early in 1959. To supply fuel for the new plant coal properties were acquired in southern Indiana and contracts made with the Peabody Coal Co. to mine, process, and transport the coal. The Squaw Creek mine near Boonville in Warwick County was under development. The Aluminum Company of America operated plants at Lafayette where aluminum tube, ingots and extrusions were produced, and at Richmond where bottle and jar closures and collapsible tubes were manufactured.

Pig Iron and Steel.—In Lake County steel mills were operated at East Chicago by Inland Steel Co. and Youngstown Sheet and Tube Co., and at Gary by the United States Steel Corp.

According to the American Iron & Steel Institute, the capacity of Indiana steel mills on January 1, 1959, was 18,440,500 short tons of steel and blast-furnace capacity 9,696,700 tons of pig iron. These figures represented increases of 1.6 million tons in steel capacity and a half million ton in pig iron capacity over 1957.

Steel production totaled 12.7 million short tons and pig iron production nearly 7.8 million tons.

In addition to iron ore, 6.1 million tons of coke, 2.3 million tons of limestone, large quantities of flue dust, mill cinder, and roll scale, scrap, and slag were consumed in the blast furnaces.

REVIEW BY COUNTIES

Mineral production was reported from all counties except Brown, Jefferson, Johnson, Ohio, Tipton, Union, and Washington. Production, valued at over $1 million, came from 19 counties; nearly half came from six counties—Clark, Lake, Lawrence, Putnam, Vigo, and Warrick.

Adams.—The Krick Tyndall Co. operated a clay pit near Decatur and used the output for heavy clay products.

Crushed limestone for agricultural use and for road construction was produced near Bryant by John W. Karch Stone Co. and by Mesh-

[14] Walker, Frank H., Natural Brines of Indiana and Adjoining Parts of Illinois and Kentucky: Indiana Dept. of Conservation, Geol. Survey, Rept. of Progress No. 13, April 1959. 58 pp.

[15] Gutstadt, Allan M., Cambrian and Ordovician Stratigraphy and Oil and Gas Possibilities in Indiana: Indiana Geol. Survey Bull. 14, September 1958, 103 pp.

[16] Henderson, J. R., Jr., and Zietz, Isidore, Interpretation of An Aeromagnetic Survey of Indiana: Geol. Survey Professional Paper 316–B, 1958, 37 pp.

[17] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas: Vol. 13, Dec. 31, 1958, pp. 23.

berger Bros. Stone Corp. at plants near Linn Grove and Pleasant Mills. A small quantity of sand and gravel came from a pit near Geneva.

Allen.—May Sand & Gravel Corp. operated a limestone quarry, crushing plant, and sand and gravel pit and plant near Fort Wayne. Building and road materials and agricultural limestone were produced. Paul C. Brudi Stone & Gravel Co., Inc., at Fort Wayne, and W. W. Gravel Co., Inc., Roanoke, operated gravel pits and processing plants.

Bartholomew.—Meshberger Stone Co., Inc., quarried limestone at a site nine miles southeast of Columbus. Output was crushed for agricultural use and for road material. Driftwood Gravel Co., Inc., operated a gravel pit and washing plant 7 miles north of Columbus.

Benton.—Moss and humus peat was dug from a bog near Otterbein by Millburn Peat Co. of Chicago, Ill. The materials were sold for horticultural use. A small quantity of road gravel was produced near Fowler.

Blackford.—Miscellaneous clay was mined near Hartford City by Inman Tile Co. and was used for drain tile and heavy clay products. At Montpelier the Montpelier Stone Co. operated a limestone quarry and crushing plant. Agricultural limestone and road materials were produced.

Hartford Peat & Gravel Co. produced reed and sedge peat from a bog near Hartford City.

Cass.—Limestone was quarried and crushed at two sites in the county by the Cass County Stone Co. and The France Stone Co. (Toledo, Ohio). The material was sold for blast furnace flux, railroad ballast, roadstone, and agricultural use.

Sand and gravel was produced at two pits.

Clark.—Portland, masonry, natural cements, and miscellaneous clay and limestone for cement were produced near Speed by the Louisville Cement Co. The company completed a phase of its long-term program for plant improvement during the year.

Limestone was quarried and crushed for agricultural use and road material by T. J. Atkins & Co., Inc. (Jeffersonville), and by Sellersburg Stone Co. (Sellersburg).

Sand and gravel was produced at two pits.

Clays.—Clay, coal, and a small quantity of sand and gravel were produced. Coal came from one underground and ten strip mines. The Chinook, Quality, Old Hickory, and Lone Star mines reported the largest production.

A considerable tonnage of fire and miscellaneous clays was mined. Much of the production was by coal-mining companies, producing from underclays beneath lower Pennsylvanian coals. The material was used or sold for manufacturing cement, floor and wall tile, firebrick, and heavy clay products.

Crawford.—Limestone was quarried and crushed near Marengo by Hy-Rock Products Co. and at Eckerty by Mulzer Bros. Agricultural limestone, railroad ballast, riprap, and road materials were produced.

Daviess.—Coal was mined from a strip mine (Mine No. 2) by the Hicks Coal Co. Sand and gravel pits were operated near Elnora and Plainville.

TABLE 10.—Value of mineral production in Indiana, by counties [1 2]

County	1957	1958	Minerals produced in 1958 in order of value [2]
Adams	$512,228	$554,168	Stone, clays, sand and gravel.
Allen	1,232,078	1,347,086	Stone, sand and gravel.
Bartholomew	(3)	(3)	Do.
Benton	(3)	(3)	Peat, sand and gravel.
Blackford	(3)	(3)	Stone, peat, clays.
Boone	(3)	58,574	Sand and gravel.
Carroll	(3)	(3)	Stone, sand and gravel.
Cass	(3)	(3)	Do.
Clark	(3)	(3)	Cement, stone, clays, sand and gravel.
Clay	3,641,992	3,596,480	Coal, clays, sand and gravel.
Clinton	(3)	(3)	Sand and gravel.
Crawford	(3)	(3)	Stone.
Daviess	117,176	144,429	Sand and gravel, coal.
Dearborn	149,953	181,507	Sand and gravel.
Decatur	(3)	(3)	Stone.
De Kalb	241,684	188,726	Sand and gravel.
Delaware	(3)	(3)	Do.
Dubois	137,694	146,900	Coal, clays, sand and gravel.
Elkhart	171,163	294,509	Sand and gravel, stone (marl).
Fayette	92,095	(3)	Sand and gravel.
Floyd	(3)		
Fountain	790,944	854,727	Sand and gravel, coal, clays.
Franklin	(3)		
Fulton	23,533	26,800	Sand and gravel, stone (marl).
Gibson	2,390,074	2,139,804	Coal, sand and gravel.
Grant	992,174	(3)	Stone, sand and gravel, peat.
Greene	(3)	6,647,306	Coal, clays, sand and gravel.
Hamilton	(3)	935,728	Stone, sand and gravel, peat.
Hancock	56,394	42,376	Sand and gravel.
Harrison	137,294	142,250	Stone.
Hendricks	210,646	(3)	Sand and gravel.
Henry	81,135	127,895	Do.
Howard	(3)	(3)	Stone, sand and gravel.
Huntington	(3)	(3)	Stone, sand and gravel, clays.
Jackson	271,364	264,647	Clays, sand and gravel.
Jasper	(3)	(3)	Stone, sand and gravel.
Jay		79,068	Stone.
Jennings	(3)	(3)	Do.
Knox	5,428,494	5,205,674	Coal, sand and gravel.
Kosciusko	411,142	415,905	Sand and gravel, stone (marl).
Lagrange	(3)	(3)	Do.
Lake	(3)	(3)	Cement, clays, sand and gravel.
La Porte	(3)	413,727	Sand and gravel, stone (marl).
Lawrence	12,719,644	11,459,307	Stone, cement.
Madison	658,262	739,092	Stone, sand and gravel.
Marion	(3)	(3)	Sand and gravel.
Marshall	84,489	127,050	Sand and gravel, clays.
Martin	2,214,129	(3)	Gypsum, stone, clays.
Miami	362,417	515,653	Sand and gravel.
Monroe	8,011,792	7,600,680	Stone.
Montgomery	152,422	126,062	Clays, sand and gravel.
Morgan	283,211	741,130	Do.
Newton	(3)	(3)	Stone.
Noble	(3)	(3)	Sand and gravel, stone (marl).
Orange	691,936	839,905	Stone, abrasives.
Owen	1,671,635	1,444,923	Stone, coal, sand and gravel, clays.
Parke	487,069	396,704	Sand and gravel, coal, clays.
Perry	(3)	(3)	Stone, clays.
Pike	8,747,038	8,301,692	Coal.
Porter	407,556	388,101	Sand and gravel, clays.
Posey	82,822	(3)	Sand and gravel.
Pulaski	(3)	(3)	Stone, clays, sand and gravel.
Putnam	(3)	(3)	Cement, stone, clays, sand and gravel.
Randolph	195,001	177,730	Stone, sand and gravel.
Ripley	240,532	500,370	Stone.
Rush	224,870	215,664	Stone, sand and gravel.
St. Joseph	650,193	567,221	Sand and gravel.
Scott	191,932	264,006	Stone.
Shelby	564,094	629,358	Stone, sand and gravel.
Spencer	(3)	(3)	Coal, sand and gravel.
Starke	71,542	67,500	Sand and gravel.
Steuben	354,671	(3)	Sand and gravel, stone (marl).
Sullivan	(3)	2,522,714	Coal, sand and gravel.
Switzerland	93,025	91,184	Stone, sand and gravel.
Tippecanoe	612,235	(3)	Sand and gravel.
Vanderburgh	339,100	317,723	Sand and gravel, clays.
Vermillion	1,090,530	1,450,030	Sand and gravel, coal, clays.
Vigo	13,072,314	12,650,375	Coal, sand and gravel, clays
Wabash	46,692	38,971	Sand and gravel.

See footnotes at end of table.

TABLE 10.—Value of mineral production in Indiana, by counties—Con.

County	1957	1958	Minerals produced in 1958 in order of value [2]
Warren	$185,431	[3]	Sand and gravel.
Warrick	19,723,442	$17,458,576	Coal, stone.
Wayne	661,156	717,172	Sand and gravel, stone.
Wells	[3]	184,735	Stone, sand and gravel, peat.
White	[3]	350,000	Stone.
Whitley	[3]	[3]	Sand and gravel.
Undistributed	[4] 108,218,419	105,631,923	
Total [5]	[4] 198,034,000	197,677,000	

[1] The following counties are not listed because no production was reported: Brown, Jefferson, Johnson, Ohio, Tipton, Union, and Washington.
[2] Except for natural gas and petroleum production that was not available by counties. Value of these commodities is included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Revised figure.
[5] Total adjusted to eliminate duplicating value of clays and stone.

Decatur.—Limestone was quarried and crushed for agricultural use, riprap, and road material at four sites in the county. The New Point Stone Co. plant near New Point and the Harris City Stone Corp., Greensburg, were the largest operations.

Dubois.—Coal was mined from three underground mines and one strip operation.

Fire and miscellaneous clays were mined near Huntingburg for use in manufacturing art pottery, stoneware, and heavy clay products. A small quantity of paving sand came from a pit near Jasper.

Elkhart.—Marl was mined from a pit near Elkhart by E. N. Ulmer & Son. Sand and gravel was produced from five pits. Most of the output was processed for use as building or road materials.

Fountain.—The Kingman strip mine was operated by the Morgan Coal Co. Fire clay and miscellaneous clays were mined near Veedersburg by the Hydraulic-Press Brick Co. of Crawfordsville. A part of the output was sold as raw clay, and the balance used in heavy clay products. Miscellaneous clays were also mined near Attica by Poston-Herron Brick Co. and at Riverside by the Rostone Corp. Most of the material went into heavy clay products but a small tonnage was used in manufacturing molded plastics. Sand and gravel was produced from three pits.

Franklin.—The Herman H. Wessel Co., producer of miscellaneous clays and fabricator of heavy clay products, was sold in May to the Huntersville Brick & Tile Corp. The new company will operate at the same site.

Fulton.—Marl was produced by M. E. Zellers from a pit near Kewanna. Sand and gravel was produced at five sites.

Gibson.—Underground coal mines were operated by Princeton Mining Co. (King's Station mine) and Somerville Coal Co. (Somerville mine). The strip mine of the Saxon Coal Corp. was idle.

Sand and gravel was produced at three pits near Owensville and Princeton.

Grant.—Near Jonesboro moss peat was dug from a bog by Glacier Peat Moss Co.

The Pipe Creek Stone Co., at a quarry and plant near Mier, produced flagging, riprap, fluxstone, railroad ballast, road materials,

and agricultural limestone. Sand and gravel was produced at two sites.

Greene.—Coal was produced from eight mines (two underground and six strip). Because of decreased production one underground mine and three strip mines were idle. Maumee Collieries Co., Linton No. 28 mine and Airline No. 32 mine, and Sherwood-Templeton Coal Co., Friar Tuck mine, were the largest producers. All were strip operations.

Bloomfield Brick Co., Inc., mined miscellaneous clay near Bloomfield for heavy clay products. Sand and gravel was produced at two sites.

Hamilton.—Stony Creek Stone Co. operated a limestone quarry and crushing plant near Noblesville and produced road materials. Fox Prairie Products, Inc., of Indianapolis dug moss peat from a bog near Noblesville. Sand and gravel was produced at six pits.

Harrison.—Limestone quarries were operated near Corydon by the Corydon Crushed Stone & Lime Co. and the Mathes Stone Co., and near Depauw by the Davis Crushed Stone & Lime Co. The material was crushed for agricultural limestone and road material.

Howard.—Yeoman Stone Co. quarried limestone, near Kokomo. Part of the output was sold as house stone veneer and flagging. The rest was crushed for road material and agricultural limestone.

Ted McKinney & Son operated a sand and gravel pit and plant near Tipton. Building and paving materials were produced.

Huntington.—Miscellaneous clays were mined near Huntington by Majenica Tile Co. and near Simpson by the Simpson Clay Works. The output was used for farm draintile.

The Erie Stone Co. (Toledo, Ohio) operated a limestone quarry and plant at Huntington. The crushed material was sold for flux, mineral wool, railroad ballast, road materials, and agricultural use.

Sand and gravel was produced from one pit.

Jackson.—Miscellaneous clays were mined at three sites and were used for building brick, other heavy clay products, and cement.

Sand and gravel was mined and processed at two sites for use as building and road material.

Knox.—Coal production was at about the same rate as in 1957. Three underground and two strip mines were operated. Enoco Collieries, Inc., and Shasta Coal Corp. were the leading producers. Sand and gravel was produced at three sites near Vincennes.

Kosciusko.—Agricultural marl production was reported by Aschliman & Weirich, Goshen; Custer Bros., Milford; and E. M. Ulmer & Son, Etna Green. Sand and gravel was produced at eight sites in the county. Most of it was processed for use as building and road material. Some engine sand was produced near Syracuse.

Lagrange.—Marl was produced by Glen Hesher from a pit near Howe. Sand and gravel was produced at four pits in the county.

Lake.—Lake County continued as one of the major mineral-producing areas as well as the most heavily industrialized county in the State.

Portland and masonry cements were produced at Buffington by Universal Atlas Cement Co. A new plant with separate loading and storage facilities was added during the year.

National Brick Co. of Chicago, Ill., mined miscellaneous clay near Munster for its own use. Industrial sands were produced by John N. Bos Sand Co. of Chicago, Ill., from a pit near Gary. Byproduct sulfur was recovered from crude petroleum at the Whiting refinery of Standard Oil Co. of Indiana. H. B. Reed & Co., Inc., manufactured roofing granules from natural slag at Hammond.

Pig iron and steel were produced in Gary by U.S. Steel Corp. and in East Chicago by Inland Steel Co. and Youngstown Sheet & Tube Co.

LaPorte.—Sand and gravel was produced from eight pits and was the leading mineral commodity. The area was an important source of industrial sands (molding, engine, glass) as well as materials for building and road construction. Marl was dug from a pit near Walkerton by E. N. Ulmer & Son.

Lawrence.—The area was one of the leading building stone-producing centers of the United States although competitive building materials continued to reduce the demand for limestone for building facing.

Portland and masonary cements were produced at Mitchell by Lehigh Portland Cement Co. The company also quarried and crushed limestone for use in manufacturing cement. Plant modernization, phased over a period of several years, continued without interruption of production. Orders were placed for two new and larger kilns for use in 1959.

Dimension limestone was quarried and milled by Heltonville Limestone Co., Indiana Limestone Co., and Ingalls Stone Co. Building stone was also fabricated from purchased limestone at mills in the area.

Spalls, from the stone mills, were crushed and ground for agricultural purposes and for use in glass manufacturing by Bedford Ground Limestone Co.

Limestone was quarried for riprap and crushed for agricultural limestone and road materials by Mitchell Crushed Stone Co., Inc., Oolitic Ground Limestone Co., and Ralph Rogers & Co., Inc.

Sandstone was quarried and dressed for building stone by Indiana Sandstone Co., Inc., and Leonard Sandstone Co., Inc.

Marion.—The county continued to lead in sand and gravel production. Several large pits and processing plants were operated by American Aggregates Corp., Standard Materials Corp. and Spickelmier Industries, Inc. Most of the output was used in Metropolitan Indianapolis for building and road construction.

The Indianapolis Cut Stone Corp. fabricated purchased limestone for building use.

Martin.—Gypsum was mined and fabricated into building materials near Shoals by the National Gypsum Co. and United States Gypsum Co. Also near Shoals, General Refractories Co. mined a quartz conglomerate deposit. The material was crushed at the site and shipped to company plants in other States for use in manufacturing silica brick.

Loogootee Clay Products Corp. manufactured draintile from miscellaneous clays mined near Loogootee. The Burris pit of the Loogootee Block Coal Co., Inc., was idle.

Monroe.—Monroe County continued as a leading building-stone production area. Limestone quarries and fabricating mills were operated by Bloomington Limestone Corp., Empire Stone Co., The Carl Furst Co., B. G. Hoadley Quarries, Inc., Independent Limestone Co., Ingalls Stone Co., Midwest Quarries Co., Inc., Texas Quarries, Inc., Victor Oolitic Stone Co., and Woolery Stone Co., Inc. In the Bloomington area purchased limestone was milled for building use in 13 plants. Indiana Calcium Corp. operated a fine-grinding plant in Bloomington and produced material for filler, mineral food, and coal-mine rock dust from spalls purchased from the limestone mills in the area.

Limestone was quarried and crushed for agricultural use and road material by the Bloomington Crushed Stone Co., Inc., near Bloomington, and McNeely Stone Co. at Ellettsville.

The Hinkle Sandstone Co. produced flagging and sawed stone.

Montgomery.—Miscellaneous clay for manufacturing vitrified sewer pipe was mined near Crawfordsville by American Vitrified Products Co. of Cleveland, Ohio, and in the same area Hydraulic-Press Brick Co. mined clay for its own use.

Sand and gravel was produced at four places in the county.

Morgan.—Miscellaneous clay was mined at four pits in the county. Near Brooklyn, the Brooklyn Brick Co., Inc., produced building brick; the Indiana Drain Tile Co., Inc., manufactured heavy clay products; and the Hydraulic Press-Brick Co. produced lightweight aggregates. At Martinsville the Adams Clay Products Co. produced building brick.

Sand and gravel for building and road materials was produced at four pits.

Noble.—Agricultural marl was produced by Luther & Haney (Albion). Four sand and gravel pits were operated in the county.

Orange.—Hindostan Whetstone Co. produced whetstones from a quarry near Orleans, the only one of its type in the State.

Limestone was quarried and crushed for agricultural purposes, concrete aggregate, and roadstone by Calcar Quarries, Inc. (Paoli), William Cave Stone Co. (French Lick), and Radcliff & Berry, Inc. (Orleans).

Sandstone for building use was produced by Colored Sandstone Co., West Baden. French Lick Sandstone Co., Inc., milled sandstone, quarried in Lawrence and Martin Counties, at French Lick.

Owen.—Ingalls Stone Co. operated the Romona limestone quarry. The output was shipped to the company mill at Bedford for finishing as building stone. Limestone was quarried and crushed for flux, railroad ballast, road material, and for agricultural use by Dunn Limestone Co., Inc. (Spencer), and Gordon & Shepherd Stone Co. (Shelburn). The Koepke quarry was opened near Spencer.

Maumee Collieries Corp. produced coal from the Old Glory No. 33 strip mine and sold fire clay to manufacturers of architectural terra cotta, art pottery, and heavy clay products.

Burcham Bros., Inc., operated a strip coal mine.

Sand and gravel was produced at two sites in the county.

Parke.—S. L. Turner Coal & Clay Co. mined coal and fire clay from the Turner strip mine. Maple Grove Coal Co. operated a strip mine. G & F Corp. (Brazil) mined miscellaneous clays for fabricating heavy clay products.

Western Indiana Gravel Co. produced sand and gravel for railroad ballast and building and paving purposes at Montezuma.

Perry.—U.S. Brick Co. (Tell City) mined miscellaneous clay for use in brick manufacture. Mulzer Bros. operated a limestone quarry and crushing plant in Derby.

Pike.—Pike County ranked third as a coal-producing county; production came from 12 mines (5 underground and 7 strip). Leading output came from the Enos mine of the Enos Coal Mining Co.

Porter.—Miscellaneous clay was mined at Chesterton by Chas. S. Schrock and at McCool by J. S. Robbins. Sand for industrial use (engine, fire, and molding sand) was produced by John N. Bos Sand Co. near Gary, by Crisman Sand Co. in Crisman, and by Portage-Manley Sand Co. in Dune Park.

Pulaski.—Francesville Drain Tile Corp. mined miscellaneous clay for draintile. Also near Francesville limestone was quarried and crushed for agricultural use and road material by the Francesville Stone Co., Inc.

Putnam.—Lone Star Cement Corp. produced portland and masonry cements at Limedale, mined clay, and quarried limestone for its own use. The Indiana State Farm (Greencastle) produced clay and crushed limestone for State agencies.

Limestone quarries and crushing plants were also operated by Manhattan Crushed Stone Co. in Manhattan, The Ohio & Indiana Stone Corp. in Greencastle, and the Russellville Stone Co. in Russellville. Harris Stone Service, Inc., opened a quarry 2 miles southwest of Bainbridge.

Spencer.—Mulzer Bros. Coal Co. produced coal from a strip mine, and an underground coal mine was operated by St. Meinrad's Arch Abbey. Hardy Sand Co. produced molding sand near Richland.

Sullivan.—Coal production came from one strip and four underground mines. Leading output came from the Minnehaha mine of Fairview Collieries Corp. The Hoosier Gem strip mine of Ayrshire Collieries Corp. was under development near Dugger. It was expected to start producing in 1959.

Development of the Thunderbird mine of Thunderbird Collieries Corp. started in March and the mine was expected to open early in 1959.

Sand and gravel was produced in three pits.

Vanderburgh.—Standard Brick & Tile Corp. mined miscellaneous clay at Evansville for its own use. Bedford-Nugent Co. (Evansville) purchased the Koch Sand & Gravel Co. It will be operated as part of the Bedford-Nugent Co.

Vermillion.—Fire clay was mined by Arketex Ceramic Corp. at Newport for manufacturing structural tile. Cayuga Brick Corp. mined miscellaneous clay for use in draintile and building brick.

Coal was produced from one strip and three underground mines.

Sand and gravel was produced in three places.

Vigo.—Miscellaneous clay was mined at West Terre Haute by Terre Haute Vitrified Brick Works, Inc., for its own use. Nearly 3 million tons of coal was produced from two strip and six underground mines. The Green Valley and Talleydale mines of Snow Hill Coal Corp. and the Viking mine of the Viking Coal Corp. were the lead-

ing underground mines. The Chieftain mine of Maumee Collieries Co. was the largest strip mine.

Sand and gravel was produced at five pits.

Warrick.—Coal was produced from seven underground and eight strip mines. The Squaw Creek mine of the Peabody Coal Co. was under development. The county continued to be the leading coal producer although output was 10 percent less than in 1957.

The Mineral Industry of Iowa

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Iowa.

By Samuel A. Gustavson [1]

THE VALUE of the mineral output of Iowa has increased annually since 1953. In 1958 the value was over $85 million, or 24 percent above 1957.

The principal mineral products of Iowa were clays, gypsum, limestone, and sand and gravel. Production of these minerals has followed the constantly increasing demand for cement and other building materials. The major factor in production gains in 1958 was the increase in highway construction. Contrary to the steady growth in output and use of minerals for construction, bituminous-coal mining has declined for many years.. Production of coal in 1958 was about 10 percent less than in 1957.

Iowa was the principal market for its own mineral products; however, gypsum products, cement, and peat had a sizable market in adjacent States. Among the States, Iowa ranked fourth in production of gypsum and eighth in production of cement.

Employment and Injuries.—Data for cement, coal, and gypsum represent 100 percent of the industry. Data for clay represent reports from companies producing 86 percent of the State's output (including clay used for cement), for limestone 72 percent (including limestone used for cement and lime), and for sand and gravel 31 percent.

TABLE 1.—Mineral production in Iowa [1]

Mineral	1957		1958	
	Thousand short tons (unless otherwise stated)	Value (thousand)	Thousand short tons (unless otherwise stated)	Value (thousand)
Cement:				
Portland ---- 376-pound barrels	10,423	$33,219	12,260	$39,993
Masonry ---- do	400	1,662	415	1,748
Clays [2]	752	944	837	1,054
Coal [3]	1,312	4,543	[4] 1,179	[4] 4,147
Gypsum	1,123	3,773	1,230	4,491
Sand and gravel	12,042	8,927	12,411	10,965
Stone	15,214	18,768	21,045	26,138
Value of items that cannot be disclosed: Fire clay, lime and peat	----	614	----	633
Total Iowa [5]	----	68,986	----	85,356

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay included with "Value of items that cannot be disclosed."
[3] Relates only to mines that produce 1,000 tons or more.
[4] Preliminary figure.
[5] Total has been adjusted to eliminate duplicating the value of clays and stone.

[1] Chief, Minneapolis Field Office, Division of Mineral Industries, Region V, Bureau of Mines, Minneapolis, Minn.

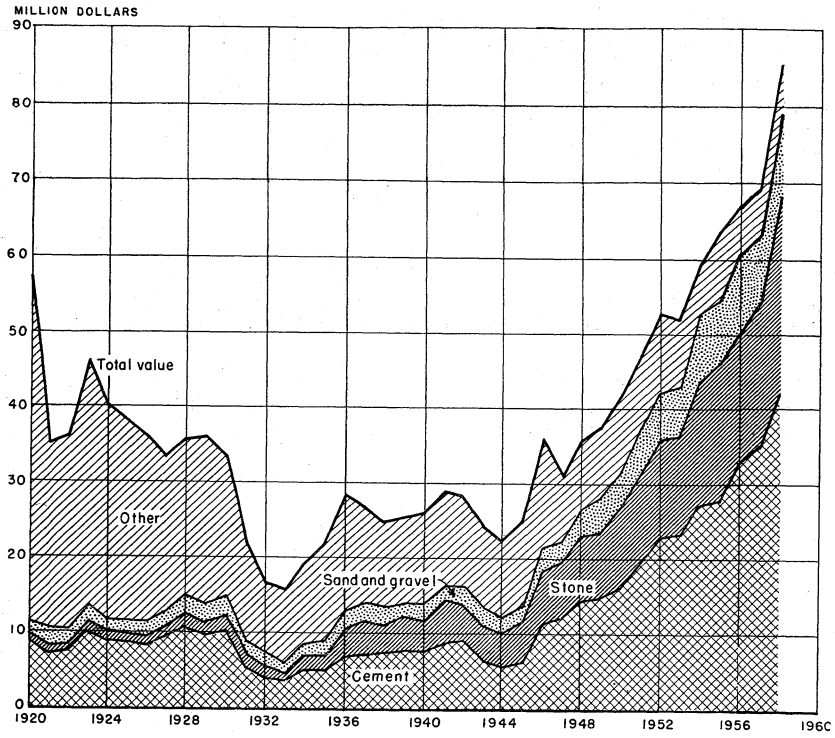

FIGURE 1.—Value of cement, stone, sand and gravel, and total value of mineral production in Iowa, 1920–58.

TABLE 2.—Summary of employment and injuries for selected mineral industries in Iowa [1]

Commodity	Average number of men working	Total man-hours	Total number of lost-time injuries		Total number of days lost or charged	Injury-frequency rate	Injury-severity rate
			Fatal	Non-fatal			
1957:							
Cement [2]	1,024	2,671,055	-------	6	(3)	2.25	(3)
Clay [4]	295	574,575	-------	27	372	49.76	686
Coal	626	902,209	5	17	30,453	24.38	33,754
Gypsum	223	546,722	-------	1	145	1.83	265
Limestone [5]	1,282	2,422,349	1	97	(3)	40.46	(3)
Sand and gravel	153	381,943	-------	5	103	13.09	270
1958:							
Cement [2]	992	2,691,581	1	1	(3)	.74	(3)
Clay [4]	424	911,959	-------	42	313	46.05	343
Coal	511	823,424	1	32	7,230	40.08	8,780
Gypsum	345	778,985	-------	1	55	1.28	71
Limestone [5]	978	1,955,724	-------	63	(3)	32.21	(3)
Sand and gravel	612	1,167,184	-------	33	633	28.27	542

[1] Data exclude office workers; final for 1957 and preliminary for 1958.
[2] Includes cement plants and quarries or pits producing raw material used in manufacturing cement.
[3] Data not available.
[4] Excludes pits producing clay used exclusively in manufacturing cement.
[5] Excludes quarries producing limestone used exclusively for manufacturing cement and lime.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Demand for cement was greater than in 1957, following an upward trend that began in 1944. This upward trend was parallel to the growth in highway construction and in the building industry. In 1957 the estimated plant capacity was increased from 13 million to 14 million barrels of cement per year by the addition of a 400-foot kiln at the Mason City plant of Lehigh Portland Cement Co. Five cement plants were active with a total of 27 kilns ranging in size from 110 feet in length by 7 feet in diameter to 475 feet in length by 11 feet 6 inches in diameter. Except for repairs and unavoidable shutdowns, kilns operated continuously in 1958. According to company reports the downtime of individual kilns ranged from 50 to 90 days. Some downtime may be attributed to the high level of stocks in the first part of the year when bad weather delayed shipments. All plants produced types I and II, general-use and moderate-heat cements; type III, high-early-strength; and air-entrained cement. Masonry cements were produced at four plants.

Sales of Portland cement rose about 18 percent in quantity and 20 percent in value over 1957. Sales of masonry cements increased about 4 percent in quantity and 5 percent in value. Unit prices per barrel, f.o.b. mill, after cash discounts and excluding cost of containers, averaged about $3.26 compared with $3.19 in 1957. Masonry cements averaged $4.22 per barrel compared with $4.16 in 1957. The cements produced were marketed chiefly in Iowa and Minnesota; appreciable quantities were also marketed in Illinois and Wisconsin and small amounts in Nebraska, North Dakota, and South Dakota. On December 31, 1958, stocks of cement at plants totaled about 1⅓ million barrels, an approximate decrease of 66,000 barrels from 1957 yearend stocks. There was an accelerated trend toward use of specially constructed trailers to haul bulk cement direct from plant to user. These special trailers are loaded with cement and placed on flatcars to be hauled by rail to city of destination, then by truck (prime movers) to user, or they are hauled by truck all the way. This method eliminates bagging and one or more transfers for bulk deliveries. The trailers have equipment for unloading.

Clays.—Shale and clay mined in Iowa are suitable chiefly for use in heavy clay products, such as common brick, building tile, and sewer or drain tile or for manufacturing cement. Market demand for finished heavy clay products, especially farm draintile, increased in 1958. An increase in use of draintile usually follows a wet year, and the availability of Government funds to absorb part of the cost of installation. About 48 percent of all clay produced in 1958 was used in making heavy-clay products. A small part of this output was used in manufacturing refractories and was classed as fire clay. About 52 percent was used in cement manufacture.

Shale or clay pits were operated by 26 firms in 16 counties. The bulk of the output came from pits in Cerro Gordo, Dallas, Polk, Scott, and Webster Counties. The producing company used all of the clay in manufacturing its own products (less than 0.5 percent of the raw clay was sold).

Most heavy clay products were used in the State; however, some tile was sold in adjacent States.

Gypsum.—Iowa is a major producer of gypsum ranking fourth in the Nation after Michigan, California, and Texas. For many years all output had been from deposits in Webster County; however, late in 1957 the United States Gypsum Co. explored a gypsum deposit near Sperry, just north of Burlington in Des Moines County. In 1958 the company began to develop the property and construct a plant for processing the crude gypsum.

Demand for gypsum products was greater, and sales exceeded those of 1957 and 1956 but were about 100,000 tons under the peak year of 1955. Estimated average unit value of crude gypsum as reported by producers increased from $3.36 per ton in 1957 to $3.65 per ton in 1958. Four companies produced and processed gypsum in Webster County. Products included base-coat plasters, ready-mixed, and other special-use plasters; gypsum lath, wallboard, sheathing, tile, and other preformed products; and pulverized gypsum. The products were used chiefly in the building industry, but considerable quantities were sold for agricultural use, as a portland-cement retarder, and as a filler in various products. Small tonnages were used in the glass and pottery industries, for art molding and castings, in dental and orthopedic plaster, and for other uses.

Lime.—Quick and hydrated lime was produced by Linwood Stone Products Co., Inc., at a plant in Buffalo near Davenport, Scott County. High-calcium limestone was used. The chief end applications of the quicklime were in steel open-hearth furnaces, water-purification processes, sewage and trade-waste treatment, and as mason's lime. Hydrated lime was sold principally for use as mason's lime and for water treatment. Sales were greater in 1958.

Perlite.—Crude material from Colorado and Nevada was expanded in plants by all four gypsum producers in Webster County. The expanded perlite was used chiefly in premixed lightweight plaster.

Sand and Gravel.—The continued high level of highway construction and, to a smaller degree, of building construction resulted in about a 3-percent increase in total output of sand and gravel.

The average unit value of sand and gravel increased from about 74 cents a ton in 1957 to 88 cents in 1958, indicating primarily an increase in output of higher priced washed or processed material rather than an increase in unit price for a specific grade.

Only 4 percent of the commercial-sand and 12 percent of the gravel output were sold as unwashed pit-run material; most of this material was used as fill. Comparable figures for 1957 were 6 and 13 percent, respectively. Highway departments used different available materials for fill; however, sand and gravel requires a binder, and fortunately some gravel deposits have a clay bed over or beneath the gravel bed. When fill is required both clay and sand and gravel are mined in the proper proportions and mixed before loading in trucks for delivery. About 86 percent of all commercial sand and gravel was hauled by truck to point of destination; about 14 percent went by rail or truck and rail; and a small quantity was shipped by water. All non-commercial production was handled by truck.

TABLE 3.—Sand and gravel sold or used by producers by classes of operations and uses

Class of operation and use	1957		1958	
	Short tons (thousands)	Value (thousand)	Short tons (thousands)	Value (thousand)
COMMERCIAL OPERATIONS				
Sand:				
Glass	5	$3	----	----
Building	1,779	1,519	2,104	$1,824
Paving [1]	1,555	1,249	1,541	1,401
Railroad ballast	33	16	45	19
Fill	160	101	338	179
Other	4	8	19	20
Undistributed [2]	175	409	145	366
Total	3,710	3,304	4,193	3,809
Gravel:				
Building	1,103	1,588	1,501	2,108
Paving [1]	3,909	2,626	4,290	3,661
Railroad ballast	42	22	101	65
Fill	50	20	111	48
Other	11	70	30	125
Total	5,116	4,325	6,033	6,007
Total sand and gravel	8,826	7,629	10,226	9,817
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving [1]	469	142	155	96
Gravel:				
Paving [1]	2,681	1,136	1 963	1,020
Building	66	20	67	33
Total sand and gravel	3,216	1,298	2,185	1,149
ALL OPERATIONS				
Sand	4,180	3,446	4,348	3,905
Gravel	7,862	5,480	8,063	7,060
Grand total	12,042	8,927	12,411	10,965

[1] Includes materials used in bridges, culverts, etc.
[2] Value of items that cannot be disclosed: Molding, blast, engine, and filter sand (1957–58).

The 10 leading producers, several operating in two or more areas of the State, in alphabetical order were:

Booneville Gravel Co., Booneville.
Concrete Materials Co., Cedar Rapids.
Coon Valley Gravel Co., Des Moines.
L. G. Everist, Inc., Sioux Falls, S. Dak.
Hallett Construction Co., Crosby, Minn.
Keefner Sand & Gravel Co., Des Moines.
Maudlin Construction Co., Webster City.
Mauer Construction Co., Sac City.
Northern Gravel Co., Muscatine.
Pound Construction Co., Scranton.

Stone.—Limestone production increased 38 percent in tonnage and 39 percent in value over 1957, primarily as the result of Federal highway construction and greater agricultural use in the State. The unit values for specific limestone products were virtually unchanged from 1957. The principal commercial uses were for concrete aggregate and road surfacing (73 percent), as a constituent in manufacturing cement (16 percent), and for agricultural use (8 percent). Minor uses included metallurgical flux and chemical uses (consumption of which declined) and as a filler, mineral food, and dust for coal mines (con-

sumption of which increased slightly). A small quantity of dimension limestone was produced, chiefly for rubble or flagging, also some veneer for building construction.

Most of the limestone output was high-calcium (95 percent $CaCO_3$), some was low-calcium (5 to 25 percent $MgCO_3$), and a small part was high-magnesium limestone or dolomite (25 to 45 percent $MgCO_3$).

TABLE 4.—Limestone sold and used by producers, by uses

Class of operation and use	1957		1958	
	Short tons (thousand)	Value (thousand)	Short tons (thousand)	Value (thousand)
Commercial:				
Agriculture	1,106	$1,509	1,630	$2,223
Dimension	(1)	(1)	10	82
Fluxing stone	(1)	(1)	41	64
Railroad ballast	(1)	(1)	7	11
Rirrap	302	394	308	385
Concrete aggregate, roadstone, etc	10,633	13,202	14,875	18,374
Cement	2,066	2,044	3,231	3,500
Other [2]	316	872	247	894
Total	14,424	18,021	20,349	25,534
Noncommercial, all uses (concrete aggregate, roadstone, riprap)	790	747	696	604
Grand total	15,214	18,768	21,045	26,138

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes limestone for chemical uses, asphalt filler, fertilizer, dust for coal mines, mineral food, lime and other uses (1957–58); filter beds, poultry grit, and other filler (1957).

The 10 leading producers of limestone, listed alphabetically, were:

Beu & Sons Co., Grundy Center.
Concrete Materials & Constr. Co., Cedar Rapids.
Dewey Portland Cement Co., Kansas City, Mo.
Kaser Construction Co., Des Moines.
Linwood Stone Products Co., Inc., Davenport.
Marquette Cement Mfg. Co., Chicago, Ill.
Missouri Valley Limestone Co., Oakland.
Penn-Dixie Cement Corp., Nazareth, Pa.
E. I. Sargent Quarries, Inc., Des Moines.
Weaver Construction Co., Iowa Falls.

MINERAL FUELS

Coal.—Bituminous coal was produced in 10 south-central counties. Total production was about 10 percent less than in 1957. There were 23 active underground mines and 30 strip mines compared with 32 and 31, respectively, in 1957. Few mines employed as many as 20 men. Strip mining accounted for most of the output. Average value was reported at $3.52 a ton compared with $3.46 in 1957. Prices at individual mines ranged from a low of $2.25 a ton to a high of $7.50 a ton in 1958. All production was sold on the open market, chiefly in Iowa for use in generating electric power and in heating State, county, and municipal buildings or institutions. Mines in Marion County accounted for 62 percent of the State's total output.

No mechanical cleaning plants were operated in the State. Part of the output of six mines was oil-treated.

Peat.—Production and sales of peat decreased somewhat from 1957. The unit value of peat rose slightly, probably owning to a larger proportion being sold in small bags for home use. Virtually all of the peat was sold for use as a soil conditioner or a packing agent for shipping plants. Some was fortified with minerals, packaged, and sold as a complete soil for plant growth. Peat was produced by two companies from bogs in Worth and Winnebago Counties.

TABLE 5.—Bituminous coal production, value, and number of mines operated in 1958, by counties

(Exclusive of mines producing less than 1,000 net tons)

County	Production (net tons)			Total value	Number of mines operated	
	Underground	Strip	Total		Underground	Strip
Appanoose	75,695	----------	75,695	$402,690	9	----------
Keokuk, Lucas, and Warren [1]	28,939	12,894	41,833	182,988	1	3
Mahaska	3,372	156,695	160,067	536,157	1	7
Marion	92,482	634,710	727,192	2,414,542	6	11
Monroe	50,468	41,994	92,462	306,710	6	4
Polk	----------	12,085	12,085	40,000	----------	1
Van Buren	----------	16,257	16,257	88,418	----------	1
Wapello	----------	53,022	53,022	175,405	----------	3
Total	250,956	927,657	1,178,613	4,146,910	23	30

[1] Figures are combined to avoid disclosing individual company confidential data.

REVIEW BY COUNTIES

Most of the 99 counties in Iowa reported mineral production in 1958. The few exceptions were Audubon, Davis, Ida, Iowa, Page, Poweshiek, Ringgold, Shelby, and Wayne. Some limestone or sand and gravel may have been produced in these counties, because several companies reporting production of those minerals did not show a breakdown by county of origin. Sixty-seven counties reported production of sand and gravel, and 60 counties reported limestone production. The data were furnished by 136 commercial and 34 noncommercial sand and gravel producers and 98 commercial and 13 noncommercial limestone producers. Estimates were made for a few companies from previous records and other sources. Although output of sand and gravel and stone showed substantial overall increases, table 6 shows that decreases were reported in many counties.

Appanoose.—Clay for manufacturing building brick and draintile was produced by the Iowa Clay Products Co., Centerville. Nine underground operations produced bituminous coal, the leading producer again being Sunshine Coal Co. Producers in 1957 that did not operate in 1958 were Long Branch Coal Co. and Square Deal Coal Co. Three companies produced limestone primarily for highway or agricultural use.

TABLE 6.—Value of mineral production in Iowa, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Adair	$690,634	$690,634	Stone.
Adams	(2)	(2)	Do.
Allamakee	202,742	122,707	Stone, sand and gravel.
Appanoose	902,659	866,380	Stone, coal, clays.
Audubon	10,854	----	
Benton	124,051	26,650	Stone, clays.
Black Hawk	920,948	903,670	Stone, sand and gravel.
Boone	251,683	270,406	Sand and gravel, clays.
Bremer	(2)	(2)	Stone, sand and gravel.
Buchanan	218,706	50,000	Stone.
Buena Vista	116,521	33,178	Sand and gravel.
Butler	193,405	280,524	Stone, sand and gravel.
Calhoun	10,530	30,159	Sand and gravel.
Carroll	87,543	49,847	Do.
Cass	(2)	47,157	Sand and gravel, stone.
Cedar	(2)	(2)	Stone.
Cerro Gordo	17,577,539	20,383,781	Cement, stone, clay, sand and gravel.
Cherokee	78,813	46,146	Sand and gravel.
Chickasaw	(2)	(2)	Stone.
Clarke	(2)	184,942	Do.
Clay	169,478	144,006	Sand and gravel.
Clayton	(2)	(2)	Sand and gravel, stone.
Clinton	309,700	(2)	Stone, sand and gravel.
Crawford	102,318	109,543	Sand and gravel.
Dallas	283,976	691,918	Sand and gravel, clays
Davis	133,794	----	
Decatur	(2)	(2)	Stone.
Delaware	334,470	404,890	Stone, sand and gravel.
Des Moines	307,497	296,826	Do.
Dickinson	60,435	40,934	Sand and gravel.
Dubuque	317,010	520,479	Stone, sand and gravel.
Emmet	99,543	156,485	Sand and gravel.
Fayette	317,960	379,950	Stone, sand and gravel.
Floyd	212,421	238,906	Stone, sand and gravel, clays.
Franklin	361,256	457,748	Sand and gravel, stone, clays.
Fremont	(2)	(2)	Stone.
Greene	192,684	(2)	Sand and gravel.
Grundy	(2)	(2)	Stone, sand and gravel.
Guthrie	(2)	87,312	Sand and gravel.
Hamilton	52,348	50,917	Do.
Hancock	155,447	(2)	Stone, sand and gravel.
Hardin	1,105,290	937,150	Do.
Harrison	(2)	(2)	Do.
Henry	239,112	(2)	Do.
Howard	64,072	121,532	Do.
Humboldt	415,978	378,031	Do.
Jackson	53,585	116,340	Stone.
Jasper	225,580	321,181	Sand and gravel.
Jefferson	78,167	113,500	Stone.
Johnson	677,780	(2)	Stone, sand and gravel.
Jones	149,308	134,989	Do.
Keokuk	169,866	13,530	Coal, clays.
Kossuth	109,620	150,150	Sand and gravel.
Lee	416,715	371,554	Stone, sand and gravel.
Linn	1,218,817	1,052,580	Do.
Louisa	483,951	(2)	Stone.
Lucas	113,140	(2)	Coal, stone.
Lyon	123,141	129,060	Sand and gravel.
Madison	1,630,421	2,042,065	Stone, clays
Mahaska	1,023,096	824,448	Coal, sand and gravel, stone, clays.
Marion	2,956,764	3,075,432	Coal, stone, sand and gravel.
Marshall	(2)	(2)	Sand and gravel.
Mills	(2)	(2)	Stone.
Mitchell	299,766	378,818	Stone, sand and gravel.
Monona	4,823	49,496	Sand and gravel.
Monroe	333,738	306,710	Coal.
Montgomery	(2)	(2)	Stone.
Muscatine	682,219	870,938	Sand and gravel, stone.
O'Brien	(2)	6,265	Sand and gravel.
Osceola	(2)	(2)	Do.
Palo Alto	116,638	81,265	Do.
Plymouth	152,395	333,468	Sand and gravel, stone.
Pocahontas	(2)	(2)	Stone, sand and gravel.
Polk	11,082,242	15,509,868	Cement, sand and gravel, stone, clays, coal.
Pottawattamie	(2)	(2)	Stone.
Sac	(2)	(2)	Sand and gravel.
Scott	10,429,826	11,932,732	Cement, stone, lime, clays, sand and gravel.
Sioux	629,302	561,471	Sand and gravel.
Story	347,350	359,192	Stone, sand and gravel, clays.

See footnotes at end of table.

TABLE 6.—Value of mineral production in Iowa, by counties[1]—Continued

County	1957	1958	Minerals produced in 1958 in order of value
Tama	(2)	(2)	Stone, sand and gravel.
Taylor	(2)	(2)	Stone.
Union		$932	Sand and gravel.
Van Buren	$620,966	616,264	Stone, coal, sand and gravel.
Wapello	718,712	594,130	Stone, coal, sand and gravel, clays.
Warren	37,693	28,825	Clays, coal.
Washington	180,469	(2)	Stone.
Webster	4,137,078	5,092,674	Gypsum, stone, clays, sand and gravel.
Winnebago	22,675	[3] 34,267	Sand and gravel, peat.
Winneshiek	335,685	364,597	Stone, sand and gravel.
Woodbury	(2)	554,996	Sand and gravel.
Worth	(2)	(2)	Stone, peat, sand and gravel.
Wright	90,196	141,590	Sand and gravel.
Undistributed	6,177,459	14,003,410	
Total[4]	68,986,000	85,356,000	

[1] The following counties are not listed because no production was reported: Ida, Iowa, Page, Poweshiek, Ringgold, Shelby, and Wayne.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Peat value included with Worth County.
[4] The total has been adjusted to avoid duplication in the value of clays and stone used in producing cement and lime.

Benton.—Clay from a surface deposit was produced by the Garrison Brick & Tile Works at Garrison for making draintile. Some limestone was also produced.

Boone.—Clay was produced by Grarok, Inc., Boone, for use in manufacturing heavy clay products. Sand and gravel was also produced by two companies and the Boone County Highway Department.

Cerro Gordo.—Cerro Gordo was the leading county in the State in value of mineral output and the major producer of cement and clay. Cement producers were Lehigh Portland Cement Co. and Northwestern States Portland Cement Co. The two companies had plants near Mason City and operated their own clay and limestone quarries. Clay was also produced by Mason City Brick & Tile Co.; principal product was draintile. Limestone and sand and gravel were produced by several other companies, primarily for highway and building use.

Clayton.—The Clayton Silica Co., Division of Concrete Materials Co. of Cedar Rapids, operates an underground mine in the St. Peter sandstone formation and produces several size products primarily for use in the foundry industry.

Dallas.—Clay was produced by Adel Clay Products Co. and Redfield Brick & Tile Co., both of Redfield, and United Brick & Tile Co. of Iowa, Sioux City. The product was used chiefly for building brick or clay tile. Redfield Brick & Tile Co. produced some clay for use in refractories. Sand and gravel was also produced for construction use.

Des Moines.—Near Sperry, about 10 miles north of Burlington, United States Gypsum Corp. explored a gypsum deposit in 1957 and 1958. In 1958 they began developing the mine and constructing a plant to process gypsum. Limestone was produced by several companies for construction and agricultural use. Raid Brothers Construction Co. also produced some rubble for use in erosion control along riverbanks.

Floyd.—The Rockford Brick & Tile Co. mined clay for making drainage tile. Sand and gravel and crushed limestone were produced by several companies.

Franklin.—Building brick and other heavy clay products were produced by Sheffield Brick & Tile Co. Sand and gravel was mined by four companies and the Franklin County Highway Department. Limestone was produced by three companies.

Hardin.—Several companies mined sand and gravel and limestone in the county. The Weaver Construction Co. produced limestone for use as rubble.

Jones.—Limestone was produced by several companies, chiefly for agricultural and construction. The DeWees-Weber Stone Co., Anamosa, produced the only dimension limestone in the State for use as veneer in house construction. The Farmers & Builders Supply Co. mined a small tonnage of limestone for rubble and flagging. Sand and gravel was also produced in the county.

Keokuk.—Clay for heavy clay products was produced by John Nelson & Sons. Nelson Coal Co. mined bituminous coal from a strip pit.

Lucas.—Big Ben Coal Co. operated an underground coal mine and Oakdale Coal Co. a strip pit. Some limestone was produced by the county.

Madison.—Clay and limestone were produced by Marquette Cement Manufacturing Co. for its cement plant in West Des Moines. Penn-Dixie Cement Corp. also produced limestone for its plant in West Des Moines. Considerable limestone for building and highway use was mined by private companies and the county.

Mahaska.—Seven strip mines and one underground mine produced coal. The Knight Coal Co. did not produce in 1958; and the Ver Steeg No. 2 mine was operated by Shinn Coal Co., a new producer. Clay was mined by Oskaloosa Clay Products Co. for manufacturing building brick and by What Cheer Clay Products Co. for making vitrified sewer pipe. The output of sand and gravel and limestone was used primarily for road surfacing.

Marion.—Bituminous coal was the principal mineral product of the county. Six underground and 11 strip mines furnished 62 percent of the coal output of Iowa. Wilkinson Coal Co. was the State's leading producer. W. D. Coal Co. was a new producer. Companies operating in 1957 with no output in 1958 included the Desplanque Coal Co., Donnelly Coal Co., Kirkville Coal Co., and Ruby Coal Co. Limestone and sand and gravel were also produced in the county, chiefly for concrete aggregate and road construction.

Monroe.—Six underground and four strip coal mines were operated. New producers were the Desplanque Coal Co., Prothero Coal Co., Inc., and South Iowa Coal Co. Operators not producing in 1958 were Karpan Coal Co., Whites Creek Coal Co., Airline Coal Co., and C. N. Knox Coal Co.

Polk.—Mineral products of Polk County, which includes the industrial area of Des Monies, comprised cement, clays, coal, limestone, and sand and gravel. Cement was produced by Hawkeye Portland Cement Co. and Penn-Dixie Cement Corp.; both companies obtained clay and limestone from pits in Madison County. Clay was mined

by Des Moines Clay Co. and United Brick & Tile Co. of Iowa for manufacturing common brick and by John Furman Contracting Co. for making viitrified sewer pipe. Sand and gravel was produced by several companies. A bituminous-coal mine was operated by Hopkins Coal Co.

Scott.—The industrial area of Davenport is located in the county. Cement, clays, lime, limestone, and sand and gravel were produced. Dewey Portland Cement Co. produced limestone and clays for its cement plant and sold crushed limestone. Quick and hydrated lime were produced by Linwood Stone Products Co., the only lime plant in Iowa. Several companies produced limestone for various uses. LeClair Quarries produced dimension limestone for use as rubble and flagging.

Story.—Nevada brick & Tile Co. produced clay for manufacturing common brick. Sand and gravel and stone were mined chiefly for road construction and agricultural use.

Van Buren.—Laddsdale Coal Co. operated a bituminous-coal strip mine. Hamlin Bros. Coal Co. a producer in 1957, was idle in 1958. Limestone was quarried for highway-construction, railroad-ballast, and agricultural use. Douds Stone, Inc., operated one of the few underground limestone quarries in the State. Sand and gravel was also produced for construction and highway use.

Wapello.—Structural brick and tile were produced by Ottumwa Brick & Tile Co. Three bituminous-coal strip mines were active, but the underground mine worked by New Globe Coal Co. in 1957 was nonproductive. Limestone, and sand and gravel were also produced in the county.

Warren.—Building brick was produced by Carlisle Brick & Tile Co. Goodwin Tile & Brick Co. produced brick and tile and sold some clay for use in mortar mix. Hy-Line Coal Co. began operating a strip mine. The S. & R. Coal Co., an underground operation in 1957, was idle.

Webster.—Crude gypsum was mined and processed by four companies—Bestwall Gypsum Co., The Celotex Corp., National Gypsum Co., and United States Gypsum Co. All companies had board and perlite-expanding plants. The Celotex Corp. board plant was new; 1958 was its first full year of operation. Clays and shales were produced by Johnson Clay Works, Inc., Kalo Brick & Tile Co., Lehigh Sewer Pipe & Tile Co., and Vincent Clay Products Co. Products included brick, draintile, vitrified tile, and building tile. Sand and gravel and limestone, chiefly for road and construction use, were also produced in the county. Fort Dodge Limestone Co. operated an underground quarry.

Winnebago.—Eli Colby Co. produced peat. Sand and gravel was also produced.

Worth.—Eli Colby Co. and Colby Pioneer Peat Co., with processing plants at Hanlontown, mined and processed virtually all the peat produced in the State. Limestone and sand and gravel were also produced in the county.

The Mineral Industry of Kansas

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of Kansas.

By W. G. Diamond[1] and Walter H. Schoewe[2]

MINERAL production in Kansas in 1958 was valued at $498.5 million, $13 million less than in 1957—the first decrease since 1949. In order of value, the five principal minerals were petroleum, natural gas, cement, stone, and salt.

Pawnee Salt Corp. was organized in 1958. Construction plans included buildings, plant equipment, evaporation system, and brine wells. The first petrochemical-complex installation in Kansas, constructed by Vickers Petroleum Co. at Potwin, Butler County, began producing in 1958.

Employment and Injuries.—According to the Employment Security Division of the Kansas Department of Labor, weekly earnings in the

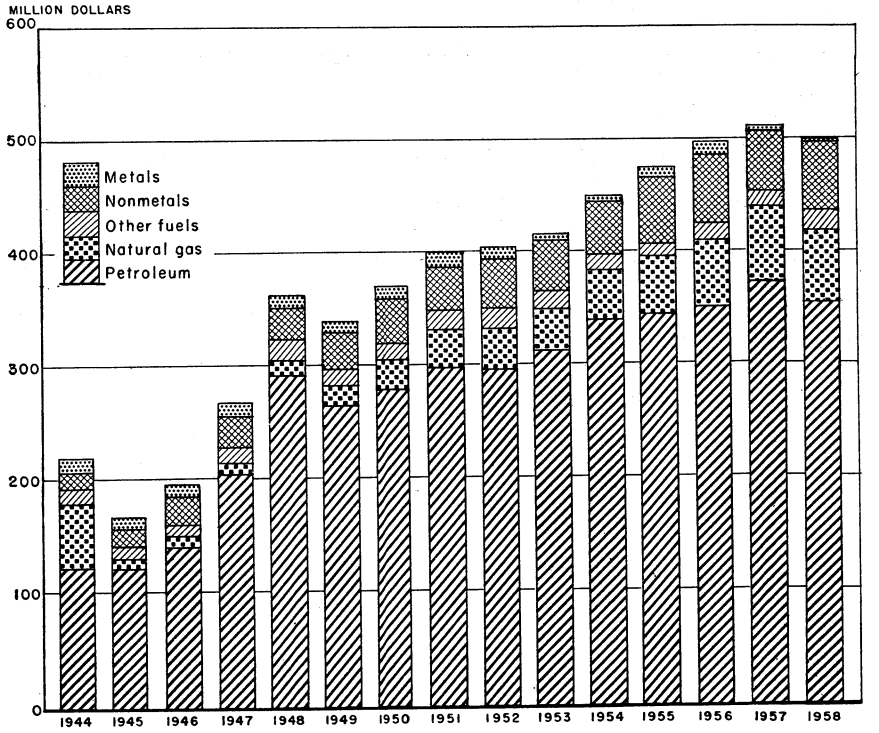

FIGURE 1.—Value of mineral production in Kansas 1944–58.

[1] Commodity-industry economist, Region IV, Bureau of Mines, Bartlesville, Okla.
[2] Geologist, State Geological Survey of Kansas, University of Kansas, Lawrence, Kans.

mining industry averaged $97.13, hourly earnings $2.34, and weekly hours worked 41.5. These averages represented a $1.06 increase in weekly earnings, an 8-cent increase in hourly earnings, and a 1.1-hour decrease in weekly hours compared with 1957.

TABLE 1.—Mineral production in Kansas [1]

Minerals	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement [2]—thousand 376-pound barrels	8,178	$24,814	9,601	$30,048
Clays—thousand short tons	909	1,240	875	1,145
Coal—do	749	3,331	823	3,711
Helium—thousand cubic feet	36,743	570	27,888	432
Lead (recoverable content of ores, etc.)	4,257	1,217	1,299	304
Natural gas—million cubic feet	586,690	66,883	561,816	64,047
Natural-gas liquids:				
Natural gasoline—thousand gallons	119,247	6,569	110,293	6,229
LP-gases—do	103,494	4,042	115,175	5,193
Petroleum (crude)—thousand 42-gallon barrels	123,614	372,078	[3] 118,188	[3] 354,564
Salt (common)—thousand short tons	1,018	10,353	1,073	11,348
Sand and gravel—do	9,345	6,175	10,317	6,769
Stone [4]—do	10,412	11,926	12,424	15,036
Zinc (recoverable content of ores, etc.)	15,859	3,679	4,421	902
Value of items that cannot be disclosed: Natural cement, gem stones (1958), gypsum, pumice, stone (dimension and crushed sandstone)		1,191		1,627
Total Kansas [5]		511,513		498,526

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers.
[2] Excludes natural cement, value for which is included with "Value of items that cannot be disclosed."
[3] Preliminary figure.
[4] Excludes certain stone value included with "Value of items that cannot be disclosed."
[5] Total adjusted to eliminate duplication in the value of clays and stone.

Six fatal accidents and four permanent partial injuries occurred in quarrying and stone crushing. One permanent partial injury was reported in the salt-mining industry and one in the metal-mining industry.

According to the Workmen's Compensation Commission, State of Kansas, 10 fatal accidents occurred in oil- and gas-well drilling.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The mineral fuels (petroleum, natural gas, natural-gas liquids, and coal) furnished more than 87 percent of the value of the minerals output.

Carbon Black.—Production of carbon black was slightly below 1957. Carbon black was produced by the furnace process using natural-gas liquids and natural gas as feedstocks.

Coal.—Bituminous-coal production was reported in six counties. About 99 percent of the coal was mined by open-pit methods. Overburden excavation totaled 14.5 million cubic yards and averaged nearly 18 cubic yards for each ton of strip-mined coal.

TABLE 2.—Average annual employment, mining industries and products of petroleum and coal [1]

Industry group	Average annual employment					
	1949–53 (average)	1954	1955	1956	1957 [2]	1958 [3]
Mining (total)	18,080	18,400	19,000	19,300	18,500	18,300
Metal	640	300	400	400	300	100
Nonmetal	1,620	1,600	[2] 1,800	2,000	1,800	1,800
Coal	800	500	[2] 400	400	400	300
Petroleum and natural gas extraction	15,020	16,000	16,400	16,500	16,000	16,100
Products of petroleum and coal	5,120	5,000	4,900	4,900	4,900	4,800

[1] Employment Security Division, Labor Department, State of Kansas.
[2] Revised figures.
[3] Preliminary figures.

TABLE 3.—Production of coal at mines producing more than 1,000 tons

Year	Number of mines			Short tons (thousands)	Value (thousands)
	Underground	Strip	Total		
1949–53 (average)				1,972	$7,788
1954	10	30	40	1,372	5,603
1955	5	19	24	742	3,166
1956	4	15	19	884	3,856
1957	3	14	17	749	3,331
1958	2	13	15	823	3,711

Helium.—The Federal Bureau of Mines operated the Otis helium plant in Rush County and extracted 25.8 million cubic feet of helium from natural gas. Shipments totaled 27.9 million cubic feet valued at $432,000.

Natural Gas.—Kansas ranked fifth in the Nation in the marketed production and value of natural gas. Production originated in 49 counties. The Hugoton gas area, comprising all or part of Finney, Grant, Hamilton, Haskell, Kearny, Morton, Seward, Stanton, and Stevens Counties, produced 59 percent of the State total. Nineteen counties produced 2 billion cubic feet or more. The estimated proved recoverable reserve of natural gas at year end was 20,234 billion cubic feet—a 5-percent gain over 1957.[3]

Important new gasfields discovered during the year were:[4]

County:	*Pool or field name*	*Initial production (thousand cubic feet per day)*
Comanche	Perry Ranch	10,300
Pratt	Tatlock Southwest	4,633
Do	Hopewell	6,150
Seward	Three Star	24,100
Stafford	Grunder	3,589
Stevens	Panoma Southwest	7,418
Cowley	Peck	7,000

[3] American Petroleum Institute and American Gas Association, Proved Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas: Vol. 13, 1958, p. 19.
[4] American Association of Petroleum Geologists, Bull., Vol. 43, No. 6, June 1959, pp. 1208–1220.

TABLE 4.—Marketed production of natural gas

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1949–53 (average)	381,758	$28,834	1956	526,091	$59,448
1954	412,369	43,711	1957 [1]	586,690	66,883
1955	471,041	52,286	1958	561,816	64,047

[1] Revised figures.

TABLE 5.—Marketed production of natural gas from Kansas part of Hugoton gas area [1]

Year	Million cubic feet	Year	Million cubic feet
1942	46,365	1951	371,002
1943	70,922	1952	375,082
1944	92,923	1953	387,635
1945	90,345	1954	346,732
1946	119,638	1955	394,257
1947	157,663	1956	381,875
1948	185,873	1957	396,889
1949	247,869	1958 [2]	349,264
1950	320,545		

[1] Goebel, E. D., Hilpman, P. L., Hornbaker, A. L., and Beene, D. L., Oil and Gas Developments in Kansas During 1957: State Geol. Survey of Kansas, Univ. of Kansas Pub., Bull. 133, 1958, p. 33.
[2] Conservation Division, Kansas Corporation Commission.

Natural-Gas Liquids.—Sixteen natural-gasoline plants reported production. The Cunningham gasoline plant of Skelly Oil Co. in Kingman County discontinued operations May 1. Tuloma Gas Products Co., a subsidiary of Standard Oil Co. of Indiana, planned building storage facilities for liquefied-petroleum-gas products south of Hutchinson in Reno County. Two caverns in salt beds, to be created 550 to 800 feet below the surface, would have an estimated potential capacity of nearly 35 million gallons. The proved recoverable reserve of natural-gas liquids was estimated at 8,381 million gallons, or 5 percent above 1957 estimates.[5]

Petroleum.—Kansas ranked fifth in the Nation in production of petroleum with 76 counties reporting activity. The five leading petroleum-producing counties were Barton, Ellis, Russell, Butler, and Graham. El Dorado Refining Co., El Dorado, Butler County, was purchased by American Petrofina, Inc., of Texas and a new Platformer added during the year. Alkylation units were planned or under construction at several refineries, including Skelly Oil Co. refinery at El Dorado, Derby Refining Co. at Wichita, Cooperative Refining Association at Coffeyville, and Anderson-Prichard Oil Corp. at Arkansas City. Standard Oil Co. constructed a new ultraforming unit at its Neodesha refinery, capable of processing more than 6,000 barrels of naphtha a day. A new propane deasphalting unit, with a capacity of 1,200 barrels a day, was installed at the Arkansas City

[5] Work cited in footnote 3, p. 10.

refinery of Anderson-Prichard Oil Corp. Mid-America Refining Co. increased its daily crude capacity 15,000 barrels and its asphalt capacity 400 barrels. Consumers Cooperative Association added a Unifier, Platformer, compressor, and control buildings to its plant at Phillipsburg.

TABLE 6.—Natural-gas liquids produced, in thousands

Year	Natural gasoline		LP-gases		Total	
	Gallons	Value	Gallons	Value	Gallons	Value
1949–53 (average)	107,360	$6,402	61,673	$2,217	169,033	$8,619
1954	(1)	(1)	(1)	(1)	(1)	(1)
1955	118,599	6,318	92,596	2,643	211,195	8,961
1956	105,482	5,928	90,287	3,843	195,769	9,771
1957	119,247	6,569	103,494	4,042	222,741	10,611
1958	110,293	6,229	115,175	5,193	225,468	11,422

[1] Figure withheld to avoid disclosing individual company confidential data.

Drilling and Exploration.—Exploratory and development drilling totaled 14.1 million feet, a decrease of 8 percent from 1957. Exploratory drilling accounted for 3.2 million feet and 844 wells, compared with 3.4 million feet and 849 wells in 1957.[6] Cable tools were used to drill approximately 3 percent of all wells in 1958, compared with 7 percent in 1957. According to the National Oil Scouts and Landmen's Association, 22 crew-weeks were spent in core-drill prospecting.

TABLE 7.—Natural gasoline and LP-gases processed in 1958, in barrels

[Conservation Division, Kansas Corporation Commission]

Company	Location		Natural gasoline	Butane	Propane	LP-gases	Total
	Nearest town	County					
Cities Service Oil Co	Burrton	Reno	49,389		17,680	43,733	110,802
Do	Wichita	Sedgwick	427,543		302,373	304,610	1,034,526
Colorado Interstate Gas Co	Lakin	Kearny	95,265				95,265
Dunn-Mar Oil & Gas Co	Otis	Rush	31,260	5,950			37,210
Hugoton Production Co	Ulysses	Grant	175,083	109,355	154,087		438,525
Kansas-Nebraska Natural Gas Co	Deerfield	Kearny	119,596		18,151	16,279	154,026
Magnolia Petroleum Co	Ulysses	Grant	183,645	52,317	97,635		333,597
Do	Spivey	Kingman	196,240	90,623	178,701		465,564
Northern Natural Gas Co	Holcomb	Finney	80,528				80,528
Do	Sublette	Haskell	153,715				153,715
Pan American Petroleum Corp	Ulysses	Grant	377,334	521,990	398,954		1,298,278
Panhandle Eastern Pipeline Co.	Liberal	Seward	547,525	213,034	125,188		885,747
Plateau Natural Gas Co	Cheney	Sedgwick	16,926			9,178	26,104
Skelly Oil Co	Cunningham	Kingman	10,185			11,924	22,109
Do	Medicine Lodge	Barber	120,281		70,667		190,948
The Texas Co	Atlanta	Cowley	16,092			18,303	34,395
Total			2,600,607	993,269	1,363,436	404,027	5,361,339

[6] Oil and Gas Journal, vol. 57, No. 4, Jan. 26, 1959, p. 125.

TABLE 8.—Production of crude petroleum, in thousands

Year	Barrels	Value	Year	Barrels	Value
1949–53 (average)	110,670	$287,146	1956	124,204	$346,529
1954	119,317	335,280	1957	123,614	372,078
1955	121,669	340,670	1958 [1]	118,188	354,564

[1] Preliminary figures.

TABLE 9.—Production, indicated demand, and stocks of crude petroleum, by months, 1958, thousand barrels

Month	Production	Indicated demand	Stocks (end of month)	Month	Production	Indicated demand	Stocks (end of month)
January	10,349	10,002	10,499	August	10,336	10,105	9,131
February	8,831	9,699	9,631	September	10,052	10,076	9,107
March	8,955	9,193	9,393	October	10,522	8,990	10,639
April	9,546	7,835	11,104	November	9,988	10,473	10,154
May	9,997	11,261	9,840	December	10,085	10,202	10,037
June	9,651	10,037	9,454				
July	9,876	10,430	8,900	Total	118,188	118,303	

TABLE 10.—Production of crude petroleum by fields, thousand barrels

[Oil and Gas Journal]

Field	1954	1955	1956	1957	1958 [1]
Bemis-Shutts	3,549	3,263	3,076	5,638	5,178
Bloomer	1,589	1,456	1,268	1,162	972
Burnett-Southwest	2,170	2,464	2,230		
Burrton-Haury	809	732	695	668	641
Chase [2]	5,339	4,897	4,689	4,578	3,951
El Dorado	3,864	4,242	4,348	4,672	4,369
Fairport	823	903	964	1,054	1,063
Genesco-Edwards	2,869	2,941	2,734	2,222	1,935
Gladys	[3]	1,024	1,885	1,832	1,690
Gorham	1,692	1,589	1,543	1,308	1,203
Hall Gurney	4,528	4,064	3,587	3,580	3,325
Luka-Carmi	1,421	1,464	1,486	1,141	1,058
Kraft-Prusa	4,357	3,826	3,498	3,238	2,949
Marcotte	1,681	1,712	1,621	2,061	1,793
Morel	1,654	1,470	1,461	1,623	1,480
Ray	1,280	1,312	1,225	1,320	1,366
Seeley-Wick	1,798	1,479	1,341	987	721
Stoltenberg	1,119	1,043	951	1,205	811
Thrall-Agard	1,002	775	748	599	490
Trapp	5,461	4,943	4,427	3,883	3,497
Welch-Bornholdt	1,361	1,254	1,108	1,024	1,075
Other fields [4]	70,951	74,816	79,319	79,829	78,621
Total Kansas	119,317	121,669	124,204	123,614	118,188

[1] Preliminary figures.
[2] Silica included with Chase.
[3] Included with "Other fields."
[4] Bureau of Mines data.

TABLE 11.—Oil- and gas-well drilling and crew-weeks spent in geophysical oil and gas prospecting in 1958 [1]

County	Proved or development wells			Exploratory wells			Grand total	Geophysical-prospecting (crew-weeks)		
	Oil	Gas	Dry	Oil	Gas	Dry		Seismograph	Gravity meter	Magnetometer
Atchison										1
Barber	32	25	26	4	5	28	120	4		
Barton	96		56	10	1	38	201	1		
Brown										1
Butler	106		71	14		71	262	39		
Chase	6			1		8	15	2		
Chautauqua								3		
Cheyenne						4	4	14		
Clark		6	5			1	12	21		
Clay			1			3	4			
Coffey	4		2			1	7			
Comanche	1	6		1	1	7	16			
Cowley	116	2	60	18	2	92	290	15		
Decatur			2	3		3	8	5		
Dickinson	1		1			13	15			
Doniphan										5
Edwards	21	4	2	4	4	7	42	1		
Elk								3		
Ellis	93		53	20		80	246	3		
Ellsworth	4		7			8	19	1		
Finney	12	29	4			2	47	4	2	
Ford			1			2	3	1		
Geary						1	1			
Gove			3			5	8	1		
Graham	119		61	39		113	332	8		
Grant					3	1	4		2	
Gray						1	1	21		
Greeley										5
Greenwood	122		33	13		28	196			
Hamilton			1		1	1	3	36	17	
Harper	32	5	9	3	1	15	65	18		
Harvey	17		10	3		25	55	8		
Haskell	8		1	4	1	4	18			
Hodgeman	8		4			7	19			
Jackson										1
Kearney				1		1	2	2	17	
Kingman	42	17	18	3	6	21	107	4		
Kiowa	11	4	5	1	1	10	32	1		
Lane						1	1	4		
Lincoln						1	1			
Logan						6	6	19		
Lyon	3					5	8	5		1
Marion	148	2	22	11	1	72	256	15		
Marshall						1	1			
McPherson	72	1	7	4	1	33	118	3		
Meade	8	25	19		1	3	56	4		
Mitchell						1	1			
Morris	2		1			2	5			6
Morton	7	28	7			4	46	1		
Nemaha				1			1			
Ness	10		4	3		11	28			
Norton	7		7	4		6	24	2		
Osborne			1			2	3			
Pawnee	4	1	5	5		13	28	7		
Phillips	3		3	4		4	14	1		
Pottawatomie						1	1			1
Pratt	4			4	2	21	31	1		
Rawlins			1	2		6	9	27		
Reno	4	16	7	1		15	43	2		
Rice	51		18	1		26	96	1		
Riley						2	2			
Rooks	22		22	15		36	95	2		
Rush	3		7	1		19	30	1		
Russell	69		24	10		26	129	5		
Saline	10		5	1		4	20	3		
Scott						1	1	8		
Sedgwick	61		23	7		34	125			
Seward		14	4		2	2	22			
Shawnee						1	1			1
Sheridan	12		5	2		22	41	1		
Sherman				3		10	13	3		
Stafford	35	1	27	12	2	47	124	11		
Stanton		5	2		1	2	10		1	

See footnote at end of table.

TABLE 11.—Oil- and gas-well drilling and crew-weeks spent in geophysical oil and gas prospecting in 1958[1]—Continued

County	Proved or development wells			Exploratory wells			Grand total	Geophysical-prospecting (crew-weeks)		
	Oil	Gas	Dry	Oil	Gas	Dry		Seismograph	Gravity meter	Magnetometer
Stevens		3				1	4			
Sumner	34	1	15	12		60	122	27		
Thomas						9	9	3		
Trego	16		4	2		36	58	3		
Wabaunsee	1		1	1		9	12	14		5
Wallace						1	1	13	3	
Wichita								14	5	
Total: 1958	1,437	195	677	248	36	1,157	3,750	416	52	22
1957	1,788	300	1,099	294	57	1,126	4,664	555	52	4

[1] National Oil Scouts and Landmen's Association, Oil- and Gas-Field Development in United States: Vol. 29, 1959.

TABLE 12.—Important new oilfields discovered in 1958[1]

Field	County	Initial production (barrels a day)	Field	County	Initial production (barrels a day)
Conness (revived)	Graham	310	Rollingson	Pratt	1,608
Fabricius	do	2,769	Wil Southeast	Stafford	312
Gurk	do	397	Blood	Butler	3,424
Mount Vernon	do	326	Seydell	Sumner	3,000
Eubank	Haskell	401	Llanos	Sherman	319
Pabst	Ness	3,264			

[1] American Association of Petroleum Geologists, Bull., vol. 43, No. 6, June 1959, pp. 1208-1220.

Pipelines.—Jayhawk Pipeline Corp., owned by Colorado Oil & Gas Corp. and National Cooperative Refinery Association, completed 197 miles of 12-inch pipeline from Meade to McPherson and 42 miles of 10-inch pipeline from McPherson to Valley Center. Cities Service Gas Co. received authorization to build 105 miles of natural-gas pipeline in Montgomery, Allen, Anderson, Franklin, Miami, Johnson, and Wilson Counties. Plans included development of the Elk City storage field in Montgomery County.

Petrochemical Plants.—Vickers Petroleum Co., Inc., began producing at the first petrochemical-complex installation in Kansas. The plant, at Potwin, Butler County, produced benzene, toluene, xylene, and higher aromatics, using catalytic reformate as raw material. At its plant near Pittsburg, Crawford County, Spencer Chemical Co. processed natural gas to produce methanol, ammonia, nitric acid, aqua ammonia, ammoniating solutions, ammonium nitrate, and dry ice. Cooperative Farm Chemicals Associations produced ammonia, ammonium nitrate, and nitrogen solutions at its plant near Lawrence, Douglas County. Raw material was natural gas. Reichhold Chemicals, Inc., Kansas City, produced phenol-formaldehyde resins and polyvinyl acetate emulsions.

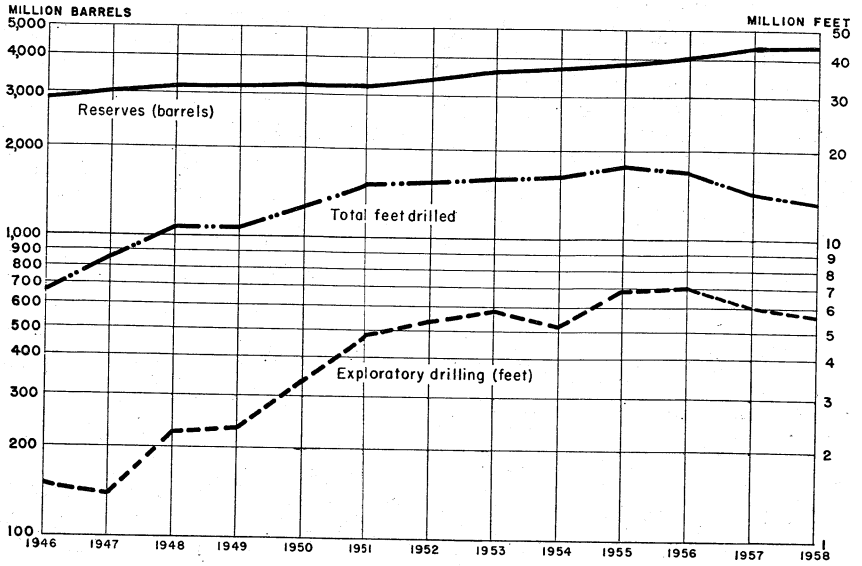

FIGURE 2.—Proved reserves of total hydrocarbons and footage drilled, 1946–58.

Legislation.—The U.S. Supreme Court overruled the Kansas Supreme Court and ruled that a State may not fix minimum prices at the wellhead on natural gas destined for interstate commerce. The Kansas Corporation Commission had fixed a minimum price of 11 cents a thousand cubic feet for natural gas produced in the Kansas Hugoton field.

The Kansas Supreme Court ruled unconstitutional the State's 1-percent severance tax on oil and gas, imposed in 1957. The Court ruled that the Act's title was defective, making the entire law unconstitutional and void.

NONMETALS

Barite.—Sherwin-Williams Co. completed construction of a barium monohydrate plant adjacent to its barium carbonate plant at Coffeyville, Montgomery County.

Boron.—Callery Chemical Co. produced boron products, including rocket fuel, at its plant near Lawrence, in Douglas County.

Cement.—Portland-cement plants in Allen, Montgomery, Neosho, Wilson, and Wyandotte Counties yielded 9.2 million barrels of portland cement, and output averaged 76 percent of capacity. Shipments totaled 9.3 million barrels—74 percent in bulk and 26 percent in bags. Monarch Cement Co. completed its expansion program, begun in 1956, increasing annual capacity to 2 million barrels. Fort Scott Hydraulic Cement Co., Inc., produced natural cement at Fort Scott, Bourbon County. All cement plants also produced masonry cement.

Clays.—Clays were produced in 10 counties. Fire clay and miscellaneous clay from eight counties were used in making heavy clay products. Buildex, Inc., Franklin County, and Kansas Industries,

Inc., Wyandotte County, produced lightweight aggregate from miscellaneous clay. Kansas Brick & Tile Co. announced a $10,000 expansion program at its Hoisington plant in Barton County. Acme Brick Co. announced that its Great Bend-Kanopolis plant would be expanded to manufacture tile and other products in addition to brick.

TABLE 13.—Production and shipments of portland cement, 376-pound barrels

Year	Production (barrels)	Shipments	
		Barrels (thousands)	Value (thousands)
1949–53 (average)	8,478,917	8,384	$19,616
1954	8,803,007	9,076	23,874
1955	9,219,533	9,072	24,521
1956	10,486,150	10,240	29,371
1957	8,117,799	7,864	23,593
1958	9,244,184	9,298	28,843

Gypsum.—Production of crude and calcined gypsum declined. Gypsum was produced by National Gypsum Co. near Medicine Lodge, Barber County, and by Bestwall Gypsum Co. at Blue Rapids, Marshall County.

Perlite.—Panacalite Perlite, Inc., expanded perlite at its Kansas City plant from crude rock mined in the Western States for use mainly as a lightweight aggregate. Both quantity and value decreased in 1958.

Pumice.—Crude pumice produced near Wilson in Lincoln County was crushed for use in abrasives and cleaning powders. The output and value were below 1957.

Salt.—Five companies produced evaporated and rock salt in Ellsworth, Reno, and Rice Counties. A new salt company, Pawnee Salt Corp. of Pawnee Rock, Barton County, was organized. Construction plans included erecting buildings, plant equipment, an evaporation system, and brine wells. American Salt Co. announced plans for a $750,000 modernization and expansion program at its Lyons plant in Rice County. Frontier Chemical Co., Division of Vulcan Materials Co., produced brine in Sedgwick County for use in making industrial inorganic chemicals. The company continued its $5-million expansion program. Facilities for manufacturing anhydrous hydrogen chloride were completed.

Sand and Gravel.—Sand and gravel was mined in 66 counties at 102 commercial operations and 48 Government-and-contract operations. Sedgwick and Wyandotte Counties, the leading producers,

TABLE 14.—Clays sold or used by producers, in thousands

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	681	$669	1956	977	$1,169
1954	[1] 698	[1] 778	1957	909	1,240
1955	[1] 768	[1] 873	1958	875	1,145

[1] Excludes fire clay.

TABLE 15.—Salt sold or used by producers, in thousands

Year	Evaporated salt		Rock salt		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	354	$4,481	525	$1,940	879	$6,421
1954	356	5,474	521	2,304	877	7,778
1955	362	5,820	549	2,613	911	8,432
1956	461	6,352	543	2,815	1,004	9,167
1957	522	7,785	496	2,568	1,018	10,353
1958	373	7,962	700	[1] 3,386	1,073	11,348

[1] Brine included with rock salt; previously included with evaporated salt to avoid disclosing individual company confidential data.

supplied 33 percent of the total output and 35 percent of its value. Sand and gravel was used mainly for construction and road building. Glass, molding, blast, engine, and filter sands also were produced.

Stone.—Limestone, sandstone, and miscellaneous stone were quarried in 46 counties. Activity centered in Elk and Wyandotte Counties, which accounted for 20 percent of the value of all stone produced, including limestone for cement. Wyandotte, Elk, Wilson, Allen, and Neosho Counties supplied 39 percent of the total value of limestone production. Crushed limestone was produced in 45 counties and dimension limestone in 8 counties. Crushed sandstone came from Lincoln and Graham Counties and dimension sandstone from Bourbon County. Miscellaneous stone (chat) was mined by nine operators in Cherokee County. Most of the crushed stone was used for concrete aggregate, roadstone, riprap, and agricultural lime.

TABLE 16.—Sand and gravel sold or used by producers, in thousands

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	5,899	$4,009	2,252	$1,101	8,151	$5,110
1954	8,341	6,366	2,081	828	10,422	7,194
1955	9,000	6,342	1,665	568	10,665	6,910
1956	10,656	7,429	1,859	593	12,515	8,022
1957	7,680	5,425	1,665	750	9,345	6,175
1958	8,282	5,806	2,035	963	10,317	6,769

TABLE 17.—Stone sold or used by producers, in thousands

Year	Limestone [1]		Sandstone		Miscellaneous stone		Total stone [1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1954	9,161	$11,957	355	$687	861	$298	10,377	$12,942
1955	10,860	14,341	746	1,243	877	363	12,483	15,947
1956	11,654	14,630	315	516	1,465	557	13,434	15,703
1957	8,871	11,278	[2]	[2]	1,540	648	[3] 10,412	[3] 11,926
1958	11,495	14,653	[2]	[2]	929	383	[3] 12,424	[3] 15,036

[1] Includes diatomaceous marl and limestone for cement.
[2] Figure withheld to avoid disclosing individual data.
[3] Excludes sandstone.

Vermiculite.—Vermiculite was exfoliated at Wichita, Sedgwick County, from crude material shipped from the Western States.

METALS

The Kansas lead- and zinc-producing area in Cherokee County is part of the Tri-State district, which also includes Oklahoma and the Southwestern Missouri district. Further details on Tri-State activity are given in the Oklahoma chapter.

Mills and Smelters.—National Lead Co. suspended operation of its Ballard No. 8 mill in January. Eagle-Picher Co. operated its lead smelter at Galena and produced pigments. Ozark Smelting & Mining Co. produced lead pigments at Coffeyville.

Lead.—Mine output of lead was the lowest since 1915, as production ceased in July. The Stoskopf mine of Searcy-Henderson Mining Co. was the largest producer, followed in order by Eagle-Picher Co.'s Bilharz and Westside mines. All of these mines produce from mixed lead-zinc ores.

Zinc.—The output of zinc was the lowest since 1906. No zinc was produced in the last half of the year. Westside mine of Eagle-Picher Co. was by far the leading producer of the 25 contributing mines. Other mines having significant production included the Grace "B" and Bilharz mines of Eagle-Picher Co. and the Stoskopf mine of Searcy-Henderson Mining Co.

TABLE 18.—Mine production of lead and zinc, by months, 1958, in terms of recoverable metals

Month	Lead (short tons)	Zinc (short tons)	Month	Lead (short tons)	Zinc (short tons)
January	345	1,032	May	149	611
February	199	720	June	210	862
March	237	575	July–December	----------	----------
April	159	621	Total	1,299	4,421

TABLE 19.—Mine production of lead and zinc, in terms of concentrate and recoverable metals [1]

Year	Mines producing	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content [2]			
						Lead		Zinc	
		Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1949–53 (average)	----------	9,851	$1,825	46,915	$4,649	7,494	$2,305	25,302	$7,513
1954	26	5,390	916	[3] 38,896	2,638	4,033	1,105	[4] 19,110	4,128
1955	36	7,362	1,353	51,252	3,981	5,498	1,638	27,611	6,792
1956	41	10,130	1,955	53,142	4,688	7,635	2,397	28,665	7,854
1957	43	5,703	1,026	29,189	2,311	4,257	1,218	15,859	3,679
1958	25	1,828	242	8,210	499	1,299	304	4,421	902

[1] Based on Kansas ore and old tailing treated at mills during calendar year indicated.
[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 concentrate ("ore") and metal, it should be borne in mind that the value given for the concentrate is that actually received by the producer, whereas the value of lead and zinc is calculated from the average price for all grades.
[3] Includes 360 tons from old tailing remilled.
[4] Includes 194 tons from old tailing remilled.

REVIEW BY COUNTIES [7]

Allen.—Allen County ranked first in the State in output of cement. Portland and masonry cements were produced by Lehigh Portland Cement Co. at Iola and Monarch Cement Co. at Humboldt. Petroleum and natural gas were recovered in the county. Humboldt Shale Mining Co. and United Brick & Tile Co. mined miscellaneous clay for heavy clay products.

Anderson.—Petroleum was produced in Anderson County, principally by secondary-recovery methods. Hunt Rock Co. and Murray Limestone Products Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Atchison.—Limestone was crushed for concrete aggregate, roadstone, riprap, and agricultural stone. Producers included Geo. W. Kerford Quarry Co., Ralph Bromley & Sons, and the U.S. Army Corps of Engineers.

Barber.—Barber County ranked fourth in natural gas and sixth in natural-gas-liquids output. Exploratory drilling resulted in one new oilfield, the Palmer, in the Marmaton formation. Petroleum production was less than in 1957. Skelly Oil Co. recovered natural gasoline and propane at its Medicine Lodge plant. National Gypsum Co. produced crude and calcined gypsum. M. W. Watson mined paving sand and Barber County Highway Department, paving gravel.

TABLE 20.—Value of mineral production in Kansas, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Allen	$10,754,168	$12,085,998	Cement, petroleum, stone, clays, natural gas.
Anderson	1,862,184	(2)	Petroleum, stone.
Atchison	187,168	428,196	Stone.
Barber	13,032,000	(2)	Natural gas, petroleum, gypsum, natural-gas liquids, sand and gravel.
Barton	39,735,727	35,041,504	Petroleum, sand and gravel, clays, natural gas.
Bourbon	773,394	903,138	Natural cement, stone, petroleum, coal.
Brown	8,760	2,000	Sand and gravel.
Butler	23,881,416	22,694,528	Petroleum, stone.
Chase	186,146	305,303	Petroleum, stone, sand and gravel, natural gas.
Chautauqua	2,988,463	3,046,530	Do.
Cherokee	7,862,160	3,909,049	Coal, zinc, stone, lead, clays, natural gas, gem stones.
Cheyenne	13,250	53,238	Sand and gravel.
Clark	1,308,473	1,504,078	Petroleum, natural gas, sand and gravel.
Clay	71,486	192,297	Stone, petroleum, sand and gravel.
Cloud	365,666	366,805	Sand and gravel, clays.
Coffey	494,238	447,406	Petroleum, stone, coal, sand and gravel, natural gas.
Comanche	36,014	78,803	Petroleum, natural gas, sand and gravel.
Cowley	13,317,519	13,544,406	Petroleum, stone, natural gas, sand and gravel, natural-gas liquids.
Crawford	1,296,972	1,675,804	Coal, clays, petroleum, stone, natural gas.
Decatur	1,385,263	1,225,286	Petroleum, sand and gravel.
Dickinson	752,467	798,293	Stone, petroleum, sand and gravel.
Doniphan	310,585	414,958	Stone.
Douglas	(2)	(2)	Sand and gravel, petroleum.
Edwards	(2)	(2)	Petroleum, natural gas, sand and gravel.
Elk	1,588,542	1,887,370	Stone, petroleum, natural gas, sand and gravel.
Ellis	34,752,073	34,169,227	Petroleum, sand and gravel.
Ellsworth	8,664,785	7,349,069	Petroleum, salt, clays, sand and gravel.
Finney	6,342,692	5,557,404	Natural gas, petroleum, natural-gas liquids, sand and gravel.

See footnotes at end of table.

[7] For more detailed fuels data see: American Association Petroleum Geologists Bulletin, Vol. 43, No. 6, June 1959, pp. 1208–1220.
Goebel, E. D., Hilpman, P. L., and Beene, D. L., Oil and Gas Developments in Kansas During 1958: State Geol. Survey of Kansas Pub. Bull. 138, 1959, 228 pp.

TABLE 20.—Value of mineral production in Kansas, by counties [1]—Continued

County	1957	1958	Minerals produced in 1958 in order of value
Ford	$214,110	$288,304	Sand and gravel, natural gas, petroleum.
Franklin	1,056,446	1,064,270	Petroleum, clays, stone.
Geary	359,200	435,574	Stone, sand and gravel.
Gove	68,005	85,397	Petroleum, sand and gravel.
Graham	19,904,815	20,386,422	Petroleum, stone, sand and gravel.
Grant	(2)	12,890,402	Natural gas, natural-gas liquids, sand and gravel.
Gray	(2)	(2)	Sand and gravel.
Greenwood	20,627,096	18,703,808	Petroleum, stone.
Hamilton	489,557	487,124	Natural gas, petroleum, sand and gravel.
Harper	2,549,019	(2)	Petroleum, natural gas, sand and gravel.
Harvey	(2)	(2)	Petroleum, sand and gravel, natural gas.
Haskell	4,595,287	4,024,768	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Hodgeman	503,668	796,628	Petroleum.
Jackson	68,334	139,918	Stone, sand and gravel.
Jefferson	474,000	493,587	Stone.
Jewell	(2)	(2)	Stone, sand and gravel.
Johnson	273,274	326,253	Stone, petroleum, natural gas.
Kearny	7,882,181	7,725,607	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Kingman	(2)	(2)	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Kiowa	2,955,977	2,579,259	Petroleum, natural gas, sand and gravel.
Labette	445,447	(2)	Petroleum, stone, natural gas.
Leavenworth	472,219	546,369	Stone, sand and gravel, petroleum, natural gas.
Lincoln	(2)	(2)	Stone, pumice.
Linn	360,635	405,676	Petroleum, stone, coal, natural gas.
Logan	2,400		
Lyon	973,802	872,217	Petroleum, sand and gravel, stone.
Marion	6,686,880	(2)	Petroleum, stone, natural gas.
Marshall	574,010	594,298	Gypsum, sand and gravel, stone.
McPherson	12,306,096	12,201,411	Petroleum, natural gas, sand and gravel.
Meade	3,837,887	3,911,245	Petroleum, natural gas.
Miami	1,969,218	1,770,105	Petroleum, stone, natural gas.
Montgomery	6,554,482	6,537,588	Cement, petroleum, stone, natural gas, clays.
Morris	1,143,240	1,196,138	Petroleum, stone, natural gas.
Morton	12,479,688	11,838,813	Natural gas, petroleum.
Nemaha	65,590	72,731	Petroleum, stone, sand and gravel.
Neosho	6,596,737	7,870,387	Cement, petroleum, stone, natural gas.
Ness	1,595,913	1,701,474	Petroleum.
Norton	2,727,722	(2)	Petroleum, pumice.
Osage	117,760	207,875	Stone, coal.
Osborne	237,168	243,653	Petroleum, sand and gravel, stone.
Ottawa	17,429	18,842	Sand and gravel.
Pawnee	9,796,346	7,459,160	Petroleum, natural gas, sand and gravel.
Phillips	5,841,342	5,919,095	Petroleum, sand and gravel.
Pottawatomie	103,297	164,510	Stone, sand and gravel.
Pratt	7,001,922	11,598,282	Petroleum, sand and gravel, natural gas.
Rawlins	11,489	23,200	Petroleum.
Reno	9,787,670	11,483,042	Salt, petroleum, natural gas, natural-gas liquids, sand and gravel.
Republic	(2)	(2)	Sand and gravel.
Rice	18,034,314	18,366,999	Petroleum, salt, stone, sand and gravel, natural gas.
Riley	100,172	(2)	Sand and gravel, stone.
Rooks	21,267,674	19,301,314	Petroleum.
Rush	2,892,451	2,435,663	Petroleum, helium, natural gas, natural-gas liquids.
Russell	27,447,739	26,430,145	Petroleum, sand and gravel, natural gas.
Saline	2,156,637	2,029,794	Petroleum, sand and gravel.
Scott	106,899	117,993	Petroleum.
Sedgwick	12,818,416	12,651,261	Petroleum, natural-gas liquids, sand and gravel, salt, stone, natural gas.
Seward	5,285,696	5,360,073	Natural gas, natural-gas liquids, petroleum.
Shawnee	981,544	942,477	Stone, sand and gravel.
Sheridan	1,181,589	1,302,004	Petroleum, sand and gravel.
Sherman	(2)	68,691	Sand and gravel, petroleum.
Smith	(2)	(2)	Sand and gravel.
Stafford	(2)	17,945,059	Petroleum, natural gas, sand and gravel.
Stanton	2,328,535	2,486,029	Natural gas, petroleum.
Stevens	12,152,673	11,750,593	Natural gas.
Sumner	8,850,728	(2)	Petroleum, sand and gravel, natural gas.
Thomas	35,548	50,717	Sand and gravel, petroleum.
Trego	5,686,970	5,674,659	Petroleum, sand and gravel.
Wabaunsee	(2)	805,946	Do.
Wallace	(2)	(2)	Stone, sand and gravel.
Washington	96,600	143,150	Sand and gravel.

See footnotes at end of table.

TABLE 20.—Value of mineral production in Kansas, by counties [1]—Continued

County	1957	1958	Minerals produced in 1958 in order of value
Wichita	$1,032	$2,422	Petroleum.
Wilson	5,391,286	6,430,433	Cement, petroleum, stone, clays, natural gas, sand and gravel.
Woodson	2,732,578	2,624,820	Petroleum, stone, natural gas.
Wyandotte	6,040,867	7,994,554	Cement, stone, sand and gravel, clays.
Undistributed	50,225,102	48,867,212	
Total	511,513,000	498,526,000	

[1] The following counties are not listed because no production was reported in 1957 or 1958: Greeley, Lane, and Mitchell.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Barton.—The county ranked first in the State in total value of mineral, petroleum, and clay output. New oil- and gas-field discoveries were Bottoms, Galatia, Cruckenberg (revived), Merten Southwest, Nay South, Olmitz, Popp, Stiles, and Voight. Sand and gravel, mainly for building and paving, was produced by DuBois Sand Co., San Ore Construction Co., Moos Bros. Sand Co., Gruber Sand Plant, Arkansas Sand Co., and Barton County Highway Department. Acme Brick Co. and Kansas Brick & Tile Co. mined clay for making heavy clay products. Kansas Brick & Tile Co. announced a $10,000 expansion program.

Bourbon.—Natural and masonry cements were manufactured by Fort Scott Hydraulic Cement Co., Inc., at Fort Scott. Bandera Stone Co. quarried dimension sandstone. Limestone for concrete aggregate, roadstone, riprap, and agricultural purposes was crushed by Cullor Limestone Co., Inc., Fort Scott Hydraulic Cement Co., Inc., and Bourbon County Highway Department. Garrett Coal Co. strip-mined coal. A small quantity of petroleum was recovered.

Butler.—The county ranked fourth in the State in total value of mineral and petroleum production. Secondary-recovery operations supplied a large part of the petroleum. New oilfield discoveries were Blood, Douglas Townsite, Elbing South, Mellor East, Mellor North, Mellor West, Paulson, Paulson Northeast, and Plum Grove. Vickers Petroleum Co., Inc., completed building its $2 million Universal Oil Products Udex extraction unit at Potwin and produced benzene, toluene, xylenes, and other aromatics. Skelly Oil Co. continued its expansion program; a H-F alkylation unit was completed and a control laboratory building, a continuous coking unit, and a new vacuum distillation unit neared completion. American Petrofina, Inc., purchaser of the assets of El Dorado Refining Co., put its Platformer on stream late in the year. Myers Material, Inc., and Butler County Highway Department quarried and crushed limestone for concrete aggregate and roadstone.

Chase.—Riddle Quarries, Inc., crushed limestone for concrete aggregate and roadstone. Chase County Highway Department mined paving gravel. Petroleum and natural gas were produced.

Chautauqua.—Production of petroleum and natural gas was reported in the county. Sedan Limestone Co. crushed limestone, mainly for concrete aggregate and roadstone. Sand for paving was produced under contract for Chautauqua County Highway Department.

Cherokee.—The entire output of lead and zinc in Kansas originated in Cherokee County. Crude ore was mined by 11 companies at 19 mines; the 2 largest producers were Eagle-Picher Co. (6 mines) and National Lead Co. (4 mines). Owing to low metal prices, National Lead Co. closed its Ballard mine-mill unit near Baxter Springs in January. In July, Eagle-Picher Co. closed its remaining mines and Central Mill, thereby completing shutdown of both the Kansas and Oklahoma sections of the field. Lead and zinc mining had been conducted almost continuously since the discovery of deposits in 1876 near the present site of Galena, Kans. Eagle-Picher Co. operated its lead smelter and pigment plant at Galena and produced sulfuric acid by the contact process.

The county continued to rank first in coal mined in Kansas. Strip mines were operated by P & M Coal Mining Co., Wilkinson Coal Co., S & M Coal Co., Inc., and Black Diamond Coal Co. Chat was produced by nine operators. Leading producers included Eagle-Picher Co., Baxter Chat Co., and Southwest Chat Co. Limestone was crushed by John J. Stark for concrete aggregate and roadstone. United Brick & Tile Co. mined miscellaneous clay for heavy clay products.

Clark.—Petroleum and natural gas were produced in Clark County. Paving gravel was mined by Clark County Highway Department.

Clay.—Riddle Quarries, Inc., and Everett Quarries, Inc., crushed limestone for concrete aggregate and roadstone. Petroleum was produced in the county. Alsop Sand Co. and Clay Center Concrete & Sand Co., Inc., mined building and paving sand and paving gravel.

Cloud.—Cloud County ranked third in the State in value of clay and seventh in value of sand and gravel production. Cloud Ceramics mined fire clay near Concordia for making heavy clay products. Sand and gravel, used mainly for building and paving, was produced by Earl Beaver Sand Co., Ross Sand Co., Inc., and Walker Sand Co.

Coffey.—Petroleum and natural gas were recovered. Jones Rock Co., Neosho Valley Rock Co., and Coffey County Highway Department crushed limestone for concrete aggregate, roadstone, and agricultural stone. Coal was strip-mined by S. L. Rogers Coal Co. Coffey County Highway Department mined paving gravel.

Comanche.—Petroleum and natural gas were produced. Perry Ranch field was a new gas discovery. Building sand and paving gravel were mined by Comanche County Road Department.

Cowley.—Cowley County ranked fifth in the State in sand and gravel output and tenth in total value of mineral production. Petroleum, natural gas, and natural-gas liquids were produced. New oil- and gas-field discoveries in 1958 were Atlanta, Bernstorf, Burden Townsite, Estep, Higby, Maple, Peck, Windsor Southeast, and Windsor Southwest. Texaco, Inc., recovered natural gasoline and LP-gases at its plant near Burden. Anderson-Prichard Oil Corp. installed a new propane deasphalting unit at its Arkansas City refinery. Dimension limestone was prepared by Silverdale Cut Stone Co., Silverdale Limestone Co., and John V. Elam. C. L. Daniels Stone Co. crushed limestone. Sand and gravel, mainly for building and paving, was produced by McFarland Gravel Co., Oxford Sand & Gravel Co., Myers Materials, Inc., Warren R. Phillips, and Wilson Bros.

Crawford.—Crawford County ranked second in the State in production of both coal and clay. Coal was mined underground by Blue Ribbon Coal Co. and strip-mined by Clemens Coal Co., Apex-Compton Coal Co., Inc., Cliff Carr Coal Co., Palmer Coal Co., and Jones Coal Co. Miscellaneous clay and fire clay were mined by W. S. Dickey Clay Manufacturing Co. for making heavy clay products. John J. Stark crushed limestone for concrete aggregate, roadstone, and agricultural stone. Small quantities of petroleum and natural gas were produced.

Decatur.—Petroleum was recovered in the county. Decatur County Highway Department produced paving sand.

Dickinson.—Stone, petroleum, and sand and gravel were produced in Dickinson County. Anderson-Oxandale and Riddle Quarries, Inc., crushed limestone for concrete aggregate, roadstone, riprap, and agricultural uses. Shoffner Sand & Gravel Co. mined sand and gravel for building and paving.

Doniphan.—Limestone was quarried and crushed for riprap, concrete aggregate, roadstone, and agricultural stone by Geo. W. Kerford Quarry Co., Wolf River Limestone, Inc., Everett Quarries, Inc., and the U.S. Army Corps of Engineers.

Douglas.—Bowersock Mills & Power Co. mined sand for paving and other uses. Petroleum was produced in the county. Callery Chemical Co. manufactured boron specialty chemicals, including high-energy fuels for jet aircraft and missiles. Cooperative Farm Chemicals Association produced ammonia, ammonium nitrate, and other nitrogen compounds, using natural gas as raw material.

Edwards.—Petroleum and natural gas were recovered in the county. New oilfield discoveries were Trousdale North, Wil North, and Wil South. Sand for building was produced by Showalter Sand & Gravel Co.

Elk.—The county ranked second in stone production. Concrete Materials Construction Co. quarried and crushed limestone near Moline for concrete aggregate, roadstone, riprap, railroad ballast, and agricultural stone. Elk County Highway Department crushed limestone and gravel for use on roads.

Ellis.—Ellis County ranked second in total value of mineral and petroleum production. New oilfield discoveries included Air-Braun, Chris, Chrisler South, Eagle Creek East, Herbert, Toulon South, Toulon Southeast, and Werth fields. Lewis C. Schmidtberger produced sand for building use at a plant near Victoria.

Ellsworth.—Petroleum was recovered, and some development and exploratory drilling were done. Independent Salt Co. produced rock salt near Kanopolis. Acme Brick Co. mined fire clay for heavy clay products. Building and paving sand and gravel were produced by Henry Milberger, Stoppel Construction Co., and Ellsworth County Highway Department.

Finney.—Natural gas was recovered from the Finney County section of the Hugoton gas area. Northern Natural Gas Co. recovered natural gasoline at its plant near Holcomb. Petroleum was also recovered in the county. Sam Alsop Construction Co. and Finney County Highway Department produced sand and gravel.

Ford.—Ford County ranked sixth in sand and gravel output. Producers included Miller Sand & Gravel Co., Dodge City Sand Co., Seacat Sand & Excavating Co., and Davis & Son Sand Sales. Sand and gravel was used for building, paving, and fill. Natural gas and petroleum also were produced.

Franklin.—Petroleum was recovered, mainly by secondary-recovery methods. Buildex, Inc., mined miscellaneous clay near Ottawa and produced lightweight aggregate by the Haydite process. Dan Fogle and Franklin County Highway Department crushed limestone for concrete aggregate, roadstone, and other uses.

Geary.—Walker Cut Stone Co. produced crushed and dimension limestone and Grosshans and Petersen, Inc., crushed limestone. Junction City Sand & Gravel Co. mined sand and gravel for building, paving, and fill.

Gove.—Sand and gravel for paving was mined by Harry Henery, Inc., and Gove County Highway Department. Petroleum was also recovered.

Graham.—Graham County ranked fifth in the State in value of mineral and petroleum production. Important new or revived fields were Conness (revived), Fabricius, Gurk, Harmony South, Mitchell, Mount Vernon, and Nana Northwest. E. C. Shroeder Co. crushed limestone for riprap, concrete aggregate, and roadstone. Government-and-contractor operators crushed sandstone for riprap. San Ore Construction Co. produced paving sand.

Grant.—The county ranked first in the State in natural-gas-liquids and third in natural-gas production. All natural gas was recovered from the Hugoton gas area. The State's entire output of carbon black was produced by Columbian Carbon Co. at Hickok and United Carbon Co. at Ryus. Natural gasoline, butane, and propane were produced by Hugoton Production Co., Magnolia Petroleum Co., and Pan American Petroleum Corp. Grant County Highway Department mined paving gravel.

Greenwood.—Petroleum was produced in Greenwood County, largely by secondary-recovery methods. New oilfield discoveries were Lane and Salt Springs Northwest. Limestone for concrete aggregate and roadstone was quarried and crushed by Myers Materials, Inc., and Greenwood County Highway Department.

Hamilton.—Natural gas and petroleum were recovered in the county. The Wedel field was a new gas discovery. Hamilton County Highway Department produced building and paving sand.

Harper.—Petroleum and natural gas were produced in Harper County. New oil- and gas-field discoveries were Attica, Goheen, Harper, and Hibbord Northeast. Sand and gravel for paving was mined by San Ore Construction Co. and Harper County Highway Department.

Harvey.—Production of sand and gravel, petroleum, and natural gas was reported in the county. Thach Sand & Gravel Co. produced building and paving sand and gravel. New oilfield discoveries were Alta Mills, DuBois North, and West Branch.

Haskell.—Natural gas (from the Haskell County section of the Hugoton gas area) and petroleum were produced. Three new fields were discovered: Eubank, Eubank South, and Koenig. Northern Natural

Gas Co. recovered natural gasoline at its plant near Sublette. M. W. Watson and Haskell County Highway Department produced gravel for paving use.

Jackson.—Anderson-Oxandale, Reno Construction Co., and G. W. Baker quarried and crushed limestone for concrete aggregate and roadstone. Jackson County Highway Department produced paving gravel.

Jefferson.—Roy Baker and N. R. Hamm Quarry, Inc., quarried and crushed limestone for concrete aggregate, roadstone, riprap, agricultural stone, and asphalt filler.

Jewell.—Ideal Cement Co. quarried cement rock for use in cement. Jewell County Highway Department produced paving gravel.

Johnson.—Reno Construction Co., Deitz Hill Development Co., and Johnson County Highway Department crushed limestone, mainly for concrete aggregate and roadstone. A small quantity of dimension limestone was produced. Petroleum and natural gas also were recovered.

Kearny.—Kearny County ranked fifth in the State in output of natural gas and natural-gas liquids. A small quantity of petroleum was produced. Colorado Interstate Gas Co. recovered natural gasoline at Lakin; Kansas-Nebraska National Gas Co. recovered natural gasoline, propane, and LP-gases at Deerfield. Sand and gravel was mined by Popejoy Sand & Gravel Co. and Kearny County Highway Department.

Kingman.—Kingman County ranked fourth in recovery of natural-gas liquids. Plants were operated by Skelly Oil Co. and Magnolia Petroleum Co. Skelly Oil Co. discontinued its Cunningham gasoline plant May 1. Petroleum and natural gas were produced. Alameda and Saylor fields were new oil discoveries. Ray Wells mined sand for building use.

Kiowa.—Petroleum and natural gas were produced in the county. New oilfield discoveries were Booth, GRW, and Quaker. Kiowa County Highway Department produced paving sand.

Labette.—Labette County Highway Department produced crushed and dimension limestone. John J. Stark crushed limestone for concrete aggregate, roadstone, and agstone. Petroleum and natural gas also were produced.

Leavenworth.—Crushed limestone, produced by Loring Quarries, Inc., J. C. Haigwood, Kansas State Penitentiary, and the U.S. Army Corps of Engineers, was used for riprap, concrete aggregate, roadstone, railroad ballast, and agricultural stone. Missouri Valley Sand, Inc. dredged paving and fill sand, and Leavenworth County Highway Department produced paving gravel. Petroleum and natural gas were also produced.

Lincoln.—Quartzite Stone Co. crushed sandstone for filter use, concrete aggregate, roadstone, railroad ballast, and riprap. Pumice was produced by Ernest Hanzlicek.

Linn.—Murray Limestone Products Co., Lee Giles, and Linn County Highway Department quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Wood Coal Co. strip-mined coal. Petroleum and natural gas were recovered.

Lyon.—Wesley Parks mined building and paving sand and gravel near Hartford. The City of Emporia Highway Department quarried and crushed limestone for concrete aggregate and roadstone. Petroleum was also produced in the county.

Marion.—Petroleum and natural gas were produced in Marion County. Antelope East and Lincolnville fields were new oil discoveries. Riddle Quarries, Inc., and Walt Keeler Co., Inc., crushed limestone for concrete aggregate, roadstone, riprap, and agricultural stone.

Marshall.—Bestwall Gypsum Co. mined and processed gypsum at Blue Rapids. Building and paving sand and gravel were mined by Blue River Sand & Gravel Co., Heinzelman Construction Co., C. V. Garrett, and Marshall County Highway Department. Hopper Bros. Quarries and Marshall County Highway Department crushed limestone for riprap, concrete aggregate, roadstone, and agricultural uses.

McPherson.—Petroleum and a small quantity of natural gas were recovered. New oil and gas discoveries were Elyria, Goessel, Groveland Northeast, Larson, and Mound Ridge Townsite. McPherson County Road Department produced paving gravel.

Meade.—Production of petroleum and natural gas was reported. Mohler Northeast field was an oil and gas discovery.

Miami.—Petroleum was the leading mineral produced in Miami County. Waterflood projects supplied a large part of the recovered petroleum. Small quantities of natural gas were also recovered. Limestone was produced by L. W. Hayes, Inc., A. J. Forster, and Miami County Highway Department.

Montgomery.—Montgomery County ranked fourth in the State in output of cement. Universal Atlas Cement Co. produced portland and masonry cements at its Independence plant. Petroleum and natural gas were recovered. Limestone was crushed by H & S Rock Co., Universal Atlas Cement Division of United States Steel Corp., Montgomery County Highway Department, and the City of Coffeyville, for concrete aggregate and roadstone. United Brick & Tile Co. mined clay for making heavy clay products. Ozark Smelting & Mining Co., a subsidiary of Sherwin-Williams Co., processed zinc ores into zinc pigments at Coffeyville. Sherwin-Williams Co. completed facilities for manufacturing barium monohydrate adjacent to the company's barium carbonate plant. Cherryvale Zinc Co. added a unit to complete metallurgical reduction and refining of lead-tin materials.

Morris.—Petroleum, natural gas, and stone were produced. Anderson-Oxandale crushed limestone from four quarries for concrete aggregate, roadstone, and agricultural stone.

Morton.—Morton County ranked second in natural-gas production. The output came mainly from the Greenwood and Hugoton gas areas. Petroleum was recovered in the county.

Nemaha.—Anderson-Oxandale crushed limestone and sand for road construction. Petroleum was recovered in the county.

Neosho.—Neosho County ranked second in cement production and shipments. Portland and masonry cements were produced by Ash Grove Lime & Portland Cement Co. Petroleum and natural gas were recovered. A large part of the petroleum was produced by secondary-

recovery methods. Harry Byers & Sons, Inc., prepared crushed and dimension limestone. O'Brien Rock Crusher and Neosho County Highway Department crushed limestone.

Ness.—Petroleum was produced. New oilfield discoveries were Pabst, Elmore, and Margheim.

Norton.—Petroleum and pumice were produced. New oilfield discoveries were Norton Townsite and Spiess. Wyandotte Chemical Corp. mined pumice at Calvert for use in cleaning and scouring products.

Osage.—Coal was mined underground by Bell Coal Co. and strip-mined by Johnson Coal Co. Clark Rock Quarry and K. B. Dusenbury, Inc., quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Osborne.—Osborne County Highway Department produced gravel and crushed limestone for use on roads. Petroleum was recovered in the county.

Pawnee.—Petroleum and natural gas were produced. New oil and gas discoveries were Bow, Dunes West, Jac, Jessie, Nixon, and Orange fields. Sand and gravel for building, paving, and other uses was mined by Johnson Sand & Gravel Co., Larned Sand & Gravel Co., and Pawnee County Highway Department.

Phillips.—Petroleum was recovered in Phillips County. D. G. Hansen and Phillips County Highway Department produced paving gravel. Consumers Cooperative Association added a Unifier, Platformer, compressor, and control buildings to its refinery at Phillipsburg.

Pottawatomie.—Bayer Stone, Inc., and Manhattan Cut Stone Co., Inc., prepared dimension limestone. Anderson-Oxandale crushed limestone. Sand for building and paving uses was mined by Wamego Sand Co. and paving gravel by Pottawatomie County Highway Department.

Pratt.—Petroleum and natural gas were produced. New oil- and gas-field discoveries were Hopewell, Rollingston, and Tatlock Southwest. Sand and gravel for building and paving was produced by Miller Sand & Gravel Co., Mrs. C. D. Hogard, and Pratt County Highway Department.

Reno.—Reno County ranked first in the State in output of salt. Evaporated salt was produced by Morton Salt Co., Carey Salt Co., and Barton Salt Co. Carey Salt Co. also mined rock salt. Petroleum, natural gas, and natural-gas liquids were recovered. Stroud field was a new oil discovery. Cities Service Oil Co. recovered natural gasoline, propane, and LP-gases at its Burrton plant. Sand and gravel was mined by five commercial operations and the City of Hutchinson. Leading commercial producers were J. E. Steele Sand & Gravel Co. and J. N. Shears Sons, Inc.

Rice.—Rice County ranked eighth in value of mineral and petroleum output. Mooney field was a new oil discovery. American Salt Co. produced evaporated and rock salt at Lyons. The company announced a $750,000 modernization and expansion program at the plant. Riddle Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, riprap, and agricultural stone. Sand and gravel was produced by Tobias, Wright, and Birchenough, Inc., Rock Hill Stone &

Gravel Co., Sterling Sand & Gravel Co., Inc., Arensman Sand & Gravel Co., and A. L. Stapleton.

Riley.—Walters Sand Co., Inc., dredged building and paving sand and gravel. Bayer Construction Co. crushed limestone at two quarries.

Rooks.—Rooks County was a major petroleum producer. New oilfield discoveries were Arpin East, Finnesy South, Kern West, Newlin, Ordway, Pywell, and Windy Ridge.

Rush.—Petroleum, natural gas, natural-gas liquids, and helium were recovered. Herr North field was a new oil discovery in 1958. Dunn-Mar Oil & Gas Co. recovered natural gasoline and butane at its Otis plant. The Federal Bureau of Mines recovered helium from natural gas at Otis.

Russell.—Russell County ranked third in the State in value of mineral and petroleum production. New oilfield discoveries were Brundage South, Kune, Machin, and Reich. Natural gas was recovered in the county. Russell County Highway Department produced paving sand and gravel.

Saline.—Saline County ranked fourth in Kansas in production of sand and gravel. Sand and gravel for building, paving, and other uses was dredged by Saline Sand Co., Inc. Petroleum was recovered, and the Mortimer field was a new oil discovery.

Sedgwick.—The county ranked second in output of sand and gravel and natural-gas liquids. Cities Service Oil Co. recovered natural gasoline, propane, and LP-gases at its Wichita plant, and Plateau Natural Gas Co. recovered natural gasoline and LP-gases at its Cheney plant. Petroleum and natural gas also were produced. Buzzi and Furley fields were new oil discoveries. A hydrofluoric acid alkylation unit was under construction at the Derby Refining Co. at Wichita. Sand and gravel was produced by the City of Wichita and 12 commercial operators. Leading producers were Dolese Bros. Co., Miles Sand Service, Superior Sand Co., Walt Keeler Co., Inc., and Bently Sand Co. The City of Wichita Highway Department quarried and crushed limestone for concrete aggregate and roadstone. Frontier Chemical Co. pumped brine from wells and manufactured chlorine, caustic soda, and salt. These materials were used to produce chloroform, wood preservatives, carbon tetrachloride, and grain fumigants. The company's expansion program continued. Vermiculite was exfoliated for use in insulation, plaster, concrete roof decks, and floors by Dodson Manufacturing Co., Inc.

Seward.—Natural gas, mainly from the Hugoton gas area, natural-gas liquids, and petroleum were recovered. Panhandle-Eastern Pipe Line Co. recovered natural gasoline, butane, and propane at its Liberal plant. New oil- and gas-field discoveries were Salley and Three Star.

Shawnee.—The county ranked third in Kansas in value of sand and gravel output. Producers were Kansas Sand Co., Inc., Consumers Sand Co., Victory Sand & Gravel Co., Shoffner Sand, Inc., River Sand Co., and Harry Henery, Inc. Building, paving, blast, engine, and other sands and building and paving gravel were dredged from riverbeds. Limestone was quarried and crushed for concrete aggregate and roadstone by Anderson-Oxandale, Netherland Stone Co., and Henry C. Luttjohann.

Sherman.—Petroleum and sand and gravel were produced. Discovery of the Llanos oilfield was significant. Sand and gravel for paving and building use was mined by Harry Henery, Inc., M. W. Watson, and Sherman County Highway Department.

Stafford.—Stafford County ranked ninth in value of mineral and petroleum production. New oil and gas fields included Cline, Glasscock, Grunder, HAH, Morning Star, Nagel, Waters, and Wil Southeast. Natural gas was recovered. Sand and gravel, principally for building and paving uses, was produced by Partin Sand & Gravel Co., San Ore Construction Co., and Stafford County Highway Department.

Stanton.—Natural gas, mainly from the Hugoton gas area, and petroleum were recovered. Sparks West field was a new gas discovery.

Stevens.—Stevens County retained its rank as leading producer of natural gas in Kansas. All production came from the Hugoton gas area.

Sumner.—Petroleum, sand and gravel, and a small quantity of natural gas were produced. New oilfield discoveries were Anson Southeast, Badger Creek, Crowe, Horsch, McIlhenny, Moyer, Pride, Seydell, and Wusk fields. Mulvane Sand Co., Inc., and Sumner County Highway Department produced sand and gravel, mainly for building and paving.

Trego.—Petroleum was recovered. New oilfield discoveries were Egger, Wakeeney East, and Bin. Trego County Highway Department produced paving gravel.

Wabaunsee.—Wabaunsee County Highway Department produced building sand. Petroleum was recovered. Ashburn field was a new oil discovery.

Wallace.—Diatomaceous marl was produced by DeLore Division of National Lead Co. for use as flatting pigment in paint. Wallace County Highway Department mined paving sand.

Wilson.—Portland and masonry cements were produced by Consolidated Cement Corp. at Fredonia. Petroleum and natural gas were recovered. Miscellaneous clay was mined for manufacturing heavy clay products by Acme Brick Co. at Buffalo and Excelsior Brick Co. at Fredonia. Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Carr Rock Products Co., Anderson-Oxandale, and Benedict Rock & Lime Co. Wilson County Highway Department mined paving gravel.

Woodson.—Petroleum, stone, and a small quantity of natural gas were produced. Nelson Bros. Quarries, Woodson County Highway Department, and Allen County Highway Department crushed limestone.

Wyandotte.—Wyandotte County ranked first in the State in output of stone and sand and gravel. Limestone was crushed for concrete aggregate, roadstone, asphalt filler, and riprap by Thompson-Strauss Quarries, Inc., Peerless Quarries, Inc., American Rock Crusher Co., and Kansas City Department of Streets and Parks. Sand and gravel was produced by eight operators; leading producers were Stewart Sand & Material Co., Peck-Woolf Sand & Material Co., Builders Sand Co., Holliday Sand & Gravel Co., and American Sand & Gravel Co. Kansas Industries, Inc., mined miscellaneous clay for making

lightweight aggregate. Lone Star Cement Corp. produced portland and masonry cements. Panacalite Perlite, Inc., expanded perlite from crude ore shipped from the Western States. Reichhold Chemicals, Inc., produced phenolformaldehyde resins and polyvinyl acetate emulsions.

The Mineral Industry of Kentucky

This chapter has been prepared under a cooperative agreement for collecting mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Kentucky Geological Survey.

By Avery H. Reed, Jr.,[1] Preston McGrain,[2] and Mildred E. Rivers[3]

RESUMPTION of a 10-year downward trend in coal mining highlighted the mineral industry of Kentucky in 1958. Among the States, Kentucky ranked third in bituminous coal, second in ball-clay production, and fourth in fluorspar.

The total value of mineral production decreased 11 percent from 1957 and was 21 percent below 1948, the record year.

Coal mining supplied 72 percent of the total value of output, compared with 75 percent in 1957. Other fuels (natural gas, natural gas liquids, and crude petroleum) represented 20 percent, compared with 18 percent in 1957. Leading companies were the large coal producers, United States Steel Corp., Peabody Coal Co., Nashville Coal Co., Inland Steel Co., and Blue Diamond Coal Co.

TABLE 1.—Mineral production in Kentucky[1]

Mineral	1957		1958	
	Thousands short tons (unless otherwise stated)	Value (thousands)	Thousands short tons (unless otherwise stated)	Value (thousands)
Clays	894	$3,915	737	$2,957
Coal	74,667	338,109	66,312	289,385
Fluorspar—short tons	20,626	979	25,861	1,201
Gem stones			(2)	(3)
Lead (recoverable content of ores, etc.)—short tons	411	118	516	121
Natural gas—million cubic feet	70,024	16,666	72,248	17,412
Natural gas liquids:				
Natural gasoline—thousand gallons	34,956	1,935	37,926	2,165
LP-gases—do	176,033	7,403	150,655	8,491
Petroleum (crude)—thousand 42-gallon barrels	17,029	53,301	[4] 17,509	[4] 51,652
Sand and gravel	4,482	4,556	4,685	4,835
Silver (recoverable content of ores, etc.)—troy ounces	56	(3)	99	(3)
Stone	12,718	16,714	12,597	17,360
Zinc (recoverable content of ores, etc.)—short tons	837	194	1,258	257
Value of items that cannot be disclosed: Nonmetals		6,211		7,059
Total Kentucky[5]		[6] 449,390		402,121

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Quantity not canvassed.
[3] Less than $1,000.
[4] Preliminary figure.
[5] Total has been adjusted to eliminate duplicating the value of clays and stone.
[6] Revised figure.

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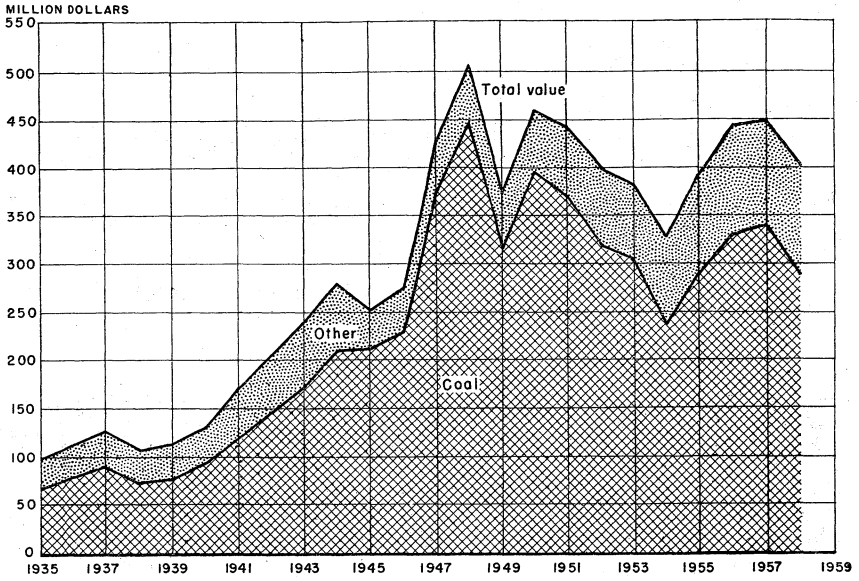

FIGURE 1.—Value of coal and total value of all minerals produced in Kentucky, 1935–58.

Employment and Injuries.—Total employment declined 12 percent below 1957, owing to lower coal output. The number of men employed in coal mining dropped 3,290, and employment fell 15 percent. Employment increased 8 percent at quarries and mills, owing to increased use of crushed stone for highways, and increased 30 percent at sand and gravel mines. Total employment at nonmetal mines was down 12 percent. Many companies operated a regular 5-day week, but coal mines averaged 3 days a week, and nonmetal mines averaged a 4-day week.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-days worked	Fatal injuries	Nonfatal injuries	Injuries per million man-days
	1957						
Coal mines	2,194	36,211	179	6,494,779	55	2,449	386
Quarries and mills	90	1,991	234	466,478	1	190	410
Sand and gravel mines	20	371	253	93,827		18	190
Coke ovens and smelters	2	311	349	108,674	1	2	28
Nonmetal mines	34	559	217	121,159		25	206
Total	2,340	39,443	185	7,284,917	57	2,684	376
	1958 [1]						
Coal mines	2,310	32,921	168	5,542,155	49	2,036	376
Quarries and mills	99	2,165	233	504,127	4	153	311
Sand and gravel mines	33	465	261	121,551	2	13	123
Coke ovens and smelters	2	314	345	108,317		3	28
Nonmetal mines	41	536	198	106,159		39	367
Total	2,485	36,401	175	6,382,309	55	2,244	360

[1] Preliminary figures.

Injury experience improved over 1957, as the frequency rate decreased 4 percent. Improvement was 35 percent at sand and gravel mines and 24 percent at quarries and mills. Individual injury reports were analyzed from all producers except quarries and mills operators.

Consumption, Trade, and Markets.—Most of Kentucky's minerals were consumed within the State, but large quantities of coal were shipped out of State for electric utility use. The first delivery of coal from Western Kentucky by barge to a new electric generating station at Memphis, Tenn., was made. Eventually the plant will use 1 million tons of coal a year. Initial shipments were made from Western Kentucky to Tampa, Fla., to supply large new utility plants; the coal was shipped by barges down the Ohio and Mississippi Rivers to New Orleans, transferred to ocean-going barges, and towed across the Gulf of Mexico to Tampa.

Western Kentucky coal companies succeeded in a 10-year effort to have their coal included in shipments abroad under the foreign-aid program. International Cooperation Administration ordered a change in coal specifications, which had previously barred Western Kentucky coal from use by Korea. Specifications had called for a coal with a sulfur content no higher than 3 percent, but Western Kentucky coal has a sulfur content of 3.4 percent.

Legislation and Government Programs.—Activity of the Defense Minerals Exploration Administration (DMEA) consisted of three fluorspar projects. Fluorspar was sold to General Services Administration (GSA) under the Government stockpiling program.

TABLE 3.—Defense Minerals Exploration Administration fluorspar contracts in force during 1958

Operator	Property	County	Amount[1]
Reynolds Metal Co.	Tyner, Hicks & Watson	Crittenden	$59,710
Do.	Grimes	do.	48,880
Do.	Kemper	Livingston	[2] 45,890

[1] Government participation, 50 percent.
[2] Completed.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—There was a sharp downturn in coal mining. Production was 11 percent below 1957 and 21 percent below 1947, the record year. The drop was most pronounced in Eastern Kentucky, where production declined 16 percent compared with 3 percent in Western Kentucky. Eastern Kentucky coal was consumed largely for metallurgical purposes, while Western Kentucky coal was consumed mainly by electric utilities. Coal was mined at 2,015 mines in 43 counties, compared with 2,167 mines in 40 counties in 1957. The leading counties were Hopkins, Muhlenberg, and Harlan. The leading producing companies were United States Steel Corp., Peabody Coal Co., and Nashville Coal Co.

In the Eastern Kentucky field 1,880 mines in 31 counties produced 38,231,000 tons, compared with 2,027 mines, 29 counties, and 45,662,000 tons in 1957. Average production per mine decreased from 22,500 tons to 20,300. Average unit value decreased from

$5.16 a ton to $4.98. Of the total production, 90 percent was mined underground, 5 percent by open pit, and 5 percent by auger; 85 percent was shipped by rail or water and 15 percent by truck; 81 percent was sold in open market, and 19 percent was captive. Of the total underground production, 81 percent was cut by machines, 9 percent was mined by continuous mining machines, and 10 percent was shot from solid. Eighty-four percent was drilled with power drills.

In the Western Kentucky field 135 mines in 12 counties produced 28,081,000 tons, compared with 140 mines, 11 counties, and 29,005,000 tons in 1957. Average production per mine increased from 207,000 tons to 208,000. Average unit value changed from $3.54 to $3.53. Of the total production, 42 percent was mined underground, and 58 percent was mined by open pit; 95 percent was shipped by rail or water, and 5 percent was shipped by truck; all coal was sold in open market. Of the total underground production, 99 percent was cut by machines, and 1 percent was mined by continuous miners. Ninety-nine percent was drilled with power drills.

TABLE 4.—Coal production, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Bell	1,086,496	$4,919,421	1,186,071	$4,475,196
Boyd	240,109	1,035,193	289,468	1,138,040
Breathitt	834,407	4,678,155	714,588	4,292,749
Butler	120,401	469,477	172,216	588,782
Carter	142,925	660,313	236,058	1,458,838
Christian	1,200	3,792	(1)	(1)
Clay	1,206,794	4,636,227	1,101,550	4,305,186
Clinton	17,829	44,751	26,022	94,980
Daviess	1,049,634	2,641,542	(1)	(1)
Edmonson			1,795	5,923
Elliott	24,928	84,596	15,992	61,729
Floyd	5,212,148	29,770,248	4,263,325	25,049,559
Grayson	1,125	3,555	1,586	7,930
Greenup			3,100	15,655
Hancock	33,533	102,610	22,792	75,213
Harlan	8,331,885	49,734,209	6,939,434	40,500,968
Henderson	273,812	856,982	241,629	704,144
Hopkins	12,699,080	46,746,040	11,428,069	42,966,594
Jackson	185,871	761,584	131,345	545,238
Johnson	432,000	1,499,040	304,800	1,061,316
Knott	1,351,285	5,193,871	1,482,764	4,745,696
Knox	293,666	1,070,634	198,483	740,812
Laurel	218,867	786,812	250,978	1,024,518
Lawrence	23,540	122,878	60,371	241,484
Lee	123,701	594,581	113,522	479,346
Leslie	2,901,198	12,896,398	2,659,553	10,905,743
Letcher	6,177,552	33,782,315	5,742,943	30,346,445
Magoffin	(1)	(1)	73,460	247,634
Martin	(1)	(1)	49,531	163,948
McCreary	(1)	(1)	470,026	1,890,901
Morgan	132,981	547,644	46,936	231,307
Muhlenberg	7,176,618	24,345,353	8,852,076	29,216,369
Ohio	3,027,425	10,874,680	2,785,368	9,299,036
Owsley			1,649	6,415
Perry	6,041,212	29,529,520	4,789,843	21,997,814
Pike	9,210,484	47,067,240	6,405,577	31,639,976
Pulaski	174,196	670,412	187,138	659,266
Rockcastle	90,839	348,743	49,781	172,772
Union	2,907,745	11,204,388	2,098,543	8,755,781
Wayne	37,039	192,516	14,655	134,240
Webster	1,714,427	5,407,695	1,528,025	4,585,588
Whitley	629,689	2,649,476	414,152	1,611,012
Wolfe	(1)	(1)	8,000	40,000
Undistributed	540,155	2,175,897	948,591	2,900,922
Total	74,666,796	338,108,788	66,311,805	289,385,065

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Plans were announced for opening a new 4,000-ton-a-day mine and preparation plant at Benham by Wisconsin Steel Division of International Harvester Co. The River Queen Coal Co. completed an 1,800-foot canal on the Green River for direct loading of barges from railroad cars.

Natural Gas.—Marketed production of natural gas increased 3 percent over 1957 but was 25 percent below 1947, the record year. Almost all gas production was from Eastern Kentucky.

TABLE 5.—Production of crude petroleum by counties, in barrels [1]

County	1957		1958	
	Barrels	Value	Barrels	Value
Allen	72,517	$226,978	67,127	$198,025
Barren	59,886	187,443	56,096	165,483
Bath	4,791	14,996	5,403	15,939
Bell			449	1,325
Boyd	1,239	3,878	754	2,224
Breathitt	32,361	101,290	301,689	889,983
Breckinridge	88,269	276,282	90,963	268,341
Butler	113,645	355,709	279,225	823,714
Christian	953,110	2,983,234	703,470	2,075,237
Clinton	61,911	193,781	64,966	191,650
Crittenden	689	2,157	710	2,095
Cumberland	22,777	71,292	18,951	55,905
Daviess	1,610,982	5,042,374	1,835,526	5,414,802
Edmonson	30	94		
Elliott	119,991	375,572	129,016	380,597
Estill	140,371	439,361	125,248	369,482
Floyd	19,102	59,790	19,588	57,785
Grayson	48	150		
Green	32,567	101,935	1,656,049	4,885,345
Greenup	1,852	5,797	1,605	4,735
Hancock	442,913	1,386,318	415,086	1,224,504
Harlan			73	216
Hart	31,390	98,251	24,288	71,650
Henderson	3,159,162	9,888,177	2,512,856	7,412,925
Hopkins	132,695	415,335	119,659	352,994
Jackson	1,278	4,000	853	2,516
Johnson	248,091	776,525	212,103	625,704
Knott	16,311	51,053	17,200	50,740
Knox	2,768	8,664	2,427	7,160
Laurel			507	1,496
Lawrence	173,969	544,523	205,354	605,795
Lee	720,211	2,254,261	802,148	2,366,337
Leslie	2,730	8,545	3,600	10,620
Letcher	86	269	43	127
Lincoln	1,771	5,544	1,787	5,272
Logan	3,726	11,662	3,418	10,083
McCreary	1,318	4,126	1,310	3,865
McLean	935,049	2,926,704	969,137	2,858,954
Magoffin	1,852,691	5,798,923	1,611,883	4,755,055
Martin	27,152	84,986	24,296	71,673
Meade	67	210		
Menifee	74	232	487	1,437
Metcalfe	136	426	65	192
Monroe	176	551	80	236
Montgomery	125	391		
Morgan	884	2,767	929	2,741
Muhlenberg	1,102,383	3,450,459	867,458	2,559,001
Ohio	1,186,085	3,712,446	1,073,464	3,166,719
Owsley	1,279	4,004	1,334	3,935
Perry	43	135	385	1,136
Pike	50,095	156,797	60,635	178,874
Powell	63,524	198,830	80,258	236,761
Robertson	82	257		
Russell	375	1,174	195	575
Simpson	21,003	65,739	18,569	54,779
Taylor	385	1,205	277	817
Todd	12,339	38,621	7,479	22,063
Union	1,956,291	6,123,191	1,766,456	5,211,045
Warren	47,324	148,124	48,134	141,996
Wayne	16,116	50,443	16,352	48,238
Webster	1,422,431	4,452,209	1,217,992	3,593,077
Wolfe	58,364	182,680	63,588	187,585
Total	17,029,000	53,301,000	17,509,000	51,652,000

[1] Data from Kentucky Geological Survey.

Natural Gas Liquids.—*Natural Gasoline.*—Production of natural gasoline increased 8 percent over 1957 and 7 percent over 1953, the previous record year. Columbia Hydrocarbon completed a $5 million fractionation plant at Siloam.

LP-Gases.—Production of liquified-petroleum (LP) gases declined 14 percent below 1957 and was 39 percent below 1956, the record year.

Petroleum.—Production of crude petroleum increased 3 percent over 1957 but was 1 percent below 1956, the record year. During the year 2,325 wells were completed, 900 in Western Kentucky, 944 in Central Kentucky, and 481 in Eastern Kentucky. At the end of the year 18,965 wells were producing. The outstanding development was the great increase in activity and production in Greene County following successful acidizing of a dolomite reservoir which had been virtually dormant for 30 years. The leading counties were Henderson, Daviess, and Union, compared with Henderson, Union, and Magoffin in 1957.

NONMETALS

Cement.—Kosmos Portland Cement Co. operated its Kosmosdale plant. In 1958 the company became an operating subsidiary of The Flintkote Co. Shipments of masonry cement increased 5 percent over 1957 but were 7 percent below 1955, the record year. Shipments of portland cement increased 9 percent over 1957 but were 2 percent below 1956, the record year. Raw materials used in cement included limestone (76 percent), clay (20 percent), gypsum (3 percent), and iron ore (1 percent). Cement was used mainly in Kentucky and was shipped to Ohio, and Indiana. The company announced plans to expand production 45 percent, increasing the rated annual capacity from 2.2 million to 3.2 million barrels.[3]

Clays.—*Ball Clay.*—Among the States, Kentucky ranked second in the ball-clay production. Ball clay was mined in Graves County for whiteware, stoneware, enameling, floor and wall tile, firebrick and block, fire-clay mortar, kiln furniture, plastics, and for export. Leading producers were Kentucky-Tennessee Clay Co. and Old Hickory Clay Co. Production decreased 8 percent below 1957 and was 18 percent below 1956, the record year. Total production was 94,200 tons valued at $1,333,000.

Fire Clay.—Nine companies mined fire clay at 15 mines in Carter and Greenup Counties for firebrick and block, fire-clay mortar, and heavy clay products. Leading producers were General Refractories Co. and Harbison-Walker Refractories Co. Production declined 43 percent below 1957 and 68 percent below 1951, the record year. Total production was 189,500 tons valued at $1,051,900.

Miscellaneous Clay.—Eleven companies mined miscellaneous clay at 12 mines in 10 counties for floor and wall tile, heavy clay products, lightweight aggregate, and cement. Leading producers were Kenlite Division of Kentucky Light Aggregates, Inc., and Kosmos Portland Cement Co. Production decreased 2 percent below 1957 and 7 percent below 1956, the record year. Total production was 453,800 tons valued at $571,800.

Fluorspar.—Fourteen companies or individuals mined fluorspar in Caldwell, Crittenden and Livingston Counties for hydrofluoric acid,

[3] Pit and Quarry, vol. 50, No. 11, May 1958.

aluminum and magnesium reduction, glass manufacture, ceramic, enamel, special fluxes, steel manufacture, iron foundries, and exports, and sale to Government stockpiles. Leading producers were Calvert City Chemical Co. and J. Willis Crider Fluorspar Co. Marketable production increased 25 percent over 1957 but was 82 percent below 1941, the record year. Six companies processed or blended fluorspar purchased in Illinois, Kentucky, or Mexico for shipment to consumers; leading shipper was Kentucky Fluorspar Co. During the year United States Steel Corp. reduced its stock at the Tabb mine at Mexico, Ky. Total marketable production was 25,400 tons valued at $1,175,800. Total cumulative production from earliest records was 2,840,000 tons.

Gem Stones.—A small quantity of fluorite specimens was collected and sold to tourists and dealers.

Lime.—National Carbide Co. started work on a $2 million plant to recover calcium oxide from calcium hydroxide residue produced at its Calvert City calcium carbide plant. Plans were announced for a similar plant at Louisville.

TABLE 6.—Fluorspar shipped to consumers, by uses

Use	1957			1958		
	Short tons	Value	Unit value	Short tons	Value	Unit value
Steel manufacture	2,894	$99,840	$34.50	3,293	$133,591	$40.57
Glass manufacture	2,167	73,100	33.73	1,950	63,765	32.70
Iron foundries	426	14,745	34.61	754	32,329	42.88
Government stockpile				731	40,683	55.65
Ceramics and enamel				372	17,696	47.57
Aluminum and magnesium reduction				53	2,327	43.91
Exports				31	1,872	60.39
Other [1]	15,139	791,672	52.29	14,690	733,819	49.95
Total	20,626	979,357	47.48	21,874	1,026,082	46.91

[1] Includes hydrofluoric acid and special fluxes.

TABLE 7.—Sand and gravel sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Ballard	29,945	$27,948	22,720	$18,340
Calloway	77,195	52,999	11,300	11,400
Carlisle	5,231	5,231	24,000	20,350
Carroll	636,000	320,000	(1)	(1)
Daviess	286,017	362,322	(1)	(1)
Fleming	1,620	1,590		
Graves	69,215	54,956	68,214	53,814
Greenup	55,703	76,322	(1)	(1)
Hancock	34,500	35,625	(1)	(1)
Hickman	31,875	27,862	36,150	32,837
Jefferson	2,066,124	2,317,851	2,394,893	2,507,285
Livingston			16,680	16,780
Lyon			2,100	1,827
Marion			1,000	1,000
Marshall	15,100	8,305	22,500	14,319
Mason	52,300	83,680	53,450	84,170
Union	(1)	(1)	30,000	37,500
Undistributed [2]	1,121,662	1,181,421	2,002,087	2,035,557
Total	4,482,487	4,556,112	4,685,094	4,835,179

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes Boone, Floyd, Fulton, Gallatin, Henderson, McCracken, Pike Counties, and counties indicated by footnote 1.

Sand and Gravel.—Twenty-four companies mined sand and gravel at 33 mines in 23 counties. Leading producers were Louisville Sand & Gravel Co. and Standard Materials Corp. Production increased 5 percent over 1957 but was 18 percent below 1956, the record year. Of the total production, 94 percent was washed, and 5 percent was hauled by rail, 18 percent by water, and 77 percent by truck.

Stone.—Sixty-eight producers crushed limestone at 90 quarries in 57 counties. Leading counties were Jefferson, Hardin, and Meade.

TABLE 8.—Sand and gravel sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value	Average unit value	Short tons	Value	Average unit value
Sand:						
Structural	1,908,215	$1,905,750	$1.00	1,544,802	$1,652,572	$1.07
Paving	608,744	653,473	1.07	828,699	796,304	.96
Engine	19,532	20,281	1.04	(1)	(1)	(1)
Filter	2,000	2,000	1.00			
Other sand	(1)	(1)	(1)	(1)	(1)	(1)
Gravel:						
Structural	1,164,546	1,226,100	1.05	930,766	1,083,994	1.16
Paving	589,617	589,591	1.00	701,389	680,521	.97
Railroad ballast	73,749	44,823	.61	(1)	(1)	(1)
Other gravel	(1)	(1)	(1)	54,671	28,171	.52
Total sand and gravel	4,482,487	4,556,112	1.02	4,685,094	4,835,179	1.03

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Total."

TABLE 9.—Crushed limestone sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Adair	102,647	$145,065	156,104	$234,156
Anderson	(1)	(1)	110,439	144,521
Barren	184,661	232,076	85,000	117,000
Bourbon	94,561	149,546	103,874	134,380
Boyle	279,159	351,444	181,222	230,166
Butler			103,724	158,847
Clinton	84,868	119,955	77,290	115,935
Fayette	(1)	(1)	442,624	756,203
Franklin	298,222	374,222	442,290	553,090
Hardin	(1)	(1)	841,562	1,177,518
Hart	107,483	144,235	130,400	173,000
Jefferson	1,310,416	1,713,418	1,487,676	2,057,837
Jessamine	(1)	(1)	96,660	108,239
Kenton	9,257	16,200	9,568	16,644
Logan	(1)	(1)	153,148	218,101
Madison	(1)	(1)	97,351	101,439
Marion	(1)	(1)	134,000	203,500
Menifee	65,133	107,167	121,978	211,239
Mercer	(1)	(1)	157,574	299,011
Metcalfe	50,000	75,000	(1)	(1)
Morgan	76,000	92,500	(1)	(1)
Nicholas	28,500	57,000	(1)	(1)
Powell	86,715	134,396	99,883	158,850
Rockcastle	(1)	(1)	394,882	507,262
Trigg	(1)	(1)	51,137	68,000
Warren	(1)	(1)	364,888	541,523
Wayne	59,623	89,434	(1)	(1)
Undistributed [2]	9,871,286	12,861,679	6,745,057	9,023,000
Total	12,708,531	16,663,337	12,588,331	17,309,461

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes Allen, Breckinridge, Caldwell, Carter, Casey, Christian, Clark, Crittenden, Edmonson, Estill, Fleming, Grayson, Green, Harlan, Harrison, Jackson, Lee, Letcher, Livingston, Meade, Metcalfe, Monroe, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Pendleton, Pulaski, Rowan, Simpson, Todd, Wayne Counties, and counties indicated indicated by footnote 1.

Leading producers were Kentucky Stone Co. (Anderson, Breckinridge, Hardin, Jessamine, Lee, Logan, Madison, Rockcastle, and Todd Counties), Reed Crushed Stone Co. Inc. (Livingston County), and Geohegan & Mathis, Inc. (Nelson and Pendleton Counties). The production of crushed limestone decreased 1 percent below 1957, the record year. Of the total, 9 percent was hauled by rail, 4 percent by water, and 87 percent by truck.

TABLE 10.—Crushed limestone sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value	Average unit value	Short tons	Value	Average unit value
Concrete and roads	10,278,302	$13,654,894	$1.33	10,413,322	$14,517,280	$1.39
Agstone	1,101,930	1,444,770	1.31	1,113,251	1,477,520	1.33
Railroad ballast	553,234	475,505	.86	397,377	416,781	1.05
Riprap	(1)	(1)	(1)	10,685	11,750	1.10
Other uses [2]	775,065	1,088,168	1.40	653,696	886,130	1.36
Total	12,708,531	16,663,337	1.31	12,588,331	17,309,461	1.38

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[2] Includes fluxing stone, asphalt and fertilizer fillers, rock dust for coal mines, stone sand, cement, and other uses.

Levi Polly crushed sandstone in Bell County for concrete and roads. Four companies quarried 2,200 tons of dimension sandstone for rough architectural building stone and for flagging. The leading producer was Kentucky Flagstone Co.

Vermiculite.—Zonolite Co. exfoliated vermiculite from South Carolina and Montana at its Wilder plant.

METALS

Aluminum.—Aluminum Company of America purchased several thousand acres of coal land in Western Kentucky along the Ohio River to meet long-range plans for establishing an aluminum-reduction plant with an adjacent powerplant using coal.

Ferroalloys.—Shipments of ferroalloys, including ferromanganese, silicomanganese, silvery pig iron, ferrosilicon, ferrochromium, and chromic silicide, declined 45 percent below 1957.

Lead.—Byproduct recovery of lead from fluorspar milling was 26 percent more than in 1957.

Pig Iron and Steel.—Armco Steel Corp. produced foundry and basic pig iron at Ashland; shipments were 11 percent less than in 1957. Steel was produced by Armco Steel Corp. and by Acme Steel Co. at Newport. Iron ore consumed was 7 percent domestic and 93 percent imported. Imports, mainly from Labrador, increased 16 percent over 1957 and exceeded those in any earlier year. Armco Steel Corp. completed a plant at Ashland to sinter iron ore from Labrador.

Silver.—A small quantity of silver was recovered from lead and zinc concentrates.

Zinc.—Fifty percent more zinc was recovered as a byproduct from fluorspar milling than in 1957.

REVIEW BY COUNTIES

Of the 120 counties in the State, 104 reported mineral production, compared with 107 in 1957. Leading counties were the large coal producers—Hopkins, Harlan, Muhlenberg, Pike, Letcher, Floyd, and Perry—which supplied 56 percent of the total State value. In addition to the detailed county production listed in table 11, natural gas, natural gas liquids, and a small quantity of gem stones (fluorspar) were produced, of undetermined county origin.

Adair.—Shamrock Stone Co. Inc., crushed limestone for concrete aggregate, roadstone, and agstone at the Butler quarry.

Allen.—McLellan Stone Co. (Allen quarry) crushed limestone for concrete aggregate and roadstone. Production of crude petroleum decreased 7 percent.

Anderson.—Kentucky Stone Co. (Tyrone mine) crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone.

Ballard.—The Kentucky State Highway Department mined paving gravel.

Barren.—J. F. Pace Construction Co. crushed limestone for concrete aggregate, roadstone, and agstone. Production of crude petroleum decreased 6 percent.

Bath.—Production of crude petroleum increased 13 percent.

Bell.—Seventy-five mines produced coal; leading producers were the Crockett mine (Kentucky Ridge Coal Co.), the No. 1 Auger mine (H. J. Bailey Coal Co.), and the Amru Strip mine (Rochester &

TABLE 11.—Value of mineral production in Kentucky, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value [2]
Adair	$145,065	$234,156	Limestone.
Allen		(3)	Petroleum, limestone.
Anderson	(3)	144,521	Limestone.
Ballard	27,948	18,340	Sand and gravel.
Barren	232,076	282,483	Petroleum, limestone.
Bath		15,939	Petroleum.
Bell	4,934,421	4,490,038	Coal, sandstone, petroleum.
Boone	(3)	(3)	Sand and gravel.
Bourbon	149,546	134,380	Limestone.
Boyd	1,074,193	(3)	Coal, miscellaneous clay, petroleum.
Boyle	351,444	230,166	Limestone.
Breathitt	4 678,155	5,182,732	Coal, petroleum.
Breckinridge	(3)	(3)	Petroleum, limestone, miscellaneous clay.
Bullitt	(3)	(3)	Miscellaneous clay.
Butler	469,477	1,571,343	Petroleum, coal, limestone.
Caldwell	(3)	(3)	Limestone, fluorspar.
Calloway	52,999	11,400	Sand and gravel.
Carlisle	5,231	20,350	Do.
Carroll	320,000	(3)	Do.
Carter	(3)	2,451,791	Coal, fire clay, limestone.
Casey	(3)	(3)	Limestone.
Christian	(3)	(3)	Petroleum, limestone, coal.
Clark	(3)	(3)	Limestone.
Clay	4,636,227	4,305,186	Coal.
Clinton	164,706	402,565	Petroleum, limestone, coal.
Crittenden	(3)	(3)	Fluorspar, limestone, petroleum.
Cumberland		55 905	Petroleum.
Daviess	3,003,864	8,266,885	Petroleum, coal, sand and gravel.
Edmonson	(3)	(3)	Limestone, coal.
Elliott	84,596	442,326	Petroleum, coal.
Estill	(3)	(3)	Petroleum, limestone.
Fayette	(3)	756,203	Limestone.
Fleming	(3)	(3)	Do.
Floyd	29,770,248	(3)	Coal, petroleum, sand and gravel.
Franklin	374,222	533,090	Limestone.
Fulton	(3)	(3)	Sand and gravel.
Gallatin	(3)	(3)	Do.
Garrard	(3)		
Graves	1,387,499	1,386,782	Ball clay, sand and gravel.
Grayson	(3)	(3)	Limestone, coal.

TABLE 11.—Value of mineral production in Kentucky, by counties [1]—Continued

County	1957	1958	Minerals produced in 1958 in order of value [2]
Green		(3)	Petroleum, limestone.
Greenup	(3)	(3)	Fore clay, sand and gravel, coal, petroleum.
Hancock	$224,835	$1,375,197	Petroleum, coal, miscellaneous clay, sand and gravel.
Hardin	578,892	1,177,518	Limestone.
Harlan	(3)	(3)	Coal, limestone, petroleum.
Harrison	(3)	(3)	Limestone.
Hart	144,235	244,650	Limestone, petroleum.
Henderson	(3)	(3)	Petroleum, coal, sand and gravel.
Hickman	27,862	32,837	Sand and gravel.
Hopkins	46,747,615	43,321,888	Coal, petroleum, miscellaneous clay.
Jackson	(3)	(3)	Coal, limestone, petroleum.
Jefferson	10,269,886	(3)	Cement, sand and gravel, limestone, miscellaneous clay.
Jessamine	(3)	108,239	Limestone.
Johnson	1,499,040	1,687,020	Coal, petroleum.
Kenton	16,200	16,644	Limestone.
Knott	5,193,871	4,796,436	Coal, petroleum.
Knox	1,070,634	747,972	Do.
Laurel	786,812	1,026,014	Do.
Lawrence	122,878	847,279	Petroleum, coal.
Lee	(3)	(3)	Petroleum, coal, limestone.
Leslie	12,896,398	10,916,363	Coal, petroleum.
Letcher	(3)	(3)	Coal, limestone, petroleum.
Lincoln		5,272	Petroleum.
Livingston	(3)	(3)	Fluorspar, limestone, zinc, lead, sand and gravel, sandstone, silver.
Logan	(3)	252,849	Limestone, sandstone, petroleum.
Lyon		1,827	Sand and gravel.
Madison	(3)	101,439	Limestone.
Magoffin	(3)	5,002,689	Petroleum, coal.
Marion	(3)	204,500	Limestone, sand and gravel.
Marshall	8,305	14,319	Sand and gravel.
Martin	(3)	235,621	Coal, petroleum.
Mason	83,680	84,170	Sand and gravel.
McCracken	(3)	(3)	Do.
McCreary	(3)	1,895,271	Coal, petroleum, sandstone.
McLean		2,858,954	Petroleum.
Meade	(3)	(3)	Limestone.
Menifer	107,167	212,676	Limestone, petroleum.
Mercer	(3)	299,011	Limestone.
Metcalfe	75,000	(3)	Limestone, petroleum.
Monroe	(3)	(3)	Do.
Morgan	640,144	(3)	Limestone, coal, petroleum.
Muhlenberg	(3)	(3)	Coal, petroleum, limestone.
Nelson	(3)	(3)	Limestone.
Nicholas	(3)	(3)	Do.
Ohio	(3)	(3)	Coal, petroleum, limestone.
Oldham	(3)	(3)	Limestone.
Owsley		10,350	Coal, petroleum.
Pendleton	(3)	(3)	Limestone.
Perry	29,529,520	21,998,950	Coal, petroleum.
Pike	(3)	(3)	Coal, petroleum, sand and gravel.
Powell	(3)	408,111	Petroleum, limestone, miscellaneous clay.
Pulaski	(3)	(3)	Coal, limestone.
Rockcastle	(3)	680,034	Limestone, coal.
Rowan	(3)	(3)	Limestone, miscellaneous clay.
Russell		575	Petroleum.
Simpson	(3)	(3)	Limestone, petroleum.
Taylor		817	Petroleum.
Todd	(3)	(3)	Limestone, petroleum.
Trigg	(3)	68,000	Limestone.
Union	(3)	14,008,326	Coal, petroleum, sand and gravel, miscellaneous clay.
Warren	(3)	683,519	Limestone, petroleum.
Washington	(3)		
Wayne	281,950	384,978	Limestone, coal, petroleum.
Webster	5,407,695	8,178,665	Coal, petroleum.
Whitley	(3)	(3)	Coal, miscellaneous clay.
Wolfe	(3)	227,585	Petroleum, coal.
Undistributed	[4] 281,815,464	247,067,854	
Total	[4] 449,390,000	402,121,000	

[1] County figures exclude native asphalt, natural gas, natural gas liquids, and petroleum in 1957, and natural gas and natural gas liquids in 1958, included with "Undistributed." The following counties are not listed because no production was reported: Bracken, Campbell, Grant, Henry, Larue, Lewis, Montgomery, Owen, Robertson, Scott, Shelby, Spencer, Trimble, and Woodford.

[2] Other than natural gas and natural gas liquids.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Revised figure.

Pittsburgh Coal Co.). Levi Polly (Pine Mountain quarry) crushed 6,300 tons of sandstone for concrete aggregate and roadstone. Production of crude petroleum was reported in 1958.

Boone.—Belleview Gravel Co. and Kentucky Sand Co. mined sand and gravel for structural, paving, and other uses.

Bourbon.—Bourbon Limestone Co. Inc. (Snapp quarry) and Hinkle Construction Corp. crushed limestone for concrete aggregate, roadstone, and agstone.

Boyd.—Nine coal mines were active; leading producers were the Coalton strip and Coalton Auger mines (Charles E. Yates) and the No. 1 mine (Ferguson & Yates Coal Co.). Big Run Coal & Clay Co., Inc. (Princess mine), mined miscellaneous clay for heavy clay products. Crude petroleum production decreased 31 percent.

Boyle.—Caldwell Stone Co. Inc. (Danville quarry), and Boyle County Highway Department (Perryville quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Breathitt.—Twenty-one coal mines were operated; leading producers were the No. 3 Elkhorn mine (Island Creek Coal Co.) and the No. 1A and No. 1 strip mines (Skyline Coal Co.). Production of crude petroleum increased 10 times the amount reported for 1957.

Breckinridge.—Kentucky Stone Co. (Webster quarry) and White Stone Co. (Hardinsburg quarry) crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone. Murray Tile Co., Inc. (Cloverport mine), mined miscellaneous clay for heavy clay products. Production of crude petroleum increased 3 percent.

Bullitt.—The Kenlite Division of Kentucky Light Aggregates, Inc. (Shepherdsville mine), mined miscellaneous clay for lightweight aggregates.

Butler.—Six mines supplied the coal production; leading mines were the South Hill Strip mine (Butler Coal, Inc.), the Green River No. 2 mine (M. R. Melton Coal Co.), and the Skoog & Stuart mine (Skoog & Stuart Coal Co.). Gary Bros. Crushed Stone Co. crushed limestone for concrete aggregate, roadstone, and agstone. The production of crude petroleum more than doubled that reported for 1957.

Caldwell.—Cedar Bluff Stone Co. (Cedar Bluff mine) and Fredonia Valley Quarries, Inc. (Fredonia quarry), crushed limestone for concrete aggregate, roadstone, and agstone. Don Manus (Tyree mine) mined fluorspar for ceramic and metallurgical uses.

Calloway and Carlisle.—The State highway department mined paving gravel.

Carroll.—Standard Materials Co. (Milton mine) and Carrollton Gravel-Sand Co. mined structural sand and structural and railroad ballast gravel.

Carter.—Seven mines accounted for all coal production; leading producers were the Joyce mine (Joyce Coal Co.), the Grayson Block mine (Fields Branch Coal Co.), and the No. 2 mine (Gollihue & Green Coal Co. Inc.). Twelve mines produced 147,000 tons of fire clay for firebrick and block, fire-clay mortar, and heavy clay products. The leading producers were General Refractories Co. (Olive Hill mine) and Harbison-Walker Refractories Co. (Brinegar strip mine). Standard Slag Co. (Carter quarry) crushed limestone for concrete aggregate and roadstone.

Casey.—Casey Stone Co. (Bethel Ridge mine) crushed limestone for concrete aggregate, roadstone, and agstone.

Christian.—Three quarries crushed limestone for concrete aggregate, roadstone, agstone, rock dust for coal mines, and stone sand. The leading producer was Hopkinsville Stone Co., Inc. Four coal mines were active; the leading producer was the No. 6 Strip mine (Boonville Coal Sales Corp.). Production of crude petroleum decreased 26 percent.

Clark.—The Allen-Codell Co. Inc. (Boonesboro mine) crushed limestone for concrete aggregate, roadstone, and fertilizer filler.

Clay.—Fifty-four mines produced coal; the leading producers were the No. 4 mine (Hacker Coal Co.), the No. 1 strip mine (Ikerd-Bandy Co. Inc.) and the Finley mine (Charles Finley Coal Co.).

Clinton.—Shamrock Stone Co. (Caldwell quarry) crushed limestone for concrete aggregate, roadstone, and agstone. There were four active coal mines; leading producers were the No. 1 mine (Cross Bros. Coal Co. and the Gwinn mine (O. D. Gwinn Coal Co.). Production of crude petroleum increased 5 percent.

Crittenden.—The leading producer of fluorspar was J. Willis Crider Fluorspar Co. (Pigmy mine). Alexander Stone Co. (No. 1 quarry) produced limestone for riprap, concrete aggregate, roadstone, agstone, and asphalt filler. Reynolds Metal Co. (Tyner-Hicks-Watson property) began a DMEA fluorspar contract in the amount of $59,710, of which the Government share was 50 percent. Kentucky Fluorspar Co., Roberts & Frazer, and four other brokers purchased fluorspar from local and foreign producers for shipment to a variety of consumers. Calvert City Chemical Co. operated its flotation mill at Mexico, treating fluorspar from its Dyers Hill mine in Livingston County. Production of crude petroleum increased 3 percent.

Cumberland.—Production of crude petroleum decreased 17 percent.

Daviess.—There were five active coal mines; leading producers were the K-9 strip mine (Green Coal Co.) and the Morris strip mine (Morris Enterprises). Owensboro River Sand & Gravel Co. and Daviess County Sand & Gravel Co. mined structural, paving, and engine sand and structural and paving gravel. Production of crude petroleum increased 14 percent.

Edmonson.—McLellan Stone Co. (No. 4 quarry) crushed limestone for concrete aggregate, roadstone, and agstone. The No. 1 strip mine (Bee Spring Coal Co.) was the only active coal mine.

Elliott.—The No. 2 mine (Copley Coal Co.) and the No. 3 mine (Ralph Hartman Coal Co.) were the only active coal mines. Production of crude petroleum increased 8 percent.

Estill.—Estill County Stone Co., Inc., crushed limestone for concrete aggregate and roadstone. Production of crude petroleum decreased 11 percent.

Fayette.—Central Rock Co. (Lexington mine) and Blue Grass Stone Co. (Lexington quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Fleming.—Gorman Construction Co. (Carpenter quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Floyd.—Floyd County ranked sixth in the State in total value of mineral production. There were 277 active coal mines; leading producers were the Wheelwright mine (Inland Steel Co.) and the Nos. 1 and 2 mines (Princess Elkhorn Coal Co.). The Mare Creek Sand Co., Inc., began mining structural, paving, and other sands. Production of crude petroleum increased 2 percent.

Franklin.—Blanton Stone Co. Inc. (Frankfort mine), Frankfort Builders Supply Co. Inc. (Devil's Hollow mine), and Franklin County Stone Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Fulton.—Hickman Sand & Gravel Co. and the State highway department mined paving sand and gravel.

Gallatin.—Gallatin Sand & Gravel Co. (Warsaw mine) and C & H Gravel Co. (Sam Hill mine) mined structural and paving sand and gravel.

Graves.—Four mines produced 94,200 tons of ball clay for use in whiteware, art pottery, high-grade tile, kiln furniture, firebrick and block, enameling, and other uses. The leading producer was Kentucky-Tennessee Clay Co. The State highway department mined paving gravel.

Grayson.—Rogers & Brunnhoeffer and Ragland Bros. (Leitchfield quarry) crushed limestone for concrete aggregate, roadstone, and agstone. The No. 1 strip mine (E. W. Johnson Coal Co.) was the only active coal mine.

Green.—Nally & Gibson Stone Co. crushed limestone for concrete aggregate and roadstone. Production of crude petroleum increased substantially over the amount reported for 1957.

Greenup.—Three mines produced fire clay for firebrick and block; the leading producer was Harbison-Walker Refractories Co. (Riggs mine). Worthington Sand & Gravel Co. mined structural and paving sand and structural gravel. The No. 1 mine (Henry Horn Coal Co.) was the only active coal mine. Production of crude petroleum decreased 13 percent.

Hancock.—Owensboro Sewer Pipe Co. and Murray Tile Co., Inc., mined miscellaneous clay for heavy clay products. There were three active coal mines; the leading producer was the Hawesville No. 1 Strip mine (Walker & Sons Coal Co.). Tri-State Aggregate Corp. mined paving sand and gravel. Production of crude petroleum decreased 6 percent.

Hardin.—Kentucky Stone Co. (Upton quarry and Lilmay mine), Osborne Bros., and Waters Construction Co. produced limestone for riprap, concrete aggregate, roadstone, agstone, and asphalt filler.

Harlan.—Harlan County ranked second in the State in the total value of mineral production. There were 185 active coal mines; leading producers were the No. 32 mine (United States Steel Corp.), the Harlan No. 4 mine (Alva Coal Corp.), and the No. 2 mine (International Harvester Co.). Sam Nally Co. crushed limestone for concrete aggregate and roadstone. Initial production of crude petroleum was reported.

Harrison.—Genet Stone Co. Inc. (Cynthiana quarry) crushed limestone for concrete aggregate, roadstone, and railroad ballast.

Hart.—McLellan Stone Co. (Horse Cave quarry) crushed limestone for concrete aggregate, roadstone, and agstone. Production of crude petroleum decreased 23 percent.

Henderson.—There were seven active coal mines; leading producers were the Mike & Pat mine (Dolph Hazelwood Coal Co.), the No. 1 Henderson mine (Henderson Mining Co. Inc.), and the Community mine (Community Coal Co.). Bedford-Nugent Co. Inc. dredged structural sand and gravel. Production of crude petroleum decreased 20 percent.

Hickman.—The State highway department mined paving gravel.

Hopkins.—Hopkins County led the State in total value of mineral production. Forty-seven coal mines were active; leading producers were the White City strip mine (Peabody Coal Co.) and the East Diamond and Pleasant View mines (West Kentucky Coal Co.). Clarkes Clay Products Co. (Ashbyburg mine) mined 2,300 tons of miscellaneous clay for heavy clay products. Production of crude petroleum decreased 10 percent.

Jackson.—Twenty coal mines were active; leading producers were the Travis Creek mine (Travis Creek Fuel Co.), the Blythe Branch No. 2 mine (Sturgill Coal Co.), and the Conveyor No. 3 mine (Benton Sturgill Coal Co.). M. A. Walker & Co. (Indian Creek and Clover Bottom quarries) crushed limestone for concrete aggregate, roadstone, and agstone. Production of crude petroleum decreased 33 percent.

Jefferson.—Kosmos Portland Cement Co. produced masonry and portland cement. Six mines produced structural, paving, and other sand and gravel; the leading producers were Louisville Sand & Gravel Co. and James C. Hofgesang. At five quarries limestone was crushed for concrete aggregate, roadstone, railroad ballast, and agstone; the leading producers were Falls City Stone Co. (Fern Creek quarry) and Louisville Crushed Stone Co. (Louisville mine). Kosmos Portland Cement Co. (Kosmosdale mine) and General Shale Products Co. (Coral Ridge mine) mined miscellaneous clay for cement and heavy clay products.

Jessamine.—Kentucky Stone Co. (High Bridge mine) crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone.

Johnson.—Sixty-six coal mines were active; leading producers were the No. 8 mine (Witten Coal Co.), the Hager Hill mine (Lynn Mining Co.), and the No. 2 mine (Millers Creek Mining Co.). Production of crude petroleum decreased 15 percent.

Kenton.—Franxman Bros. (Covington quarry) crushed limestone for concrete aggregate and roadstone.

Knott.—The leading producers of the 164 active coal mines were the Buck Branch mine (Buck Branch Coal Corp.), the No. 1 mine (Cuba Coal Co. Inc.), and the Clear Creek No. 3 mine (Kelly Coal Co. Inc.). Production of crude petroleum increased 5 percent.

Knox.—The leading producers of the 35 active coal mines were the Osborne No. 2 strip mine (Osborne Mining Co. Inc.), the No. 2–A strip, and the No. 1 strip mines (Dan Callihan Fuel Co.). Production of crude petroleum decreased 12 percent.

Laurel.—There were 14 active coal mines; leading producers were the Osborne No. 3 strip mine (Osborne Mining Co. Inc.), the No. 1 strip mine (Laurel Mountain Coal Co. Inc.), and the No. 1 mine (Franks Coal Co.). Initial production of crude petroleum was reported.

Lawrence.—Seven coal mines were active; leading producers were the No. 1 mine (Little Blain Coal Co.), the Eli-Jo mine (Lawrence Coal & Land Co.), and the No. 1 mine (Herman Wellman Coal Co.). Production of crude petroleum increased 18 percent.

Lee.—Six coal mines were active; leading producers were the Pacemaker mine (Congleton Bros. Inc.), the No. 1 strip mine (Clifton Brandenburg Coal Co.), and the No. 25 Auger mine (Kentucky

River Collieries, Inc.). Kentucky Stone Co. (Yellow Rock mine) and Central Engineering Co. crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone. Production of crude petroleum increased 11 percent.

Leslie.—There were 72 active coal mines; leading producers were the Deby No. 2 mine (Deby Coal Co.) and the No. 7 mine (Mary Gail Coal Co.). Production of crude petroleum increased 32 percent.

Letcher.—Letcher County ranked fifth in the State in the total value of mineral production. Two hundred eighty-one coal mines were active; leading producers were the Nos. 21 and 22 mines (Bethlehem Mines Corp.) and the Big Chief mine (South East Coal Co.). Hurricane Gap Quarries, Inc., crushed limestone for concrete aggregate and roadstone. Production of crude petroleum decreased 50 percent.

Lincoln.—Production of crude petroleum increased 1 percent.

Livingston.—Calvert City Chemical Co. (Dyer's Hill mine), Tinsley & Loyd (Nancy Hanks mine), and Bourbon Mining Co. (Goering mine) mined fluorspar for metallurgical uses and for hydrofluoric acid for chemicals. Reynolds Metal Co. completed a DMEA project for the exploration of fluorspar on the Kemper property and began another project on the S. R. Grimes property totaling $48,880, of which the Government share was 50 percent. Reed Crushed Stone Co. Inc. (Grand Rivers quarry) crushed limestone for concrete aggregate, roadstone, and agstone. The State highway department mined paving gravel. Salem Building Stone Co. quarried dimension sandstone for rough architectural use. Small quantities of zinc, lead, and silver were recovered from the milling of fluorspar.

Logan.—Kentucky Stone Co. (Russellville mine) crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone. Kentucky Flagstone Co. (Lewisburg quarry) and Kentucky Kolor Stone Corp. (Russellville quarry) quarried 1,500 tons of dimension sandstone for rough architectural use and for flagging. Production of crude petroleum decreased 8 percent.

Lyon.—The State highway department mined paving gravel.

Madison.—Kentucky Stone Co. (Boonesboro mine) crushed limestone for concrete aggregate, roadstone, and agstone.

Magoffin.—Eight coal mines were active; leading producers were the No. 1 Auger mine (Tip Top Coal Co. Inc.), the No. 1 mine (Trusty & Harper Coal Co.), and the No. 7 mine (Guy Marshall Coal Co.). Production of crude petroleum decreased 13 percent.

Marion.—Lebanon Stone Co. and Ward & Montgomery crushed limestone for concrete aggregate, roadstone, and agstone. Marion County Highway Department mined paving gravel.

Marshall.—The State highway department mined paving gravel.

Martin.—There were four active coal mines; the No. 2 mine (Webbs Coal & Mining Co.) and the No. 1 mine (Horn Bros. Mining Co.) were the leading producers. Production of crude petroleum decreased 11 percent.

Mason.—J. F. Hardymon Co. mined structural, paving, and other sands and structural, railroad ballast, and other gravel.

McCracken.—Federal Materials Co. Inc. (Paducah mine), dredged structural, paving, and engine sands, and structural gravel.

McCreary.—Coal production came from 16 active mines; leading producers were the Nos. 18 and 16 mines (Stearns Coal & Lumber Co.) and the Holly Hill and Wolf Creek No. 10 strip mines (B. R. Campbell & Son Coal Co. Inc.). Thomas C. Mayne (Day Ridge quarry) quarried 60 tons of dimension sandstone for rubble and for flagging. Production of crude petroleum decreased 1 percent.

McLean.—Production of crude petroleum increased 4 percent.

Meade.—Kosmos Portland Cement Co. and Owensboro River Sand & Gravel Co. produced limestone for riprap, concrete aggregate, roadstone, agstone, and cement.

Menifee.—A. W. Walker & Son (Frenchburg quarry) crushed limestone for concrete aggregate, roadstone, and agstone. Production of crude petroleum increased more than 6 times the amount reported in 1957.

Mercer.—Mercer Stone Co. and Mercer County Highway Department crushed limestone for concrete aggregate, roadstone, and agstone.

Metcalfe.—Montgomery & Co. (Chapman quarry) crushed limestone for concrete aggregate, roadstone, and agstone. Production of crude petroleum decreased 52 percent.

Monroe.—Trico Stone, Inc. (Monroe quarry), crushed limestone for concrete aggregate, roadstone, and agstone. Production of crude petroleum decreased 55 percent.

Morgan.—Kentucky Road Oiling Co. (Wrigley quarry) and Licking River Limestone Co. (Zag quarry) crushed limestone for concrete aggregate, roadstone, agstone, and other uses. Ten coal mines were active; leading producers were the No. 1 strip mine (Harold Fredrick Coal Co.), the White Oak Branch Strip mine (Less Branham Coal Co.), and the No. 1 strip mine (Marshall & Sheets Coal Co.). Production of crude petroleum increased 5 percent.

Muhlenberg.—Muhlenberg County ranked third in the State in total value of mineral production. Twenty-seven coal mines were active; leading producers were the River Queen Strip mine (River Queen Coal Co.), the Gibraltar strip mine (Gibraltar Coal Corp.), and the Paradise strip mine (Pittsburgh & Midway Coal Mining Co.). Greenville Quarries, Inc. crushed limestone for concrete aggregate and roadstone. Production of crude petroleum decreased 21 percent.

Nelson.—Geoghegan & Mathis crushed limestone for concrete aggregate, roadstone, and agstone.

Nicholas.—Nicholas County Highway Department crushed limestone for concrete aggregate and roadstone.

Ohio.—Nineteen coal mines were active; leading producers were the Ken strip mine (Peabody Coal Co.), the No. 1 strip mine (Riverview Coal Co.), and the Teague No. 3 strip mine (Teague Coal Co.). Fort Hartford Stone Co. and State Contracting & Stone Co. produced limestone for riprap, concrete aggregate, roadstone, railroad ballast, and agstone. Production of crude petroleum decreased 9 percent.

Oldham.—W. T. Liter (Crestwood mine) and Joe Clark Stone Co. crushed limestone for concrete aggregate and roadstone.

Owsley.—The No. 27 Auger mine (Kentucky River Collieries, Inc.) was the only active coal mine. Production of crude petroleum increased 4 percent.

Pendleton.—Geoghegan & Mathis (Butler & Falmouth quarries) crushed limestone for concrete aggregate, roadstone, and agstone.

Perry.—Perry County ranked seventh in the State in total value of mineral production. The leading producers of the 124 active coal mines were the Leatherwood Nos. 1 and 2 mines (Blue Diamond Coal Co.) and the Blair Fork mine (Jewel Ridge Coal Corp.). Production of crude petroleum was 9 times greater than was reported in 1957.

Pike.—Pike County ranked fourth in the State in total value of mineral production. There were 338 active coal mines; leading producers were the Stone mine (Eastern Coal Corp.), the Republic mine (Republic Steel Corp.), and the Kentland No. 1 mine (Kentland-Elkhorn Coal Co.). Pike Sand Co. mined structural and engine sands. The production of crude petroleum increased 21 percent.

Powell.—A. W. Walker & Son (Whiterock quarry) crushed limestone for concrete aggregate, roadstone, and agstone. H. B. Sipple Brick Co. (Faulkner No. 1 mine) mined 12,500 tons of miscellaneous clay for heavy clay products. Production of crude petroleum increased 26 percent.

Pulaski.—Fifteen coal mines were active; leading producers were the No. 1 mine (Dewey Robinson Coal Co.), the Wildcat No. 1 mine (Foster Stokes Coal Co.), and the No. 3 strip mine (Ikerd-Bandy Co. Inc.). Somerset Stone Co. (Somerset quarry) and Strunk Construction Co. (Tateville quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Rockcastle.—Kentucky Stone Co. (Mullins mine and Mount Vernon quarry) crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone. There were 11 active coal mines; leading producers were the No. 1 strip mine (W. R. Hunt Coal Co.), the No. 1 mine (Black Foot Coal Co.), and the No. 1 mine (Low Ash Coal Co.).

Rowan.—Morehead Limestone Co. and Kentucky Road Oiling Co. (Christy quarry) crushed limestone for fluxing stone, concrete aggregate, roadstone, and agstone. Lee Clay Products Co. (Summit mine) mined miscellaneous clay for heavy clay products.

Russell.—Production of crude petroleum decreased 48 percent.

Simpson.—Southern Stone Co. (Franklin quarry) crushed limestone for concrete aggregate, roadstone, and agstone. Production of crude petroleum decreased 12 percent.

Taylor.—Production of crude petroleum decreased 23 percent.

Todd.—Kentucky Stone Co. (Todd quarry) and D. W. Dickinson (Gallatin quarry) crushed limestone for concrete aggregate, roadstone, and agstone. Production of crude petroleum decreased 39 percent.

Trigg.—Cedar Bluff Stone Co. (Cerulean quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Union.—Five coal mines were active; leading producers were the Uniontown mine (Nashville Coal Co. Inc.), the Dekoven mine (P & M Coal Mining Co.), and the No. 1 strip mine (P & S Coal Co.). Production of crude petroleum decreased 10 percent. Union Sand & Gravel Co. (Morganfield mine) mined structural sand and structural and paving gravel. Clarks Clay Products Co. (Uniontown mine) mined 4,000 tons of miscellaneous clay for heavy clay products.

Warren.—McLellan Stone Co. (Warren and Smith's Grove quarries), Gary Bros. Crushed Stone Co. and White Stone Quarry crushed limestone for concrete aggregate, roadstone, and agstone. Production of crude petroleum increased 2 percent.

Wayne.—Bassett Products Co. crushed limestone for concrete aggregate, roadstone, and railroad ballast. There were 4 active coal mines; leading producer was the No. 1 mine (Harvey Worley Coal Co.). Production of crude petroleum increased 1 percent.

Webster.—There were 10 active coal mines; leading producers were the Precision Washed strip mine (Hart & Hart Coal Co.), the Choctaw strip mine (Russell Badgett Coal Co.), and the Teague Strip mine (Teague Coal Co.). Production of crude petroleum decreased 14 percent.

Whitley.—Coal production was reported from 48 mines; leading producers were the Whitley strip mine (Whitley Strip Mining Co. Inc.), the No. 1 strip mine (B. G. Arnold Coal Co. Inc.), and the No. 3 mine (Reaves Dixie Gem Coal Co.). Corbin Brick Co. mined miscellaneous clay for heavy clay products.

Wolfe.—The Miller mine (C. L. Thompson Coal Co.) was the only active coal mine. Production of crude petroleum increased 9 percent.

The Mineral Industry of Louisiana

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Louisiana Geological Survey.

By Robert S. Sanford,[1] Peter Grandone,[2] and Leo W. Hough [3]

DESPITE the national economic recession Louisiana had the second best year in the history of its mineral industry. Construction activity and wide industrial diversifications were stabilizing factors.

The highway construction program was the largest ever undertaken; construction started on a ½-mile-long platform for the first offshore sulfur mine; construction of the Port Nickel refinery neared completion; Burnside Bulk Marine Terminal was completed; construtions of the Ormet alumina plant was completed; the Mississippi River-Gulf Outlet Navigation project was begun; and installations at petrochemical plants, natural gasoline plants, and petroleum refineries were in various stage of completion. As a result, demand for construction of raw materials—sand and gravel, shell, cement, and clays—all gained.

TABLE 1.—Mineral production in Louisiana [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays [2] thousand short tons	642	$642	755	$755
Natural gas million cubic feet	2,078,901	232,837	2,451,587	316,255
Natural-gas liquids:				
Natural gasoline and cycle products thousand gallons	775,009	63,956	783,099	50,371
LP-gases do	335,142	14,888	410,869	21,435
Petroleum (crude) thousand 42-gallon barrels	329,896	1,094,402	[3] 312,070	[3] 1,017,562
Salt (common) thousand short tons	3,461	18,944	3,442	18,960
Sand and gravel do	12,579	14,730	[4] 15,061	[4] 17,119
Stone do	4,383	7,152	5,453	9,532
Sulfur (Frasch-process) thousand long tons	2,156	52,690	2,028	47,651
Value of items that cannot be disclosed: Cement, bentonite, gypsum, and lime		[5] 18,966		20,475
Total Louisiana [6]		[5] 1,517,523		1,517,415

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite, value for which is included with "Items that cannot be disclosed."
[3] Preliminary figure.
[4] Final figure; supersedes figure given in commodity chapter.
[5] Revised figure.
[6] Total value has been adjusted to avoid duplicating clays used for cement and oystershell used in producing lime and cement.

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Completion of the Burnside Bulk Marine Terminal improved the State's position to unload bulk cargo from foreign ports and also load bulk cargo onto barges for transportation on the inland waterways. Construction was begun on the Mississippi River-Gulf Outlet ship channel from New Orleans to the Gulf of Mexico, a total distance of 77 miles. The new channel will provide an improved second route into the second busiest port in the United States and reduce the shipping distance from New Orleans to the open gulf by 40 miles and to European ports by about 65 miles. Starting at the Inner Harbor Navigation Canal, in New Orleans, contracts for the first 5 miles of channel (36 feet deep by 500 feet wide) were awarded in 1958. New areas for wharves and industrial expansion will become available thus avoiding harbor congestion. The project was scheduled for completion in 1963 at an estimated Federal cost of $101 million.

Natural gas and natural-gas liquids output continued to climb with the ever-increasing national demand. Crude petroleum production, held back by the posted "allowables," declined only 5 percent from 1957.

Mineral production totaled $1,517 million in value, almost equal to the record year of 1957.

TABLE. 2.—Employment and wages in the mineral industries[1]

Activity	Average number workers		Total wages and salaries (thousands)	
	1957	1958	1957	1958
Crude petroleum production, natural gas and natural-gas liquids	21,469	20,380	$135,838	$132,731
Oil- and gas-field contract services	20,139	[2] 20,673	107,184	[2] 108,021
Sand and gravel quarries, pits, and dredges	1,351	1,343	4,680	4,803
Salt mines	809	714	3,310	3,308
Nonmetallic minerals	[3] 1,809	[4] 1,735	[3] 10,384	[4] 10,092
Total	45,577	44,845	261,396	258,955

[1] Louisiana State Department of Labor, Division of Employment Security.
[2] Includes approximately 3,300 formerly in service industries. The additional item is geophysical services.
[3] Mainly sulfur and some shell-production workers in 1957.
[4] Mainly sulfur; does not include shell-production workers in 1958.

TABLE 3.—Total wage and salaried workers in petroleum production, refining, and related industries[1]

Yearly average	Total	Crude petroleum and natural gas production	Petroleum refining	Pipeline transportation (except natural gas)	Gas utilities	Petroleum bulk-tank stations	Retail filling stations	Chemicals manufactured as byproducts of petroleum or used in the refining of petroleum
1954	75,000	31,900	15,850	1,450	4,950	3,650	6,600	10,600
1955	80,900	35,900	15,800	1,450	5,100	3,900	7,400	11,350
1956	87,550	40,200	15,500	1,400	5,600	4,400	8,400	12,050
1957	90,700	42,300	15,700	1,500	5,800	4,700	8,350	12,350
1958 [2]	90,350	[3] 41,350	15,450	1,400	6,000	4,600	8,600	12,950

[1] Louisiana State Department of Labor, Division of Employment Security.
[2] Preliminary figures.
[3] Includes 3,300 formerly in service industries.

Employment and Injuries.—Employment in the oil and gasfields, in quarries, pits, and mines, and on dredges declined 2 percent, and total wages declined 1 percent compared with 1957. The average annual wage for workers in these industries was $5,774, compared with $5,735 in 1957.

In all nonmetal mining and processing operations there were 1 fatal and 112 nonfatal injuries. In the alumina and aluminum-processing plants there were 1 permanent total and 35 nonfatal injuries. In the petroleum industry there were 11 fatal and permanent combined and 583 nonfatal injuries. Most of the petroleum industry's injuries occurred in field operations—exploration, drilling, and production.

Nine lives were lost, October 15, 1958, at the worst offshore oilfield fire in Louisiana history. The six-well derrick collapsed an hour after the fire started. Five wells had been drilled directionally, less than 10 feet apart, with multiple completions; hence, the equivalent of 19 separate oil and gas wells was burning—probably the worst fire in the history of the industry. As firefighters could not extinguish the fire one well at a time by conventional methods, auxiliary wells were drilled to intercept the original wells at depth; mud fluid was pumped into the holes to cut off the flow of oil and gas; the fire was eventually extinguished on November 26.

Legislation.—The Louisiana Legislature enacted a new State law, urged by Gov. Earl K. Long, to change the gas-gathering tax to a severance tax. In some instances revenue received by farmers and other landowners will be cut as much as 50 percent.

REVIEW OF MINERAL COMMODITIES

MINERAL FUELS

Production of natural gas and natural-gas liquids continued upward. Crude petroleum production declined, owing largely to decreasing demand and increasing stocks. Exploration also was curtailed. The tideland dispute between the Federal Government and Louisiana remained unsettled. Offshore Louisana was assured a gain in exploratory drilling by the record-breaking sale of leases of State lands. Sales netted $61.4 million in bonus payments (compared with only $1.5 million in 1957). Guarantees of new drilling—both onshore and inland—were extracted from the bidders. Most of the contracts

TABLE 4.—Value of construction contracts awarded, in thousands [1]

Type	1956	1957	1958	Change from 1957, percent
Residential [2]	$189,241	$235,943	$245,604	+4.1
Nonresidential [3]	206,844	205,035	164,070	−20.0
Public works and utilities	252,176	188,653	268,513	+42.3
Total	648,261	629,631	678,187	+7.7

[1] Dodge Statistical Research Service, Louisiana Business Review: Vol. 23, No. 2, February 1959, p. 14.
[2] Includes apartments, hotels, dormitories, and 1- and 2-family dwellings.
[3] Includes commercial, manufacturing, educational, and other nonresidental buildings.

required drilling during the first year, or a penalty of one-half the bonus would be assessed.

According to the Louisiana Department of Conservation, at the yearend there were 881 oil and/or gasfields in the State, with approximately 30,000 wells capable of producing oil or gas. New wells drilled during the year added about 191,000 barrels a day from old and new reservoirs.

Exploration and Reserves.—Statewide drilling of 875 exploratory wells (about 10 percent less than in 1957) proved 25 percent productive (28 percent in 1957) and led to the opening of 59 new oil and/or gasfields compared with 77 new fields in 1957. Most of the exploration and success centered in South Louisiana, where 40 of the new fields were found. Discoveries in the offshore area lagged as only eight new fields (29 productive wells) resulted from 58 exploratory tests. Two of the offshore wells marked initial developments in the Marsh Island area off the coastline of Vermilion and St. Mary Parishes. Inshore, discovery of oil on Calcasieu Lake salt dome, Cameron Parish, climaxed the drilling of nearly 40 tests over a period of about 30 years. New attention was focused on the State's sparsely explored midarea, where oil discoveries were made in Sabine, Rapides, and southern La Salle Parishes.

According to the Oil and Gas Journal, 27 million feet of hole was drilled during the year; of this 4.5 million feet was exploratory.

About 27 percent of the crude petroleum reserve was in the offshore area. At the end of 1958 the ratio of oil reserve to production was 12.96 : 1.00; for natural gas it was 26.06 : 1.00 (based on marketed production). Also, at the end of the year the proved reserves of petroleum (4,044 million barrels) and natural gas (55,112 billion cubic feet) were second largest among the States.[4]

Exploratory drilling was most extensive in Terrebonne, Lafourche, Vermilion, Plaquemines, Acadia, and Jefferson Davis Parishes, with 30 or more test wells credited to each. In the offshore area the largest number of exploratory wells was drilled in Eugene Island, South Timbalier, West Cameron, East Cameron, and South Marsh Island areas.

Geophysical and core-drill prospecting was most intensive in South Louisiana, where Terrebonne, Lafourche, Vermilion, Plaquemines, Cameron, St. Martin, St. Mary, and Iberia Parishes were credited with 200 or more crew-weeks each. Offshore activities was centered mainly in the Eugene Island, West Cameron, Vermilion, and East Cameron areas.

Adverse market conditions and rising reserves of petroleum led to further curtailment of drilling activity. By December the number of rotary rigs operating declined to 325 compared with 381 in December 1957. Shallower drilling was the pattern for these wells, as the average depths of these wells reclined 316 feet in North Louisiana, 426 feet in South Louisiana, and 458 feet offshore. The average depths of development wells drilled, however, continued to increase in South Louisiana and offshore.

[4] American Petroleum Institute and American Gas Association, Proved Reserves of Crude Oil, Natural-Gas Liquids, and Natural Gas: Vol. 12, Dec. 31, 1958, pp. 9, 10, 19.

TABLE 5.—Production and estimated reserve of crude petroleum in Louisiana offshore area, 1958, and cumulative total[1]

Offshore area	1957	1958				
	Crude petroleum (thousand barrels)	Crude petroleum (thousand barrels)	Cumulative total (thousand barrels)	Estimated reserve (thousand barrels)	Number of wells	Acres[2]
Bay Marchand: Block 2[3 4]	3,368	8,421	30,552	69,448	180	5,600
Belle Isle[4]	241	822	6,711	18,289	38	1,400
Eugene Island:						
Block 18	783	642	2,712	12,288	14	1,100
Block 32	686	899	3,918	21,082	24	1,800
Block 45	244	193	1,699	4,301	4	240
Block 110	84	55	247	2,753	4	320
Block 126	3,220	3,286	13,871	51,129	66	4,500
Block 128	1,047	1,669	4,189	35,811	38	2,000
Grand Isle:						
Block 16	804	1,722	2,916	47,084	47	3,500
Block 18	2,083	1,909	9,442	29,558	35	2,400
Block 47	377	2,128	2,586	57,414	52	3,800
Main Pass: Block 69[3]	7,239	6,917	30,818	169,182	180	10,000
Ship Shoal: Block 154	880	1,524	2,824	38,176	45	2,500
South Pass:						
Block 24[3 4]	6,642	15,067	67,780	167,220	469	12,000
Block 27[3]	2,166	3,579	8,039	101,961	110	8,000
Timbalier Bay[3 4]		8,558	34,363	122,637	291	11,000
West Delta:						
Block 30[3]	2,616	4,476	8,738	121,262	135	8,300
Block 53[4]	92	1,032	3,742	8,258	13	1,080
Total	32,572	62,899	235,147	1,077,853	1,745	79,540

[1] The Oil and Gas Journal, vol. 57, No. 4, January 1959, p. 143.
[2] Figures apply to largest reservoir only.
[3] Estimated ultimate recovery of 100 million barrels or more.
[4] Combined onshore and offshore, 1958 only.

TABLE 6.—Production and additions to reserves of crude petroleum, natural gas, and natural-gas liquids[1]

Year	Crude petroleum[2]		Natural gas[3]		Natural-gas liquids[2]	
	Production	Net additions to reserve	Production	Net additions to reserve	Production	Net additions to reserve
1949	191	41	733	2,710	19	72
1950	209	275	832	1,845	21	47
1951	232	100	1,054	472	22	41
1952	244	273	1,237	2,447	23	29
1953	257	202	1,294	3,007	23	100
1954	247	202	1,399	2,341	23	71
1955	271	294	1,680	5,636	26	52
1956	299	420	1,886	2,618	26	79
1957	330	182	2,079	6,382	26	4
1958	312	186	2,115	3,676	28	177
Total proved reserves on December 31, 1958						
	4,044		55,112		1,196	

[1] Reserves based on American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural-Gas Liquids, and Natural Gas: Vols. 4–13, 1949–58.
[2] Million barrels.
[3] Billion cubic feet.

Carbon Black.—Production was cut back about 31 million pounds to a total of 503 million pounds because of declining sales to rubber, ink, and paint companies. The average value of carbon black decreased from 7.12 to 7.00 cents a pound. The following table shows the trend in the 5-year period, 1954–58:

Year	*Production, million pounds*
1954	368
1955	503
1956	538
1957	534
1958	503

Two carbon-black manufacturers received tax exemptions for additions to existing plants as follows: Thermatomic Carbon Co. at Sterlington, $579,900; Columbian Carbon Co. at Eola, $27,510.

Natural Gas.—Louisiana retained second position in the Nation as a supplier of natural gas. Marketed production continued a strong upward trend for the 13th consecutive year, increasing fourfold from 525,178 million cubic feet in 1946 to 2,451,587 million cubic feet in 1958. National demand for natural gas as a choice fuel and as a raw material for petrochemicals continued to grow rapidly. Construction of offshore pipelines continued in order to tap the natural gas potential. Of the 15 offshore natural gas gathering lines, 4 extend over 20 miles into the Gulf—the longest was 38 miles; the largest size was 26 inches in diameter. As most of the major offshore gasfields were connected with the mainland, about 10 percent of the State's net gas production in 1958 was offshore.

The average price of natural gas continued to advance, as several new contracts were written at higher rates. The largest gas-sale contract in the State among four producers (CATCO) and the Tennessee Gas Transmission Co., which had been approved by the Federal Power Commission at a sale price of 22.4 cents a thousand cubic feet, was overruled by the U.S. Court of Appeals in Philadelphia. As the producers refused to sell gas at the recommended price of 16 cents a thousand cubic feet, the case was appealed to the Third U.S. Circuit Court of Appeals in Philadelphia. Should the producing group receive a favorable decision from the circuit court, a large supply of natural gas from the Cameron Parish offshore will become available to markets.

Ocean transport of natural gas in converted dry cargo ships or special tankers expanded the potential market area. The *Methane Pioneer*, a converted dry cargo ship, completed the first successful voyage from Lake Charles to a British terminal during February 1959 with a cargo of 32,000 barrels of liquid methane to be converted to natural gas for British consumers.

The Federal Power Commission authorized Southern Natural Gas Co., Birmingham, Ala., to build $39.8 million of new facilities in southern Louisiana. The company plans to build 360 miles of pipeline, 4,310 horsepower of compressor capacity, and 23 measuring stations.

Natural-Gas Liquids.—Natural gasoline and cycle products were recovered by 64 plants in 26 parishes in the State. Increased output over 1957 of total condensable liquids was attributed mainly to a gain in natural gas produced and processed, especially casinghead

TABLE 7.—New oil and gas discoveries in 1958, by parishes[1]

Parish and field	Total depth (feet)	Production depth (feet)	Daily production rate		Type of product
			Barrels	Thousand cubic feet	
NORTH LOUISIANA					
Bossier: Rocky Mount	11,952	11,598-708	1	517	Gas.
Catahoula: Carr Lake	6,010	5,186-188	57	----------	Oil.
Concordia: Frogmore	5,842	4,951-954	144	29	Do.
Natchez Island	7,704	6,791-795	96	40.8	Do.
Omega	4,987	4,911-914	70	10.5	Do.
De Soto: Canadian Bayou	6,871	4,162-172	115	----------	Do.
Red River: Gay Island	3,001	2,595-597	219	----------	Do.
Sabine: Pendleton	7,978	2,840-900	132	60	Do.
Tensas: Lake Marydale	8,413	8,162-164	120	720	Do.
West Newlight	7,300	7,221-229	170	156	Do.
Westwood	7,645	7,349-390	111	63	Do.
SOUTH LOUISIANA					
Acadia: Southwest Mermentau	12,500	9,589-619 9,602-631	12	803.79	Gas.
Allen: West Pilgrim Church	10,004	9,828-846	171	1,233	Do.
Beauregard: Alligator Lake	12,056	10,684-692	216	271	Oil.
S. Bear Head Creek	8,709	8,508-518	66	1,248	Gas.
Calcasieu: Choupique	11,592	11,564-589	390	5,500	Do.
East Buhler	9,501	8,970-993	89.5	3,505	Do.
South Manchester	5,106	4,586-591	----------	600	Do.
Cameron: Calcasieu Lake	----------	11,834-838	----------	----------	Oil.
Evangeline: East Basile	8,861	7,988-996	144	92	Do.
Jefferson: Northeast Lake Salvador	12,038	11,620-630	13.4	2,103	Gas.
Jefferson Davis: Southwest China	10,727	10,565-593	318	1,665	Do.
Lafayette: Lafayette	13,502	10,599-603	113	254	Oil.
North Ossun	13,586	12,856-886	565	3,400	Gas.
Lafourche: Melodia	13,048	12,943-949	80.5	2,050	Do.
Roux	13,500	11,794-808	133	3,850	Do.
Orleans: Lake St. Catherine	5,575	----------	----------	1,316	Do.
Plaquemines: Adams Bay	13,008	11,509-512	64	----------	Oil.
Diamond	12,615	11,810-816	185	2,700	Gas.
Nairn	12,506	11,387-407	228	318	Oil.
Pointe Coupee: Livonia	11,319	10,728-735	124	270	Do.
Rapides: Kalin	7,612	6,442-444	54	----------	Do.
S. Catahoula Lake	5,565	4,095-097	11	----------	Do.
St. Charles: W. Avondale	13,593	10,025-027	134	1,200	Gas.
St. John the Baptist: Bonnet Carre	11,438	9,431-435	132	602	Oil.
St. Martin: Belle River	13,033	10,666-674	226	86	Do.
Lake St. Rose	13,045	12,555-575 12,584-590	----------	5,000	Gas condensate.
St. Mary: East Lake Sand	14,203	13,714-718	95	3,240	Gas.
Terrebonne: Bay Round	12,450	12,165-171 12,173-179 12,181-187	109	6,563	Do.
Donner	15,200	12,664-674	353	1,022	Oil.
Pagie Lake	14,580	12,122-135	----------	5,300	Gas.
Pass Wilson	12,900	10,026-046	72	2,440	Do.
Presque Isle	13,238	11,285-288	----------	2,450	Do.
Salt Bay	12,643	10,630-636	113	6,032	Do.
West Deer Island	12,309	11,760-764	304	503,296	Do.
Vermilion: Buck Point	17,000	13,891-895	15	1,950	Do.
Grosse Isle	15,520	14,415-418	272	4,266	Do.
N. Freshwater Bayou	14,570	13,310-325	352	4,425	Do.
Perry Point	12,101	10,062-068	194	140	Oil.
Riceville	15,255	15,025-066	102	3,400	Gas.
Southwest Esther	13,020	12,900-910	39	1,614	Do.
OFFSHORE					
Cameron: W. Cameron, Block 67	13,078	11,345-355	107	5,325	Gas.
Iberia: Mound Point	12,866	8,506-516	44	5,060	Do.
Iberia and/or Vermilion: Lighthouse Point	12,235	11,520-527	49	7,070	Do.
Lafourche: South Timbalier, Block 131	7,667	6,706-714	73	496	Oil.
St. Mary: Eugene Island: Block 198	14,310	13,506-534	151	3,720	Gas.
Block 208	9,612	8,879-885	269	250	Oil.
Vermilion: Vermilion, Block 86	10,910	10,828-844	106	3,600	Gas.
Vermilion and/or Iberia: Tiger Shoal	12,395	8,954-970	32	2,960	Do.

[1] Louisiana State Department of Conservation, Annual Oil and Gas Report, 1958: pp. 8-11.

TABLE 8.—Oil- and gas-well drilling and total crew-weeks spent in geophysical oil and gas prospecting in 1958, by parishes [1]

Parish	Drilling							Geophysical, crew-weeks		
	Proved-field wells			Exploratory wells			Grand total	Method		
	Oil	Gas	Dry	Oil	Gas	Dry		Total	Reflection seismograph	Gravity meter
Acadia	54	13	18	7	10	26	128	183	183	
Allen	4	2	7	1	4	9	27	79	79	
Ascension	4			1	1	1	7	42	42	
Assumption	11	5	2	1	1	5	25	111	104	7
Avoyelles			1			4	5	1		1
Beauregard	12	6	1	4	2	15	40	92	92	
Bienville	3	3	8		2	5	21	46	33	13
Bossier	9	17	13	1	3	13	56			
Caddo	320	15	46	1		14	396	13	13	
Calcasieu	20	5	20		5	31	81	179	177	2
Caldwell					1	3	4	17	17	
Cameron	22	21	13	1	3	19	79	249	234	15
Catahoula	6		17	1		27	51	7	5	2
Claiborne	10	8	11		2	3	34	57	52	5
Concordia	27		31	7		16	81	5	5	
De Soto	54	29	73	2		11	169	7	7	
East Baton Rouge			1			1	2	1	1	
East Carroll								15	15	
Evangeline	3		3	1	1	3	11	33	26	7
Franklin	8	2	17	2	1	12	42	21	4	17
Grant	10		12			6	28	16	16	
Iberia	17	12	8	1	6	14	58	203	203	
Iberville	16		6			3	25	91	91	
Jackson			1			2	3	25	16	9
Jefferson	22	1	9		1	13	46	146	134	12
Jefferson Davis	7	5	8		8	25	53	127	127	
Lafayette	2	1		1	3	6	13	104	52	52
Lafourche	81	17	36		10	56	200	412	409	3
La Salle	75		44	3		19	141	2		2
Lincoln		5	2		1		8	52	52	
Livingston			1			1	2	2	2	
Madison						5	5	29	27	2
Morehouse						2	2	5	5	
Natchitoches	21					6	27	10	6	4
Orleans			1		1	2	4	11	11	
Ouachita	1	3	1		3	3	11	61	57	4
Plaquemines	117	15	25	9	5	33	204	256	256	
Pointe Coupee				2		3	5	27	27	
Rapides	2		4	2		6	14			
Red River	19	43	20	1	1	15	99	9	9	
Richland	3					3	6	10	4	6
Sabine	19	2	38	1		2	62	47	47	
St. Bernard	2			1		6	9	67	67	
St. Charles	18	5	10		4	4	41	31	31	
St. Helena								28	25	3
St. James	2	3				5	10	56	19	37
St. John the Baptist	10			1		5	16	8	8	
St. Landry	19	4	19	2	4	17	65	82	82	
St. Martin	35	7	12	4	4	13	75	234	185	49
St. Mary	64	19	7	1	4	18	113	234	221	13
St. Tammany								21	18	3
Tangipahoa								3	3	
Tensas	25	4	16	4	1	7	57	45	31	14
Terrebonne	107	42	29	6	14	46	244	602	553	49
Union		35	3			5	43	61	61	
Vermilion	14	15	13	3	13	42	100	412	412	
Vernon								1	1	
Washington								80	75	5
Webster	16	7	17	1	1	6	48	48	39	9
West Baton Rouge	3	1	2			1	7	13	13	
West Carroll								7	7	
Winn	3		2			6	11	34	26	8
Subtotal	1,297	372	628	73	120	624	3,114	4,870	4,517	353

See footnotes at end of table.

TABLE 8.—Oil- and gas-well drilling and total crew-weeks spent in geophysical oil and gas prospecting in 1958, by parishes—Continued

Parish	Drilling							Geophysical, crew-weeks		
	Proved-field wells			Exploratory wells			Grand total	Method		
	Oil	Gas	Dry	Oil	Gas	Dry		Total	Reflection seismograph	Gravity meter
Offshore:										
Bay Marchand	23	2	6				31			
Breton Sound								16	16	
Cameron, East		16	3		1	4	24	41	30	11
Cameron, West		6	2		4	3	15	50	34	16
Delta, West	29		11	1		1	42	5	5	
Eugene Island	16	4	15	3	5	4	47	58	22	36
Grand Isle	27		3	2		1	33	9	9	
Main Pass	27		5	1	1	1	35	14	14	
Marsh Island, South		1			5		6	16	5	11
Ship Shoal	7	2	9	1	1	3	23	18	4	14
South Pass	69	2	5				76	4		4
South Pelto	1						1			
Timbalier, South	20	3	12	2		10	47	11	11	
Vermilion	4	6	6		2	2	20	47	22	25
Subtotal	223	42	77	10	19	29	400	289	172	117
Total: 1958	1,520	414	705	83	139	653	3,514	5,159	4,689	470
1957	1,797	370	765	106	166	701	3,905	[2] 6,606	6,027	577

[1] National Oil Scouts and Landmen's Association, Oil and Gas Field Development in United States and Canada: Austin, Tex., vol. 29, 1959.
[2] Includes 2 crew-weeks by magnetometer methods.

TABLE 9.—Marketed production, gross withdrawals and disposition of natural gas in Louisiana, in million cubic feet

Year	Withdrawals [1]			Marketed production [2]	Value at wells (thousand)	Disposition	
	From gas wells	From oil wells	Total			Repressuring	Vented and wasted [3]
1949–53 (average)	1,037,874	297,090	1,334,964	1,029,920	$65,244	199,452	105,591
1954	1,325,000	375,000	1,700,000	1,399,222	124,531	215,491	85,287
1955	1,523,000	425,000	1,948,000	1,680,032	189,844	201,764	66,204
1956	1,720,000	430,000	2,150,000	1,886,302	215,038	190,768	72,930
1957	1,877,000	470,000	2,347,000	2,078,901	232,837	187,057	81,042
1958	2,223,000	505,000	2,728,000	2,451,587	316,255	220,616	55,797

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas in pipelines.
[3] Partly estimated. Includes direct waste on producing properties and residue blown to the air.

gas from oil wells. A significant 23-percent gain by LP-gases represented most of the increased output of condensable liquids. This confirms the trend in natural gasoline plants to remove more butane from the natural gasoline fraction and then to process the remaining heavier components to higher quality blending stocks for motor fuels. The LP-gas consumption pattern had been changing in recent years more in favor of fuel and chemical uses and less for blending into motor fuels at refineries. The average price of LP-gases advanced 17 percent over 1957; natural gasoline and cycle products declined about 22 percent.

TABLE 10.—Natural-gas liquids production

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)
1949–53 (average)	638,646	$48,602	270,850	$12,096	909,496	$60,698
1954	665,070	54,330	292,226	11,620	957,296	65,950
1955	782,328	59,158	291,138	10,323	1,073,466	69,481
1956	773,949	62,394	305,222	14,727	1,079,171	77,121
1957	775,009	63.956	335,142	14,888	1,110,151	78,844
1958	783,099	50,371	410,869	21,435	1,193,968	71,806

New plants going on stream were Gas Management Industries Corp. Locus Ridge plant in Tensas Parish, Sohio Petroleum Co. and Gulf Oil Corp. Mt. Washington plant in St. Landry Parish, The Superior Oil Co. Lowery plant in Concordia Parish, The Texas Co. Mud Lake plant in Cameron Parish, and Sunray Mid-Continent Oil Co. Shoats Creek plant.

Petroleum.—Production of 312 million barrels of petroleum (third largest in the Nation) was only 5 percent under the 1957 output. Although the "depth bracket" allowable was kept comparatively constant, completion of many new wells in South Louisiana (including the offshore area) caused monthly gains in production that tended to favor the State's position in relation to overall demand. About 85 percent of the production was credited to South Louisiana. The offshore area, taken alone, supplied 18 percent of the production and scored an 8.6-percent gain over 1957. Gains in reserves also enhanced the State's producing capacity.

The average price of petroleum declined from the alltime high of $3.32 a barrel in 1957 to $3.26 in 1958.

Since the discovery of petroleum through 1958 an estimated 4.8 billion barrels of oil valued at $10,500 million has been produced.

Shell Pipe Line Corp. was completing its Delta line to move petroleum from the Mississippi Delta area to Norco refinery near New Orleans.

Refineries.—At the end of 1958 there were 12 active petroleum refineries with a combined capacity of 770,160 barrels of crude oil a day, according to the Oil and Gas Journal. This compared with 13 active refineries with a combined capacity of 790,900 barrels a day at the end of 1957. Crude oil runs to stills declined 6 million barrels to a total of 231 million barrels; of this amount, 159 million barrels represented intrastate receipts, or 51 percent of production. In 1957 intrastate receipts at these refineries totaled 162 million barrels, or 49 percent of production.

The refinery trend in the State was toward increased capacity for upgrading motor fuels. Shell Oil Co. completed a multimillion-dollar improvement project at its Norco refinery. A new major unit was a Platformer capable of upgrading 16,000 barrels daily of gasoline components.

Bay Petroleum Corp. was modernizing its Chalmette refinery. Crude-oil capacity will be increased from 24,000 to 33,000 barrels daily. Changes in refinery units included a new 2,700-barrel-a-day

TABLE 11.—Production of crude petroleum

Year	Thousand barrels	Value (thousands)	Year	Thousand barrels	Value (thousands)
1949–53 (average)	226, 527	$608, 634	1957 [1]	329, 896	$1, 094, 402
1954	246, 558	722, 370	1958 [2]	312, 070	1, 017, 562
1955	271, 010	793, 280	1902–58	4, 751, 767	10, 496, 186
1956	299, 421	877, 951			

[1] Revised figures.
[2] Preliminary figures.

TABLE 12.—Indicated demand, production, and stocks of crude petroleum by months, 1958 in thousand barrels

Month	Indicated demand	Production	Stocks (end of month)	Month	Indicated demand	Production	Stocks (end of month)
January	25, 778	26, 124	19, 590	September	27, 179	26, 723	15, 343
February	23, 234	23, 427	19, 783	October	27, 026	28, 126	16, 443
March	27, 372	25, 416	17, 827	November	27, 903	27, 506	16, 046
April	25, 004	24, 610	17, 433	December	28, 535	28, 716	16, 227
May	26, 490	25, 039	15, 982				
June	25, 762	24, 315	14, 535	Total:			
July	25, 306	25, 675	14, 904	1958	315, 087	312, 070	
August	25, 498	26, 393	15, 799	1957	329, 349	329, 896	

TABLE 13.—Number of producing oil wells and average production per well

Year	Number of producing wells as of Dec. 31	Average production per well per day (42-gallon barrels)	Year	Number of producing wells as of Dec. 31	Average production per well per day (42-gallon barrels)
1949–53 (average)	12, 550	50. 9	1956	20, 905	41. 0
1954	15, 980	44. 6	1957	21, 945	42. 2
1955	18, 800	42. 7	1958	23, 070	38. 0

alkylation unit and a new two-stage distillation unit and revamping a catalytic cracking unit to increase its capacity 13,000 barrels daily.

American Oil Co. abandoned its 44-year-old Destrehan refinery near New Orleans for economic and technological reasons.

Petrochemicals.—The continuing rapid growth of the chemical and petrochemical industries constituted an important economic development. Petrochemical plants being built and contracts signed for new plants and expansions of existing plants assured continued growth for several years.

Old standby processors, such as Esso Standard Oil Co. and Ethyl Corp., were expanding their plants. Newcomers, such as Dow Chemical Co., Wyandotte Chemical Corp. and W. R. Grace & Co.—to mention only three—were building new chemical plants. The advantages to chemical manufacturers are abundant supplies of natural gas, petroleum, sulfur, salt and cheap river water for processing needs, and low-cost transportation upriver to inland markets and downriver to the Gulf of Mexico and world markets.

Liberal 10-year tax exemptions ($75.5 million for chemical and petrochemical plants during 1958), under Louisiana policy provided

TABLE 14.—Production of crude petroleum, by districts and fields, in thousand barrels

District and field	1957	1958 [1]	District and field	1957	1958 [1]
Gulf Coast:			Gulf Coast—Continued		
Anse la Butte	2,065	1,656	North Crowley	1,107	924
Avery Island	3,240	2,580	Paradis	2,625	2,286
Bateman Lake	2,120	2,191	Phoenix Lake	1,228	1,042
Barataria	1,023	800	Pine Prairie	826	692
Bay de Chene	1,794	1,600	Point-a-La Hache	1,884	915
Bay Marchand	3,791	4,684	Port Barre	763	680
Bay St. Elaine	3,376	3,338	Quarentine Bay	3,536	2,765
Bayou Blue	1,133	913	Romere Pass	3,488	2,638
Bayou Choctaw	1,204	1,131	St. Gabriel	731	597
Bayou Mallett	823	829	Section 28	1,336	1,101
Bayou Sale	2,712	2,297	Shuteston	905	979
Bully Camp	1,582	1,236	South Pass	9,301	10,359
Caillou Island	11,298	11,260	Tepetate	1,580	1,418
Charenton	1,391	1,228	Timbalier Bay	8,600	8,562
Cox Bay	2,303	1,565	University	822	508
Delta Farms	4,010	3,285	Valentine	1,688	2,302
Dog Lake	887	755	Venice	5,514	4,317
Duck Lake	2,477	2,282	Ville Platte	996	794
East White Lake	1,463	1,111	Vinton	2,061	1,756
Egan	2,263	1,839	Weeks Island	8,602	6,871
Erath	1,310	1,365	West Bay	4,016	3,705
Garden Island	1,429	1,373	West Cote Blanche	2,022	2,989
Gibson	910	809	West Lake Verrett	1,333	1,259
Golden Meadows	3,032	2,649	White Castle	966	842
Good Hope	1,058	859	Other Gulf Coast	97,011	100,780
Grand Bay	4,113	3,178	Total Gulf Coast	283,769	270,537
Gueydan	961	800			
Hackberry	6,903	5,914	Northern:		
Horseshoe Bayou	807	722	Big Creek	587	476
Iberia	814	785	Caddo	7,305	7,066
Iowa	2,006	1,743	Cotton Valley	945	771
Jeanerette	1,271	1,147	Delhi	6,411	4,931
Jennings	1,247	1,301	Esperance Point	1,621	1,415
Lafitte	3,058	2,670	Haynesville	2,695	3,213
Lake Arthur South	1,024	1,077	Lake St. John	2,258	2,072
Lake Barre	2,066	2,577	Nebo [2]	1,746	1,468
Lake Chicot	954	721	Olle [3]	1,432	1,432
Lake Fausse Point	1,750	1,499	Rodessa	710	597
Lake Pelto	2,951	3,102	Sligo	1,340	1,277
Lake Salvador	1,641	1,635	Urania	765	766
Lake Washington	11,089	9,682	Other Northern	18,312	16,049
La Rose	1,009	1,021	Total Northern	46,127	41,533
Leeville	4,033	3,711			
Little Lake	2,453	2,096	Total Louisiana	329,896	312,070
Lockport	920	768			
Main Pass	11,064	9,672			

[1] Preliminary figures.
[2] Includes Hemphill, Trout Creek, and Jens.
[3] Includes Little Creek and Summerville.

TABLE 15.—Crude runs to stills, in Louisiana refineries, in thousand barrels

Month	1957	1958	Month	1957	1958
January	21,891	18,559	August	20,337	20,412
February	19,149	16,794	September	18,411	19,980
March	20,608	18,654	October	19,117	20,956
April	19,860	17,599	November	18,546	20,483
May	20,138	18,613	December	18,645	20,710
June	19,539	18,461	Total	236,962	230,886
July	20,721	19,665			

additional incentive. Thus new plant facilities may enjoy a 10-year tax moratorium.

Petroleum Chemicals, Inc., and Calcasieu Chemical Corp., a petrochemical plant complex at Lake Charles, were designed for full processing of refinery byproduct streams that come from nearby parent-

company refineries and serve as primary feeds. In turn, each of the major chemical plants in the complex has its own byproduct streams, which are interchanged between plants. The complex consists of Petroleum Chemicals, Inc. (PCI) (owned jointly by Cities Service Oil Co. and Continental Oil Co.), and Calcasieu Chemical Corp. (CCC) (operated by Petroleum Chemicals, Inc., and owned by Continental Oil Co., Cities Service Oil Co., Mineral Industries, Inc., and Sears, Roebuck & Co.).

Petroleum Chemicals, Inc., completed its $13 million ammonia plant at Lake Charles. The new anhydrous ammonia plant, with a capacity of 100,000 short tons a year, went on stream in the spring of 1958. The air-separation, nitrogen-scrubbing, and ammonia-synthesis sections are operated from one control room. The plant was designed to make pure hydrogen from any combination of feed streams from (1) hydroformer gas (from Cities Service refinery), (2) platformer gas (from Continental refinery), and (3) butadiene absorber gas (from PCI butadiene plant).

Petroleum Chemicals, Inc., put its new ethylene plant at Lake Charles, Calcasieu Parish, on stream in September and made the first shipment of ethylene glycol. The plant was designed to produce 60 million pounds of ethylene oxide or 8 million gallons of ethylene glycol a year.[5]

W. R. Grace & Co., Polymer Chemicals Division, started its new $20-million plant at Baton Rouge in 1957 and began shipping the product Grex, a high-density polyethlylene plastic with outstanding strength and versatility, in the first quarter of 1958. The raw material used was high-purity ethylene from the nearby Esso refineries.

Ethyl Corp. completed a vinyl chloride plant at Baton Rouge. Vinyl chloride monomer is used to produce polyvinyl chloride plastic, which, in turn, is used in manufacturing upholstery materials, pipe, electric wire and cable insulation, floor covering, and many other products.

Shell Chemical Corp., subsidiary of the Shell Oil Co., awarded contracts totaling $1 million for construction of glycerine-production facilities at Norco. The plant will make about 35 million pounds of glycerine a year plus substantial quantities of acrolein. The cost of this phase of the program, scheduled for completion late in 1959, was estimated at over $10 million.

Wyandotte Chemicals Corp.'s new Geismar works, south of Baton Rouge, began operating in July. A multimillion-dollar ethylene oxide plant with an annual capacity of 60 million pounds was completed. Wyandotte used a new process for direct oxidation of ethylene to ethylene oxide. Still under construction at the Geismar works was a large chlorine caustic manufacturing plant with an anticipated daily capacity of 300 tons of chlorine and 330 tons of caustic. An explosion and fire at the company plant on November 25 hospitalized four persons and injured several others. The blast and resulting fire, believed to have broken out in the kerosine section of the plant, damaged about one-third of the plant. Reconstruction started immediately and was scheduled for completion during the spring of 1959.

[5] Oil and Gas Journal, vol. 57, No. 10, pp. 91–109.

NONMETALS

Barite.—Milwhite Mud Sales Co., a subsidiary of Mississippi River Fuel Corp., completed and placed in operation a new plant in New Orleans for processing foreign crude barite ore and for distributing all finished products from this strategic location.

Production and shipments of ground barite continued to increase. Most of the crude barite was imported. Three grinding plants were at New Orleans and one at Lake Charles.

Cement.—Production and consumption of cement increased. The effects of the Federal highway program reached the cement industry for the first time. Demands for cement by the highway program and other scheduled construction programs were expected to expand over the next few years. Ideal Cement Co. completed a cement terminal at Lake Charles on May 27. Lone Star Cement Co. completed a new wet-process cement plant, equipped with two 11-foot 3-inch-diameter by 400-foot-long kilns, during 1957. The company announced plans to install facilities to bulk-load cement trucks. This addition to the plant was scheduled for completion in June 1959.

Clays.—There was an 18-percent gain in the production and use of clays. Clays were used in manufacturing cement, lightweight aggregate, and heavy clay products, in the order of quantity. Structural clay products were manufactured from local clays at 12 brick plants in 12 parishes. Lightweight aggregate was produced at plants at Erwinville and Alexandria. Raw clay was mined for cement at plants at Baton Rouge, New Orleans, and Lake Charles. Bentonite, mined only in Lincoln Parish, was used for filtering and decolorizing mineral and vegetable oils.

Big Rivers Industries, Inc., near Erwinville now has two rotary kilns, each 8 by 165 feet. Construction had started on a third rotary kiln of the same size. Caddo Clay Products, Inc., at Morringsport,

Table 16.—Shipments of finished portland cement to Louisiana from mills

Year	Louisiana (thousand barrels)	Change, percentage		Year	Louisiana (thousand barrels)	Change, percentage	
		In Louisiana	In United States			In Louisiana	In United States
1949–53 (average)	5,090	+8.2	+5.4	1956	[1] 8,507	+16.0	+6.0
1954	6,292	+9.2	+5.7	1957	[1] 7,585	−11.0	−6.0
1955	7,340	+16.7	+6.4	1958	[2] 8,043	+6.0	+6.6

[1] Revised figure.
[2] Preliminary figure.

TABLE 17.—Miscellaneous clays sold or used by producers[1]

Year	Thousand short tons	Value (thousands)	Year	Thousand short tons	Value (thousands)
1949–53 (average)	380	$432	1956	785	$785
1954	714	941	1957	642	642
1955	651	659	1958	755	755

[1] Excludes bentonite.

Caddo Parish, completed a major rehabilitation of its plant during the year. Caddo Light Aggregate Co., Inc., a subsidiary of Bayou State Oil Corp., was building a lightweight aggregate plant northwest of Shreveport and will use clay as the raw material.

Gypsum.—Anderson & Dunham, Inc., in Winn Parish, produced crude gypsum used as aggregate for road construction and as a retarder in portland cement. Gypsum products for the building industry were made from imported crude gypsum at Westwego and New Orleans. Bestwall Gypsum Co. leased land on the recently dredged Mississippi River-Gulf Outlet near the Industrial Canal and announced plans to construct a new plant.

Salt.—Eight mines operated and produced brines, rock salt, and evaporated salt, in order of importance. Production of rock and evaporated salt increased for the third successive year; production of brines declined slightly. Production was concentrated in the vicinity of Weeks, Avery, and Jefferson Island on the Coastal Waterway and at Winnfield in Winn Parish. Brines were used by Olin Mathieson Chemical Corp. at Lake Charles for manufacturing soda ash; by Columbia-Southern Chemical Corp. for producing chlorine; and by the Solvay Process Division of Allied Chemical & Dye Corp. for soda ash, chlorine, and other chemicals.

Sand and Gravel.—A 20-percent gain in sand and gravel production resulted from increased construction. In fact, 1958 was the biggest year in Louisiana history for highway construction, and the major factor was the State's 700-mile share of the Federal Interstate System. At the end of 1958, the Louisiana State Highway Department had 20 interstate system projects under contract that totaled 57.5 miles in 11 parishes. Three projects were completed during the year. Bids totaling over $112 million were received during the year for new highway construction along the 15,000-mile, State-maintained highway system, of which about $50 million was for the Interstate Highway

TABLE 18.—Salt sold or used by producers

Year	Thousand short tons	Value (thousands)	Year	Thousand short tons	Value (thousands)
1949–53 (average)	2,532	$7,480	1956	3,704	$17,695
1954	3,089	11,101	1957	3,461	18,944
1955	3,563	15,407	1958	3,442	18,960

Table 19.—Production of salt, by types

Type	1956		1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
Evaporated salt	122	$1,995	128	$2,692	131	$2,959
Rock salt	1,294	8,516	1,335	9,802	1,349	9,729
Brine	2,288	7,185	1,998	6,450	1,962	6,272

network. The total ($45 million more than 1957) did not include such nonconstruction costs as expropriation and engineering surveys. New records in highway construction are expected in 1959, with an anticipated spending of $120 million, of which the Federal system will furnish about $75 million.

There were 64 sand and gravel operations in 25 parishes—17 more operations and 4 more parishes than in 1957.

Stone.—Twelve producers supplied over 5 million short tons of shell valued at over $9 million for concrete aggregate, highway construction, and other miscellaneous uses. Because the State lacks adequate supplies of stone, it relies on shell (oyster and clam) as a substitute. Shell, almost pure calcium carbonate, meets the highest chemical specifications and was used to produce cement, lime, and chemicals.

Flintkote Co. produced over 12,000 tons of artificially colored roofing granules at its New Orleans plant.

Sulfur.—Frasch-sulfur production and shipments were slightly below those in 1957. Toward the end of 1958 consumption increased over earlier months, but the gain was insufficient to bring the annual rate to the level achieved in 1957. Stocks of Frasch sulfur increased slightly. The effect of lower production rates for such major consuming industries as steel, rubber, rayon, and pulp was partly offset by the relatively good year in the phosphate-fertilizer industry and in segments of the chemical industry.

The quoted prices of sulfur during 1958 were $25 a long ton f.o.b. port and $23.50 f.o.b. mine—unchanged since the reduction of $3 a ton effective late in 1957.

Construction of new sulfur-producing facilities continued. Freeport Sulphur Co. continued its Lake Pelto development several miles from Grand Isle in shallow, partly protected water along the Gulf

TABLE 20.—Sand and gravel sold or used by producers, in thousands

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	5,298	$6,262	255	$97	5,553	$6,359
1954	7,641	9,593	269	94	7,910	9,687
1955	8,338	10,759	236	183	8,574	10,942
1956	14,820	18,555	254	85	15,074	18,640
1957	12,477	14,659	102	70	12,579	14,729
1958	14,610	16,982	451	137	15,061	17,119

TABLE 21.—Sulfur produced and shipped from Frasch mines, in thousands

Year	Production (long tons)	Shipments		Year	Production (long tons)	Shipments	
		Long tons	Value			Long tons	Value
1949–53 (average)	1,368	1,316	$28,915	1956	2,429	2,239	$59,330
1954	2,010	1,854	49,222	1957	2,125	2,156	52,690
1955	2,081	2,072	58,028	1958	2,055	2,028	47,651

coast. Freeport Sulphur Co. also was constructing facilities for the first offshore sulfur mine. The Grand Isle mine is in the Gulf of Mexico, approximately 7 miles off the coast of Grand Isle, Jefferson Parish. The water depth is about 50 feet. The deposit was discovered in 1949 by the Humble Oil & Refining Co. while drilling for oil and gas. Freeport acquired the sulfur rights from the Humble Co. on September 19, 1956. Offshore erection of the three platforms and about one-half mile of connecting bridges began in June 1958, drilling wells for sulfur production started in November, and production was expected in 1960. The depth of the Grand Isle ore body ranges from 1,800 to 2,500 feet. The sulfur-bearing limestone ranges in thickness from 220 to 425 feet; the average sulfur content is about 15 to 30 percent. Rock containing less than 5 percent sulfur is not classed as ore for offshore operations. The major units of the facilities are set on steel-pile-supported platforms raised 60 feet above the water and connected by a series of 200-foot-long bridges.

The heating-plant platform is 180 feet long by 175 feet wide. The plant was designed to deliver daily an average of 5 million gallons of sea water, heated to 325° F., which will be injected into the wells to melt the sulfur. The simultaneous operation or "steaming" of a number of wells is desirable; hence, wells are drilled and equipped in advance of their actual need for production to allow the capacity of the heating plant to be used efficiently. Each drilling and production platform measures 116 by 224 feet and has openings to drill from 36 surface locations on 11-foot centers. Each location, to be used about three times, will permit directional drilling of 108 wells from each platform. Thus, the wellheads can be concentrated in a small area while bottom-hole spacing will be about 175 feet. No more than 12 of these holes, however, will be used at any one time. Conventional light-duty oilfield drilling equipment with a 129-foot-high derrick was used.

The contract for a unique liquid-sulfur pipeline from the production platform to Grand Isle was awarded during 1958. The pipeline will be buried about 5 feet below the Gulf bottom and will consist of three concentric pipes: A 14-inch protective casing, a 7⅝-inch hot-water jacket line, and a 6-inch sulfur line. Liquid sulfur will be pumped through the 6-inch pipe, while hot water will be pumped through the annulus between the 6-inch and the 7⅝-inch pipes. The maximum daily capacity of the pipeline will be 4,500 long tons of sulfur. A 4½-inch pipe to return water to the mine and a 6⅝-inch fresh-water-to-mine pipe will be strapped to the 14-inch pipe.

At the shore end liquid sulfur will flow directly into insulated tank barges, towed 25 miles to Port Sulfur on the Mississippi River, and unloaded into storage tanks. Some of the sulfur will be transferred from tanks to vessels for liquid shipment to customers, but most of the sulfur will be pumped to vats, where it will be allowed to freeze.

A two-story, air-conditioned steel structure near the plant will house employees while at the mine. The building contains 60 double bedrooms, 30 bathrooms, 3 television rooms, a large recreation room, a kitchen, a cafeteria, a first-aid room, and offices. About 175 employees will be required to operate the mine and the transportation system. Of these, 150 will work at the mine, but only about half of them will be

stationed at the mine at any one period. Employees will work 5 consecutive 12-hour days while living at the mine, after which they will be away from camp for 5 days. The estimated cost of the project was $30 million, of which $8 million was the extra cost due to the site being offshore.[6]

METALS

Aluminum.—Ormet Corp., owned jointly by Olin Mathieson Chemical Corp. and Revere Copper & Brass, Inc., began producing alumina at its new $55 million plant at Burnside. The output will approximate 345,000 tons of alumina a year.

The Burnside Bulk Marine Terminal, built at a cost of $15 million, was opened for business in December. It was built by the Baton Rouge Port Commission on the Mississippi River 30 miles below Baton Rouge and was the largest publicly owned bulk marine terminal on the Gulf coast. The terminal was leased to Olin Mathieson Chemical Corp. by the Baton Rouge Port Commission. Although it was built next to Ormet's new alumina plant, the new facilities will handle a volume of cargo far in excess of Armet's requirements. About 700,000 tons a year of bauxite will be shipped direct to the Burnside Terminal from mines in Surinam. Processed alumina will be transported by barge up the Mississippi and Ohio River to the Ormets aluminum-reduction plant near Hannibal, Ohio.

Kaiser Aluminum & Chemical Corp. completed an $8 million caustic soda and chlorine plant during March at Gramercy, St. James Parish.

At full capacity, the facilities can produce 114 tons of caustic soda and 100 tons of chlorine a day. The caustic soda will be used at the adjoining alumina works. Chlorine from the plant was purchased and marketed by Olin Mathieson Chemical Corp. under a long-term contract. Construction of the Kaiser alumina plant at Gramercy was continued.

Early in 1958 Kaiser shut down one potline at its Chalmette plant; during July the potline was reactivated and continued at full annual capacity of 247,500 tons. A $1.7 million improvement project was announced. The new improvements, which will boost the plant's billet-casting facility by 50 percent, will include two new furnaces and a casting pit; the installation of a second homogenizing furnace; and the installation of a new furnace and conveyor in the small pig and ingot section which will add 7½ million pounds a month to the section's casting capacity.

Nickel and Cobalt.—By December plant construction was well advanced at the Port Nickel Refinery, Freeport Nickel Co. (formerly Cuban American Nickel Co.). The new town of Port Nickel is on the east bank of the Mississippi River 15 miles below New Orleans. Louisiana was selected largely because about 1.5 billion cubic feet of natural gas a year will be used. Construction at the company Cuban operations was not affected materially by political unrest. Both plants were scheduled for completion during the summer of 1959.

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[6] Lee, C. O., Bartlett, Z. W., and Feierabend, R. H., The Grand Isle Mine, Freeport Sulphur Co.'s Offshore Venture: AIME Preprint 59H97, 13 pp.

A ship was converted to transport liquid sulfur and liquefied petroleum gas to Cuba for metallurgical processes and to return carrying slurry concentrate from Cuba to the Port Nickel refinery. The sulfide slurry from Cuba will contain, by dry weight, approximately 55 percent nickel, 35 percent sulfur, and 5 percent cobalt, plus traces of iron, copper, chromium, zinc, lead, and aluminum. This slurry will be approximately 65 percent solids and 35 percent liquid. Nickel and cobalt will be the principal refinery products. The slurry will be pumped from the ship to wooden tanks that have storage capacity for 1 month of continuous operation at full capacity.

Anhydrous ammonia and sulfuric acid, used in the process, will be purchased. A hydrogen sulfide generator, using liquid sulfur and hydrogen gas, will produce hydrogen sulfide gas for the scavenging units. A hydrogen generator using steam and natural gas will produce hydrogen that will be compressed to 1,200 pounds a square inch and be used in the metal reductions. Three steam boilers will each produce 60,000 pounds of steam per hour at 417° F. and 285 pounds pressure for use in nickel and cobalt reduction and evaporator-crystallizers. Four 2,000 hp. air compressors will compress 19 million cubic feet of air daily to 800 pounds pressure for use in sulfide oxidation. About 475 gallons a minute of treated boiler feed water and 9,000 gallons a minute of raw, clarified, cooling water will be used.

The sulfide slurry concentrate in storage will be mixed into a uniform suspension and pumped into the sulfide oxidation autoclaves. These are spherical pressure vessels to be operated at high temperature and pressure, wherein the concentrate will be dissolved by treating with high-pressure air and sulfuric acid. Because the liquor is highly corrosive, all pipes and valves in this unit are made of titanium. The liquor will contain about 5 percent nickel and 0.5 percent cobalt. One group of contaminants (iron, aluminum, and chromium) will be removed by treatment with ammonia and by filtration in pressure filters. A second group of contaminants (copper, lead, and zinc) will be removed by treatment with hydrogen sulfide and filtered. The filter cakes will be stored for sale. The purified solution will be preheated to reduction temperatures and stored, hot, in elevated "hold spheres." From here the solution will be drawn in batches as needed into nickel-reduction autoclaves. Metallic nickel will be precipitated in the autoclaves by reduction of the solution at 350° to 400° F. with hydrogen gas. During reduction ammonia will be added to neutralize the sulfuric acid formed, maintaining the pH between 2.0 and 2.5. The nickel powder will be blown from the autoclave, separated from the associated solution, washed, and dried. As most of the nickel will be sold in briquet form, the metal powder will be fed through roll-type briquetting presses. The pressed briquets will be sintered under a controlled atmosphere, cooled, and weighed into drums for storage and shipment.

About 5 percent of the nickel in the feed liquor will remain in solution and must be separated from cobalt. By evaporating the solution, both nickel and cobalt will be crystallized out as "double salt"—$NiSo_4 \cdot (NH_4)_2SO_4$; $CoSo_4 \cdot (NH_4)_2SO_4$; $ZnSO_4 \cdot (NH_4)_2SO_4$. These crystals will be separated and redissolved in very strong ammonia. Cobalt will be oxidized to a soluble complex salt by treatment with

high-pressure air and will remain dissolved while the nickel is completely separated as a mixed salt containing nickel. This will be removed from the cobalt solution by centrifuge.

The purified cobalt solution will be treated with hydrogen gas to precipitate cobalt metal similar to the nickel reduction. Washing, drying, and briquetting the cobalt will parallel the handling of nickel.

The residual solution from crystallizing "double salt" and the liquor after cobalt reduction will contain high concentrations of ammonium sulfate and small amounts of residual metals. To recover ammonium sulfate, the solutions will be combined, treated with hydrogen sulfide to precipitate the metals, and filtered. The solution will be evaporated to crystallize the ammonuim sulfate, which is dried and screened to yield a product that meets fertilizer-grade specifications.

At normal capacity the plant will produce annually 50 million pounds of nickel, 4.4 million pounds of cobalt, and 91,000 tons of ammonium sulfate. Metal losses will be only a few tenths of 1 percent.

REVIEW BY PARISHES

Minerals were produced in all but two of the State's 64 parishes. Gases and liquid hydrocarbons were produced in 57 parishes; other minerals in 38 parishes. In terms of value of production, however, mineral production was concentrated along the Gulf coast as over 60 percent of the value was from the nine Gulf coast parishes. Three parishes reported mineral production valued at over $100 million and five parishes between $50 and $100 million.

Acadia.—Petroleum and natural gas exploration continued. Runnels Gas Product Corp. had completed the Eunice gasoline plant in 1957 and as a result the 1958 production of natural-gas liquids nearly doubled and the parish became second in the State in the value of natural-gas liquids produced.

Ascension.—The Burnside Bulk Marine Terminal was completed, and Ormet Corp. began producing alumina from imported bauxite at its new Burnside plant. Kaiser Aluminum & Chemical Corp. completed a new caustic soda and chlorine plant in March. The caustic soda will be used in the Kaiser alumina plant and the chlorine marketed by Olin Mathieson Chemical Corp. Construction of Kaiser Aluminum & Chemical Corp.'s new alumina plant continued. Ten-year State tax exemptions were granted to Wyandotte Chemical Corp. on $24.7 million capital investment to construct facilities to manufacture ethylene oxide and electrolytic chlorine caustic soda. Petroleum and natural gas were produced in the parish during the year.

Avoyelles.—Columbian Carbon Co. was expanding and modernizing its furnace-type carbon plant at Eola.

Beauregard.—A State tax exemption of $677,701 was granted H. L. Hunt to construct a new plant for recovering propane, butane, and natural gasoline. Exploratory drilling in the parish resulted in discovery of the Alligator Lake oilfield and the South Bear Head Creek gasfield.

Bossier.—The parish ranked sixth in the production of natural-gas liquids.

TABLE 22.—Value of mineral production in Louisiana, by parishes [1 2]

Parish	1957	1958	Average mining employment [3]	Minerals produced in 1958 in order of value
Acadia	$51,996,170	$53,566,184	655	Petroleum, natural gas, natural-gas liquids.
Allen	8,771,790	8,585,478	117	Petroleum, natural gas.
Ascension	809,960	788,250	114	Do.
Assumption	10,367,220	14,235,662	54	Do.
Avoyelles	3,186,100	2,290,052	63	Petroleum, natural-gas liquids, natural gas.
Beauregard	14,764,630	15,002,368	167	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Bienville	4,439,500	4,961,601	13	Natural gas, petroleum, clays.
Bossier	29,960,395	29,471,583	364	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Caddo	38,434,282	34,747,716	5,304	Petroleum, natural gas, natural-gas liquids, sand and gravel, clays.
Calcasieu	45,907,071	40,838,371	1,979	Petroleum, natural gas, salt, natural-gas liquids, cement, lime, sulfur.
Caldwell	321,145	283,284	4	Natural gas, petroleum.
Cameron	68,102,610	67,978,989	566	Petroleum, natural gas, salt, natural-gas liquids.
Catahoula	4,085,680	3,482,202	94	Petroleum, sand and gravel, natural gas.
Claiborne	26,826,155	26,843,109	585	Petroleum, natural gas, natural-gas liquids.
Concordia	16,915,775	14,829,239	297	Petroleum, natural gas, natural-gas liquids, sand and gravel.
De Soto	9,489,555	9,775,024	55	Natural gas, petroleum, natural-gas liquids.
East Baton Rouge	14,984,297	14,180,239	473	Cement, petroleum, natural-gas liquids, sand and gravel, natural gas, clays, stone.
East Feliciana	509,939	[4]	106	Sand and gravel.
Evangeline	12,693,242	11,431,505	253	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Franklin	3,240,015	2,471,044	53	Petroleum, natural gas.
Grant	630,235	930,412	27	Sand and gravel, petroleum, natural gas.
Iberia	69,937,361	58,866,683	2,184	Petroleum, salt, natural gas, clays, sand and gravel.
Iberville	26,777,417	23,427,244	219	Petroleum, natural gas, salt, sand and gravel.
Jackson	32,935	25,861	6	Natural gas.
Jefferson	41,818,265	45,750,189	4,197	Petroleum, natural gas, natural-gas liquids, shell.
Jefferson Davis	29,781,421	31,813,844	832	Petroleum, natural gas, sand and gravel, natural-gas liquids.
Lafayette	2,621,009	2,658,801	2,997	Petroleum, natural gas, clays.
Lafourche	133,821,625	129,371,671	1,976	Petroleum, natural gas, sulfur.
La Salle	17,346,196	15,195,479	453	Petroleum, natural gas.
Lincoln	19,970,460	20,067,631	202	Natural-gas liquids, natural gas, petroleum, bentonite, sand and gravel, clays.
Livingston	388,426	409,582	55	Petroleum, sand and gravel, natural gas.
Madison	1,654,150	1,271,904	11	Petroleum, natural gas.
Morehouse	1,525,875	1,309,505	39	Natural gas, petroleum.
Natchitoches	308,945	349,315	4	Petroleum, clays, natural gas.
Orleans	7,129,801	9,361,115	4,486	Cement, shell.
Ouachita	2,723,887	3,839,849	549	Natural gas, sand and gravel, petroleum, clays.
Plaquemines	[5] 320,581,367	298,667,683	3,129	Petroleum, sulfur, natural gas, natural-gas liquids.
Pointe Coupee	7,111,605	6,593,693	65	Petroleum, natural gas, natural-gas liquids, clays, sand and gravel.
Rapides	2,599,034	3,230,924	185	Sand and gravel, petroleum, clays, natural gas.
Red River	605,750	883,008	28	Petroleum, natural gas, sand and gravel.
Richland	21,181,910	16,028,665	200	Petroleum, natural-gas liquids, natural gas.
Sabine	618,810	600,453	54	Petroleum, natural gas.
St. Bernard	188,345	321,734	5	Do.
St. Charles	26,712,285	25,312,204	236	Petroleum, natural-gas liquids, natural gas.
St. Helena	[4]	535,852	16	Sand and gravel.
St. James	4,971,710	4,024,589	42	Petroleum, natural gas.
St. John the Baptist	159,595	567,178	3	Do.
St. Landry	32,081,715	34,025,788	1,235	Petroleum, natural-gas liquids, natural gas.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Louisiana, by parishes [1] [2]—Continued

Parish	1957	1958	Average mining employment [3]	Minerals produced in 1958 in order of value
St. Martin	$43,896,239	$39,594,340	374	Petroleum, natural gas, salt, natural-gas liquids.
St. Mary	79,762,980	79,294,537	2,179	Petroleum, natural gas, shell, natural-gas liquids.
St. Tammany	690,522	852,408	35	Sand and gravel, natural gas, petroleum, clays.
Tangipahoa	713,262	974,102	126	Sand and gravel, clays.
Tensas	10,644,830	10,474,185	42	Petroleum, natural gas, natural-gas liquids.
Terrebonne [5]	119,929,995	122,019,197	2,609	Petroleum, natural gas, sulfur, natural-gas liquids, shell.
Union	7,303,405	6,728,198	99	Natural gas, petroleum, sand an gravel.
Vermilion	48,645,005	54,806,483	704	Petroleum, natural gas, natural-gas liquids.
Vernon	119,567	----------	1	
Washington	943,510	1,691,242	62	Sand and gravel, natural gas, petroleum.
Webster	36,763,480	33,214,796	418	Petroleum, natural-gas liquids, natural gas, sand and gravel.
West Baton Rouge	950,280	967,761	25	Petroleum, natural gas.
West Carroll	499,050	371,319	1	Natural gas.
West Feliciana	940,954	(4)	15	Sand and gravel.
Winn	2,157,196	1,950,364	116	Salt, gypsum, petroleum, natural gas.
Undistributed	24,476,733	73,927,183	3,288	
Total [6]	[7] 1,517,523,000	1,517,415,000	44,845	

[1] East Carroll Parish not listed because no production was reported.
[2] Value of petroleum, natural gas, and natural-gas liquids by parishes based on data from Louisiana Department of Conservation, Annual Oil and Gas Report, 1958.
[3] Average of first three quarters; fourth quarter data not available.
[4] Figure withheld to avoid disclosing individual company confidential data; value included with "Undistributed."
[5] Terrebonne Parish shipments of sulfur included with Plaquemines Parish.
[6] Total has been adjusted to avoid duplicating value of clays and stone.
[7] Revised figure.

Caddo.—Caddo Clay Products Co. (formerly Arklatex Face Brick Co.) completed modernization of its plant near Morringsport and manufactured brick from clays mined locally. Caddo Light Aggregate Co., Inc., a subsidiary of Bayou State Oil Corp., was building a lightweight aggregate plant northwest of Shreveport. The parish ranked first in total number of oil and gas wells drilled. Ten-year State tax exemptions were granted in Caddo Parish during 1958 to the following companies:

Company:	*Capital investment*	*Purpose*
Southwestern Gas Electric Co.[1]	$10,700,000	Steam generating—electricity.
Do.[1]	12,000,000	Do.
Universal Oil Products Co.[1]	1,254,000	Synthetic catalyst.
Air Reduction Co., Inc.[1]	183,661	Oxygen and nitrogen.
Bayou States Oil Corp.[2]	233,600	Lightweight aggregate.
Caddo Pine Island Corp.[1]	264,767	Gasoline-extraction plant.

[1] Additions to existing plant.
[2] New plant.

Calcasieu.—The Lake Charles industrial complex, comprising about a dozen large plants, was one of the most important in the State. It was built to facilitate production and processing of crude petroleum, natural gas, salt, natural-gas liquids, cement, lime, sulfur, and clays.

To keep pace with these mineral industries, the Gulf States Utilities Co. 2-million-kw. electric generating station near West Lake was nearing completion at yearend. Its first unit was scheduled for completion in February and the second during the summer of 1959.

Petroleum Chemicals, Inc., completed construction of a $13 million anhydrous ammonia plant with a capacity of 100,000 short tons a year. In September the company also put on stream a new ethylene plant designed to produce 60 million pounds a year of ethylene oxide or 8 million gallons a year of ethylene glycol.

Ten-year State tax exemptions in Calcasieu Parish were granted during 1958 to the following companies:

Company:	*Capital investment*	*Purpose*
Gulf States Utilities Co.[1]	$18, 620, 000	Steam generating—electricity.
Olin Mathieson Chem. Corp.[1]	338, 918	Hydrazine.
Cities Service Refining Corp.[2]	4, 188, 100	Crude-oil refinery.

[1] New plant.
[2] Additions to existing plant.

Cameron.—Natural gas production and value increased 16 and 18 percent, respectively. Exploratory drilling led to the discoveries of Calcasieu Lake oilfield onshore, and West Cameron, Block 67, gasfield offshore. A 10-year State tax exemption on $5 million was granted the Superior Oil Co. for constructing an absorption-type gas-processing plant at Lake Arthur.

East Baton Rouge.—One of the State's largest industrial complexes is centered in the Baton Rouge area. Kaiser Aluminum & Chemical Corp. processed Jamaica bauxite into alumina at its North Baton Rouge plant. Polymer Chemicals Division of W. R. Grace & Co. completed constructing a new $20 million plant to produce Grex, a high-density polyethylene plastic. Ethyl Corp. completed constructing a vinyl chloride plant. Clays were mined by Acme Brick Co. for manufacturing brick. Ideal Cement Co. produced general-use, high-early-strength, and masonry cements from oystershell barged up the Mississippi River. Consolidated Chemical Industries recovered byproduct sulfur in liquid purification of gas by the Claus process. Allied Chemical & Dye Corp. announced plans to enlarge its plant at a cost of over one-half million dollars to make anhydrous hydrofluoric acid.

A 10-year State tax exemption was granted to each of the following: Ethyl Corp. at Baton Rouge, $6.5 million to construct production facilities for antiknock compounds and chemicals; and Esso Standard Oil Co. at Baton Rouge, $2.3 million to construct facilities for a butyl rubber, butyl cement, and chloro butyl polymer.

Iberia.—This parish ranked sixth in value of mineral production, and over one-third of the salt production came from three large mines.

Ten-year State tax exemptions were granted to two companies as follows: International Salt Co., Inc., Avery Island, $873,246 for plant construction to produce high-quality, low-calcium evaporated salt; and Morton Chemical Co., Weeks, $1.4 million to construct a plant for manufacturing clay absorbents.

Iberville.—Industrial expansion continued. Ten-year State tax exemptions were allowed as follows: Dow Chemical Co., Plaquemine, $11

million for plant construction to produce caustic soda perchloroethylene, trichloroethylene, etc.; Gulf States Utilities Co., Willow Glen, $22.3 million for constructing a new electric-generating plant.

Jefferson.—The parish ranked fifth in crude petroleum production. Production of 12.9 million barrels of crude petroleum gained 10 percent, and production of 25.8 billion cubic feet of natural gas gained 9 percent over 1957.

Freeport Sulphur Co. was constructing facilities for the Grand Isle sulfur mine—the first offshore mine. Erection of three platforms in 50 feet of water, connected with a half-mile bridge, was begun 7 miles offshore in June. Drilling wells for sulfur production was begun in November. The project was scheduled for completion in 1960.

Ten-year State tax exemptions were granted Gulf Natural Gas Corp. for a natural gasoline processing plant at Pine Island.

Lafourche.—The parish ranked second in the total value of minerals produced, second in crude oil produced, and fifth in natural gas produced. Exploratory drilling resulted in discovery of Melodia and Roux gasfield onshore and South Timbalier, Block 131, oilfield offshore. Freeport Sulphur Co. recovered Frasch sulfur at its Chacahoula mine.

Lincoln.—The parish ranked third in the State as a producer of natural-gas liquids. Filtrol Corp. mined bentonite clay to be used for filtering and bleaching. Building and face brick were manufactured by Ruston Brick Works from locally mined clays.

Orleans.—Cement and shell were produced in the parish. Most of the barite ground in the State was from imported ores and was processed in Orleans Parish by three companies. Crude perlite from the Western States was used by Alatex Construction Service, Inc., to manufacture expanded perlite. The finished material is used in acoustic plasters and concrete aggregate. National Gypsum Co. secured a 10-year State tax exemption on $313,050 for additions to its asbestos cement plant at New Orleans.

Ouachita.—Production of crude petroleum, sand and gravel, and natural gas increased during the year. A 10-year State tax exemption was granted to Thermatomic Carbon Co. on $390,300 for additions to its carbon black plant at Sterlington.

Plaquemines.—Plaquemines Parish, situated in the Mississippi River Delta, has large onshore and offshore reserves of petroleum and natural gas. Its total mineral production ($299 million) was highest in the State; also, its crude petroleum was first and natural gas fourth. Marketed production of 147 billion cubic feet of natural gas was a 13-percent gain over 1957. Geophysical and core-drill prospecting were active throughout the year. Exploratory drilling resulted in the discovery of Adams Bay and Nairn oilfields and Dimond gasfield, all three onshore.

Rapides.—Clays was mined for producing lightweight aggregate by Louisiana Lightweight Aggregate Co. and for structural clay products by Acme Brick Co. Six commercial sand and gravel producers (one more than in 1957) operated in the parish during 1958. Paving gravel also was produced by contract for the National Forest Service. Two oilfields—Kolin and South Catahoula Lake—were discovered.

St. Bernard.—Production of crude petroleum declined; natural gas increased from 103 million cubic feet in 1957 to 1,317 million cubic feet in 1958, as a result of pipeline connections with new gasfields.

Texas Natural Gasoline Corp. and Tennessee Gas Transmission Co. received a 10-year State tax exemption on $11.6 million for new pipeline construction and a natural-gas liquids-extraction plant. Ingram Products Co. secured a State tax exemption on $1.8 million for expansion of its petroleum products facilities.

St. James.—Kaiser Aluminum & Chemical Corp. completed a new $8-million caustic soda and chlorine plant. The caustic soda will be used in the production of alumina and the chlorine sold. Construction of the company Gramercy alumina plant was continued. Production of both crude petroleum and natural gas declined.

St. Mary.—The parish ranked fourth in the State in value of minerals and fourth in petroleum production. Exploratory drilling led to the discovery of East Lake Sand gasfield onshore; Eugene Island, Block 198, gasfield and Eugene Island, Block 208, oilfield offshore. Four companies dredged shell, which was sold for concrete aggregate and road material. A 10-year State tax exemption on $425,000 was granted to Laminar Corp. to construct an oystershell-pulverizing plant.

St. Tammany.—Production of petroleum and natural gas increased 20 and 16 percent, respectively, over 1957. Mississippi Valley Silica Co., Jahncke Service, Inc., and Kivett & Reel, Inc., produced blast and molding sand and also paving sand and gravel. Two companies mined miscellaneous clay for the manufacture of structural clay products and brick.

A 10-year State tax exemption on $457,566 was granted the Commercial Gas Processing Co. to construct a plant to recover liquefied gases and to stabilize distillates at St. Joseph.

Terrebonne.—The parish ranked second in natural gas production, third in total value of minerals, and third in oil production in the State. Freeport Sulfur Co. recovered sulfur by the Frasch method at the Bay Ste. Elaine dome near Houma. At the Lake Pelto sulfur deposit, in shallow protected water on the Gulf, the company continued preparing the mining plant and drilled several additional wells. The facilities were expected to be ready for production in 1960.

Vermilion.—The parish ranked third in value of natural gas and fifth in natural-gas liquids in the State. Production of crude petroleum and natural gas gained 18 percent and 16 percent, respectively, from 1957. Exploratory drilling was quite successful as five gasfields and one oilfield were discovered onshore, and two gasfields were discovered offshore. All were gaged to have a high potential for producing natural gas and petroleum.

Webster.—The parish ranked first in the value of natural-gas liquids recovered. It produced 4.5 million barrels of crude petroleum, 54.6 billion cubic feet of natural gas, and over 802,000 short tons of sand and gravel.

The Mineral Industry of Maine

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Maine.

By Robert W. Metcalf[1] and Mary E. Otte[2]

GEOLOGIC and aeromagnetic exploration was continued in Maine by Federal, State, and private organizations during 1958. Among minerals investigated were copper, lead, zinc, nickel, cobalt, lithium minerals, and pegmatite minerals, including beryl. The increased exploration stemmed from the August 1957 State law permitting long-term leases for mineral development instead of annual renewals. In 2 weeks of January, more mining licenses were issued than in all of 1957.

Legislation and Governent Programs.—The General Services Administration (GSA) purchased beryl and mica for the strategic materials stockpile. All the beryl was purchased through the GSA purchase depot at Franklin, N.H.; mica was purchased through depots at Franklin, N.H., Spruce Pine, N.C., and Custer, S.Dak. A DMEA contract of $71,000 was negotiated to continue exploration of possible nickel-cobalt deposits in Knox, Lincoln, and Waldo Counties.

Trends and Developments.—Indicative of the industrial growth of the Portland region was the erection and operation of a $20-million, oil-burning, steam powerplant on Cousin's Island, near Yarmouth. The one generator, operating at the beginning of 1958, carried a 44,000-kw. rating with a capacity of 50,000 kw. A second generator was installed before the end of the year, and a new pier for tankers also was built.

In central Maine, at Lincoln, Penobscot County, a new $11-million, bleached-kraft pulpmill, owned by Eastern Corp., began operations and will consume sizable quantities of sodium sulfate in the manufacture of high-luster sulfate pulp. The 175 ton-per-day plant replaced a 100 ton-per-day sulfite pulpmill.

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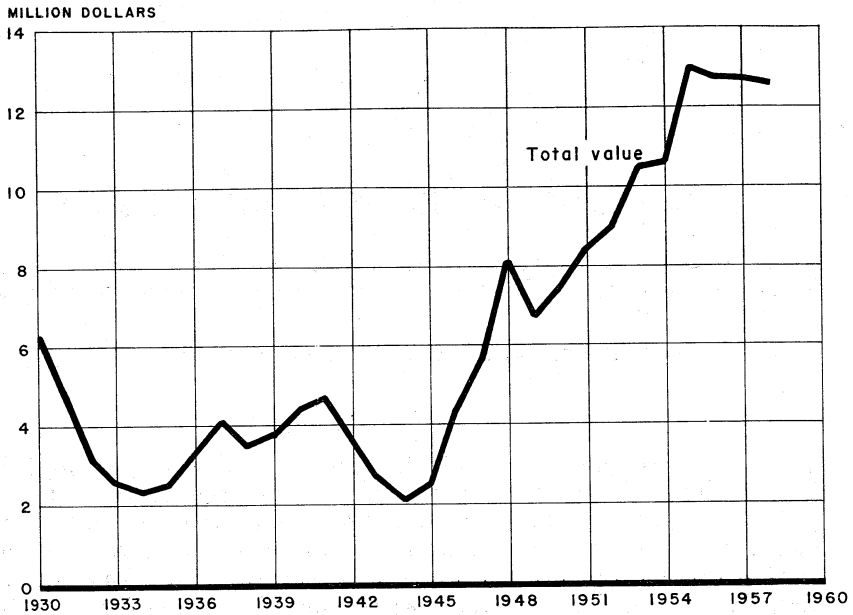

FIGURE 1.—Total value of mineral production in Maine, 1930–58.

TABLE 1.—Mineral production in Maine [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Beryllium concentrates----------gross weight	4	$2	(2)	(2)
Clays	29,924	28	23,270	$26
Feldspar----------long tons	14,330	92	13,034	83
Gem stones	(3)	1	(3)	5
Mica:				
Scrap	6	(4)	104	3
Sheet----------pounds	25,453	202	20,097	278
Peat	3,770	175	(2)	(2)
Sand and gravel	8,036,756	3,099	8,941,521	3,746
Stone	889,491	3,076	[5] 880,371	[5] 2,760
Value of items that cannot be disclosed: Cement (masonry and portland), lime, slate (1957), and value indicated by footnote 2	----------	6,617	----------	6,363
Total Maine [6]	----------	12,711	----------	12,574

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Weight not recorded.
[4] Less than $1,000.
[5] Beginning with 1958 slate included with stone.
[6] Total has been adjusted to eliminate duplicating the value of stone.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Cement was the chief mineral product in Maine, in terms of value. Production of portland cement rose 3 percent in quantity and 4 percent in value over 1957. Average value per barrel also rose from $3.36 in 1957 to $3.40 in 1958, following a 5-percent wage increase on May 1. Dragon Cement Co., Division of American-Marietta Co., the only producer, operated its 2-million-barrel wet-process plant at Thomaston, Knox County, throughout the year. General-use, moderate-heat, and some high-early-strength cement were produced. Masonry-cement output was slightly less than in 1957. Both types of cement were distributed to New England States.

Clays.—Clay production consisted of miscellaneous or common clay consumed solely in manufacturing heavy clay products, mostly structural brick. Nine clay pits operated in five counties, as follows: Androscoggin, two; Cumberland, four; and Franklin, Kennebec, and Penobscot, one each. Androscoggin led Maine counties in output of clay, followed by Cumberland and Penobscot. The chief producers were Morin Brick Co., Androscoggin County, and Lachance Bros. Brick Co., Cumberland County.

Feldspar.—Output of crude feldspar declined to the lowest level since 1945. The drop was due primarily to a slackened demand from soap and abrasives manufacturers and to decreased ceramic demand. The average value per ton in 1958 also was less than in 1957 ($6.33 compared with $6.41). Recorded production came from Oxford and Sagadahoc Counties.

Sales of ground feldspar also declined. Two mills sold ground feldspar—one at West Paris (Oxford County) and one at Topsham (Sagadahoc County). Another plant at Topsham crushed feldspathic rock for sale as poultry grit. Both Topsham plants purchased all their feldspar, whereas the West Paris operator ground both purchased and company-mined raw material. Most of the ground feldspar was consumed for ceramic uses (electrical porcelain, tile, pottery, etc.) and for soaps and abrasives.

Gem Stones.—Mineral specimens and gem-quality stones collected in Maine included cancrinite, nephelite, sodalite, agate, zircon, rose quartz, tourmaline, and beryl. Some came from Kennebec County, although the majority was collected from scattered locations in Oxford County.

Lime.—Rockland-Rockport Lime Co., Inc., Rockland, Knox County, produced high-calcium quick and hydrated lime for paper manufacture and agricultural use. Output was somewhat less than in 1957, and lime-burning operations were discontinued in October. The old kilns, built nearly 50 years ago, proved unprofitable owing to high labor costs. If results of a core-drilling program scheduled for 1959 prove favorable, the company plans to erect a modern lime plant to supply chemical lime to the paper and tanning industries.

Mica.—The bulk of the mica output came from Oxford County with a small quantity from Sagadahoc County. Hand-cobbed and full-trim mica were sold through GSA's purchase depots at Franklin,

N.H., Spruce Pine, N.C., and Custer, S.Dak. Some punch and "other" mica were sold to industry, and a small quantity of scrap mica was purchased by a mica grinder.

Nitrogen Compounds.—Anhydrous ammonia continued to be produced at Searsport, Waldo County, for use in fertilizer.

Peat.—Peat for agricultural use was produced by one firm from bogs in Hancock County.

Sand and Gravel.—In response to the accelerated road and highway construction program, production of sand and gravel continued to expand. Output totaled nearly 9 million short tons valued at $3.75 million, record figures in both quantity and value and an increase of 11 and 21 percent, respectively, over 1957. Government-and-contractor tonnage rose 15 percent over 1957 and comprised 84 percent of the total sand and gravel tonnage, compared with 81 percent in 1957.

A moderate decrease in commercial sales of sand and gravel for building and paving was counterbalanced by its augmented use in road construction by the Maine State Highway Commission, by far the leading producer in Maine. The output of the agency was both by its own crews and under contract.

TABLE 2.—Sand and gravel sold or used by producers by classes of operations and uses

	1957		1958	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Structural	180,839	$132,265	233,023	$234,176
Paving	208,305	97,113	105,402	46,783
Filter	124	43	(1)	(1)
Other	(1)	(1)	70,593	26,646
Gravel:				
Building	250,052	277,151	236,447	261,736
Paving	557,526	426,738	536,097	336,403
Railroad ballast	(1)	(1)	38,790	11,978
Other	(1)	(1)	215,086	100,935
Undistributed [2]	327,700	162,440	1,160	1,502
Total	1,524,546	1,095,750	1,436,598	1,020,159
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Structural			3,940	1,684
Paving	419,466	134,430	469,689	164,262
Gravel:				
Structural	4,500	450	3,020	1,380
Paving	6,088,244	1,868,337	7,028,274	2,558,779
Total	6,512,210	2,003,217	7,504,923	2,726,105
Grand total	8,936,756	3,098,967	8,941,521	3,746,264

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes engine sand and values indicated by footnote 1.

Stone.—Output of stone was only 1 percent less than in 1957 and again totaled nearly 900,000 short tons valued at $2.76 million. The value, however, was 10 percent less than in 1957, owing chiefly to decreases in output of curbing and flagging, dressed architectural stone, and noncommercial granite (none of the last was reported in 1958). The tonnage and value of limestone rose somewhat, principally because of increased demand for use in cement. Twelve

commercial quarries were active in 10 counties: 5 for granite in 4 counties, 3 for limestone in 1 county, 2 for quartzite in 2 counties, and 1 each for basalt and slate in 2 counties. Two types of stone were quarried in two counties. Of the granite quarries, two produced both dimension and crushed stone and the other three dimension stone only.

Dimension stone included rubble, rough and dressed construction and architectural stone, monumental stone, curbing, and flagging. Crushed and broken quartzite and granite were used principally for road construction and as riprap; crushed basalt was used as roadstone; and crushed and broken limestone was used for agricultural purposes, making cement and lime, as riprap and roadstone, and in paper manufacture. Slate was mined in Piscataquis County and sold as electrical slate and flagging; production declined substantially compared with 1957. Government-and-contractor crushed or broken limestone was produced in three counties by the Maine State Highway Commission for use as riprap. The leading stone-producing counties, in order of quantity, were Knox, Cumberland, Washington, and Kennebec and, in order of value, Knox, Hancock, Cumberland, and York.

METALS

Beryllium.—Production of beryl (beryllium concentrate) decreased sharply. Output came from four mines in Oxford County, and the average grade was 11.5 percent. The entire production was sold through the GSA purchase depot at Franklin, N.H., for the critical materials stockpile.

REVIEW BY COUNTIES

Government-and-contractor sand and gravel, mostly for paving use, was produced in all counties of the State by the Maine State Highway Commission, both by its own crews and under contract. In addition, Acadia National Park (Hancock County), 11 towns or municipalities in Androscoggin County, and 1 each in Cumberland, Hancock, and Penobscot Counties produced sand and gravel for their own use in road and street maintenance. Limestone riprap also was produced in Aroostook, Cumberland, and Somerset Counties by the Maine State Highway Commission for its own use.

Androscoggin.—Ten producers reported sand and gravel output, including prepared building and paving sand, engine sand, and prepared and bank-run gravel for paving and fill. The chief producers were Leeds Sand & Gravel Co. (Leeds Junction), C. A. Peterson Co. (Auburn), and Lewiston Crushed Stone Co., Inc. (Lewiston). Two producers mined clay for making brick.

Aroostook.—Sand and gravel was mined commercially by two producers—one near Presque Isle and the other near Houlton. Prepared and bank-run sand and bank-run gravel were used for building and paving.

Cumberland.—Seven commercial sand and gravel producers were active, mostly near Cumberland, Portland, and Scarborough. Prepared building sand, prepared and bank-run structural and paving gravel, and fill gravel comprised most of the output. The chief producer was Cumberland Sand & Gravel Co., Inc. (Cumberland).

Quartzite, for use as concrete aggregate, roadstone, and riprap, was quarried at the Blue Rock quarry, Westbrook. Four operators mined miscellaneous or common clay for manufacturing brick.

TABLE 3.—Value of mineral production in Maine, by counties

County	1957	1958	Mineral produced in 1958 in order of value
Androscoggin	(1)	$539,225	Sand and gravel, clays.
Aroostook	$341,480	328,479	Sand and gravel, stone.
Cumberland	817,312	880,911	Sand and gravel, stone, clays.
Franklin	(1)	(1)	Sand and gravel, clays.
Hancock	(1)	(1)	Stone, sand and gravel, peat.
Kennebec	(1)	471,364	Sand and gravel, stone, clays, gem stones.
Knox	(1)	(1)	Cement, stone, lime, sand and gravel.
Lincoln	90,261	103,638	Sand and gravel.
Oxford	388,942	463,622	Mica, sand and gravel, feldspar, gem stones, beryl.
Penobscot	464,458	572,132	Sand and gravel, stone.
Piscataquis	(1)	(1)	Stone, sand and gravel.
Sagadahoc	(1)	90,903	Sand and gravel, feldspar, mica.
Somerset	227,235	187,955	Sand and gravel, stone.
Waldo	(1)	(1)	Do.
Washington	(1)	(1)	Do.
York	(1)	(1)	Do.
Undistributed	10,381,198	8,935,835	
Total	12,711,000	12,574,000	

1 Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Franklin.—Two commercial operators produced prepared building and paving sand and building gravel. Output of sand and gravel declined owing to a less active road-building program in the area. Joseph Bonsaint (West Farmington), formerly Farmington Brick Co., mined common or miscellaneous clay for making brick.

Hancock.—Joseph Musetti, Hall Quarry, produced irregular-shaped dimension granite for rough construction use. Deer Island Granite Corp., Stonington, quarried dimension granite for rough and dressed architectural, dressed construction, and monumental stone. The quarry had eight benches averaging 10 feet high and 50 feet wide. One commercial operator produced pit-run gravel at Bluehill for paving. Richland Peat Mines, Inc., recovered peat from bogs.

The Penobscot Mining Corp., Harborside, has spent over $200,000 in exploring the old Cape Rosier copper-zinc-silver property in Brooksville Township and plans to sink a new shaft in the spring of 1959 for quantity sampling.

Kennebec.—Four commercial producers of sand and gravel near Augusta, Gardiner, and Waterville sold prepared building sand and prepared and bank-run paving gravel and fill. Bridge Construction Corp., Augusta, produced quartzite for road construction. Kennebec Brick Co. (Sidney) produced common clay for brick manufacture. A small quantity of mineral specimens and some gem-quality material was collected near Litchfield.

Knox.—Dragon Cement Co., Division of American-Marietta Co., quarried and crushed limestone for use in manufacturing cement. General-use and moderate-heat cement and some high-early-strength portland cement were burned at the two-kiln plant at Thomaston. Masonry cement also was prepared and sold.

Hocking Granite Industries, Inc., Clark Island, produced and sold dimension granite principally for curbing and flagging, rubble, and

dressed architectural stone. The quarry was operated with a single face averaging 130 feet in height by drilling and blasting, channel cutting, and jet piercing. Rockland-Rockport Lime Co., Inc., Rockland, produced crushed high-calcium limestone for agricultural use, lime manufacture, papermaking, and riprap. The company also manufactured quick and hydrated lime, chiefly for paper manufacture, until October when production of lime was discontinued.

One commercial producer at Warren marketed bank-run and prepared sand for building and paving and bank-run gravel for building, paving, and fill.

Lincoln.—Unscreened commercial gravel for building, paving, and other uses was produced at Newcastle.

Oxford.—Most of the sheet mica mined in Oxford County was sold through the GSA (Franklin, N.H.) purchase depot; however, some mica was sold to industry and some through the Custer (S.Dak.) and Spruce Pine (N.C.) Government purchase depots. Sales of full-trim mica decreased 17 percent in quantity, although the value increased 14 percent because of better quality material and higher prices. A small quantity of scrap also was sold by six producers, principally to private industry. The chief producers of sheet mica in the county were Bernice and John Maderic (Wheeler mine near Gilead), B & L Mining Corp. (Wheeler mine near Gilead and Pechnik mine at Norway), and P. E. L. Mining Corp. (Pechnik mine at Norway and Wardell mine at Albany). Indicative of the greater interest in mining was the fact that 33 miners worked 18 mines in 1958 compared with 20 producers at 15 mines in 1957. Several miners worked the same mine at different times during the year.

All crude feldspar was mined from open pits. The chief producers were R. C. Benson (Conant, Forest, and Tamminen mines) and Bell Minerals Co. (Perham mine). Feldspar was ground by Bell Minerals Co. (West Paris) for ceramic use, including tile, electrical porcelain, sanitary ware, and pottery, and for soaps and abrasives. Unscreened building sand and paving gravel were produced near Mexico and Norway by two firms.

Beryllium concentrate (beryl) was sold to the GSA purchase depot at Franklin, N.H., by four miners: William Pechnik (Norway), George Wiley (Albany), Winfield Knight (North Waterford), and Elmer Daggett (Canton). Oxford County was the main source of gem stones and mineral specimens collected in Maine as a hobby by individuals, picked up by mineral dealers, and sold or traded to tourists as souvenirs or for making jewelry. Gem materials collected near Greenwood, Albany, Mount Newry, Black Mountain, and other locations in the county included agate, rose quartz, pink and black tourmaline, and beryl.

Penobscot.—Penobscot County ranked second in tonnage of sand and gravel produced and fourth in value of mineral output in the State. Seven commercial producers near Bangor, Stillwater, and Orono produced moderate tonnages of prepared and bank-run building and paving sand and gravel, railroad-ballast gravel, and bank-run sand and gravel for fill. Miscellaneous clay for use in brick manufacture was produced by Brooks Brick Co. (Brewer).

Aeromagnetic exploration in Penobscot County, by the Geological Survey of Maine, included areas east of Lincoln, near Atkinson, and from Frenchman's Bay to the Enfield-Charleston area. Similar reconnaissance in the southeastern part of the county revealed an iron-manganese ore body near Greenfield.

Piscataquis.—Portland-Monson Slate Co. produced electrical and flagging slate from three underground mines and processed the slate at its Monson mill. A drastic reduction in expansion and modernization of the steel industry curtailed demand for slate. Development of the mines consisted of nearly vertical shafts in the slate seam, with 200-foot lateral drifts at depths of 400 to 600 feet. The roof was slabbed down within approximately 50 feet of the surface, where mining was stopped owing to ground water and weathered slate. Commercial gravel for paving was produced near Abbot.

Sagadahoc.—Building and paving sand and gravel were produced near Bath and Topsham by three commercial operators.

Feldspar was mined in central Sagadahoc County by eight operators. The largest were Alex Cunningham (near Georgetown), White's Service (near Topsham), and James Russo (near Topsham). The Consolidated Feldspar Division, International Minerals & Chemical Corp., ground purchased feldspar at its Topsham mill for pottery, porcelain, and other ceramic uses and for abrasive soaps. Crushed feldspar for poultry grits was sold by Topsham Feldspar Co., Topsham. Most shipments of ground feldspar were destined to Middle Atlantic and North Eastern States. Some was exported.

Earl Williams and Willard Titcomb sold full-trim mica from the Trott Cove mine near Woodwich to the GSA Franklin (N.H.) purchase depot. Punch, waste, and other mica from the same mine was sold to industry.

Somerset.—Building and paving sand and gravel and gravel fill were sold from pits near Smithfield.

Waldo.—Prepared sand for use in concrete was mined by one firm. Dressed architectural granite was quarried by Grenci & Ellis, Inc., at its Mount Waldo quarry near Frankfort. Anhydrous ammonia was manufactured by Northern Chemical Industries, Searsport.

Washington.—A. P. Wyman, Inc., Cutler, produced crushed basalt for concrete and roadstone for use on Government projects. Bank-run gravel and prepared building and paving sand were mined by 2 producers near Machias and Whitneyville.

York.—The John Swenson Granite Co., Inc., produced dimension granite from its Swenson Pink quarry at Highpine for use as rough construction and dressed architectural stone. Crushed and broken granite also was sold for riprap and for concrete aggregate and roadstone. Six benches 10 feet high and 25 feet wide were quarried by drilling and splitting with wedges and half rounds. This firm also opened a new green-syenite quarry at Ogunquit and planned to market this "Swenson Green" dimension stone in 1959.

The Mineral Industry of Maryland

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Maryland Department of Geology, Mines, and Water Resources.

By James R. Kerr [1] and Mary E. Otte [2]

TOTAL VALUE of Maryland's mineral industries increased substantially in a year mostly characterized by a decline in business activity. The increase in Maryland's mineral production was chiefly due to greatly enlarged cement capacity in a new plant and remodeled facilities at an existing plant. However, increased output of coal, stone, lime, and talc and soapstone were also significant. Clay production for refractories was down, and decreased road-building activity and overall decreased private and public construction within the State combined to cause a poor year for the sand and gravel industry.

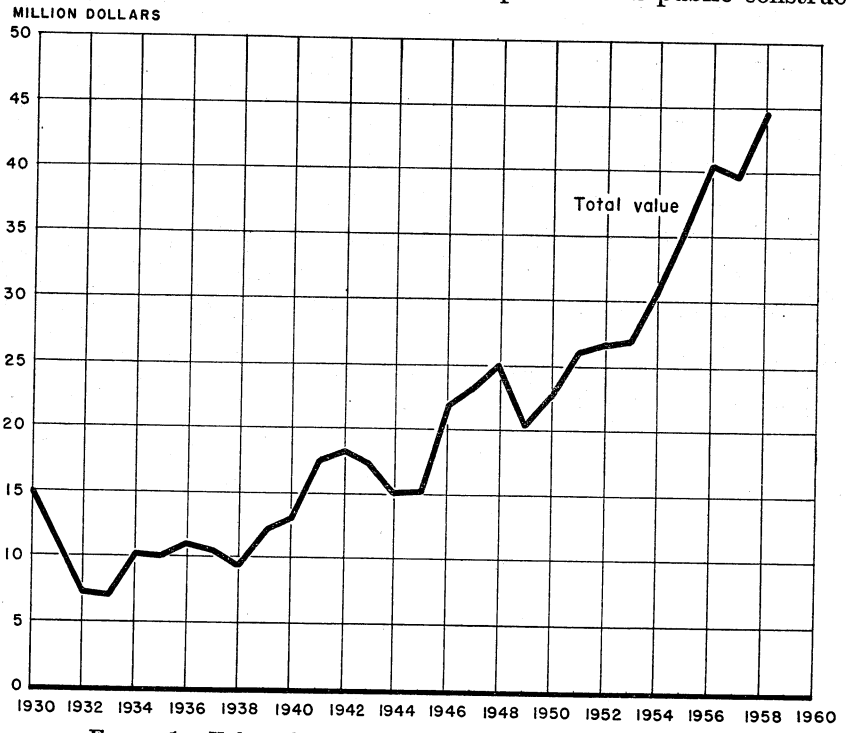

FIGURE 1.—Value of mineral production in Maryland, 1930–58.

Baltimore and Washington Counties ranked first and second in value of mineral products, followed by Carroll, Frederick, and Prince Georges.

[1] Commodity-industry analyst, Bureau of Mines, Region V, Pittsburgh, Pa.
[2] Statistical clerk, Bureau of Mines, Region V, Pittsburgh, Pa.

TABLE 1.—Mineral production in Maryland [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays [2]	631,305	$963	604,175	$815
Coal	748,298	3,082	837,738	3,161
Gem stones	(3)	(4)	(3)	2
Natural gas ---million cubic feet	4,649	1,218	4,266	1,148
Sand and gravel	8,679,389	11,594	7,864,415	10,312
Stone	6,139,932	13,392	6,721,414	14,387
Value of items that cannot be disclosed: Ball clay, beryllium concentrate (1957), portland and masonry cement, lime, greensand marl, mica (sheet) (1957), potassium salts, talc and soapstone, and values indicated by footnote 4	----------	10,664	----------	16,224
Total Maryland [5]	----------	[6] 39,625	----------	44,679

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producer).
[2] Excludes certain clays, value for which is included with "Items that cannot be disclosed."
[3] Weight not recorded.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Total adjusted to eliminate duplicating value of clays and stone.
[6] Revised figure.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Asbestos.—The Ruberoid Co., a major producer of asphalt and asbestos building materials, including roofing, took over assets and business of Funkhouser Co., Hagerstown, Md. The Funkhouser concern, a privately-held maker of mineral granules for surfacing asphalt shingles, will be operated as a division of Ruberoid Co. with headquarters at Hagerstown.[3]

Cement.—Combined shipments of portland and masonry cement increased more than 50 percent during the year. Greater cement burning capacity in the new $17 million Alpha Portland Cement Co. plant at Lime Kiln near Frederick and the first full year of operation of the new production facilities of Lehigh Portland Cement Co. at Union Bridge contributed to increased cement output. Production was at 60 percent of capacity for the year. Output consisted mainly of non-air-entrained, general use and moderate heat cement, but significant quantities of air-entrained and high-early-strength types also were produced. Power was mostly purchased, but at one plant a portion of power requirements was generated by the producer.

Shipments were primarily to the important and expanding markets of Baltimore, Md., and Washington, D.C. Significant quantities were also shipped to neighboring States of Virginia and Pennsylvania.

The increased capacity created more intense competition for markets, and more aggressive sales efforts were noted.

Clays.—Output of miscellaneous clay, which was used almost entirely for building brick and in the manufacture of cement, increased

[3] Wall Street Journal, vol. 152, No. 70, Oct. 8, 1958, p. 7.

slightly. Fire clay production however was down considerably because of a depressed refractory market, chiefly firebrick and block. Ball clay output for pottery and refractory uses was less, but tonnage for floor and wall tile manufacture increased.

Miscellaneous clay, the leading type produced in the State, was reported mined at 11 open pits; fire clay from 2 underground and 5 open pits; and ball clay from 1 open pit. Baltimore County was the leading producing area followed by Prince Georges and Washington Counties.

Gem Stones.—Specimens of williamsite, serpentine, siderite, quartz crystals, and antigorite were collected chiefly by hobbyists. Cecil County near Conowingo and Line Pits was the favorite collecting area. Considerably more data were received on gem stones because of wider canvass coverage.

Glass.—A new mile-long glass plant costing $34 million was dedicated by Pittsburgh Plate Glass Co. at Cumberland, Md. The new plant is on a 603-acre tract along the Potomac River, 6 miles below Cumberland. The new unit is geared to produce polished plate glass which is utilized principally by furniture and mirror manufacturers. The Maryland site was chosen because of its proximity to the furniture industries in the Southeast.

Although the plant is highly mechanized, employment is provided for 750 employees.[4]

Gypsum.—Crude imported gypsum was calcined at a plant near Baltimore to produce gypsum wallboard and lath and basecoat plasters.

Iron Oxide Pigments.—Finished natural and manufactured iron oxide pigments were produced at a plant near Muirkirk. The largest selling type of pigment was natural red iron oxide.

Lime.—The lime industry operated only at approximately 50 percent capacity. Output, which was centered in Frederick County, was used almost entirely for agricultural purposes and was consumed mostly within the State.

Marl, Greensand.—Continued production of greensand marl was reported by one producer for use as soil conditioner.

Mica.—No mine output of mica was reported.

Perlite (Expanded).—Crude perlite from New Mexico and Nevada was processed by two companies, one near Washington, D.C., and one near Baltimore, Md. The expanded product was used mostly as plaster and concrete aggregate plus significant tonnage for filter aid.

A ready market for perlite aggregate was noted as production increased more than 25 percent over 1957.

Potassium Salts.—Potassium sulfate was prepared from cement clinker as a byproduct of cement mill operations in Washington County. Output was at a rate slightly higher than 1957.

Sand and Gravel.—Production of sand and gravel declined for the second successive year. All major markets for the product were depressed, but the demand for paving material decreased most, with output of paving sand and gravel declining 13 and 25 percent respectively. Decreased output also was noted for structural uses,

[4] American Ceramic Society Bulletin, vol. 37, No. 8, August 1958, p. 383.

but production of glass and grinding sand and fill sand and gravel were greater than the previous year. A total of 58 commercial sand and gravel pits, operating an average of 230 days were reported active in 1958. Sixty-six percent of the total production was washed, screened or otherwise prepared. Prince Georges County was again the leading area for sand and gravel production followed by Baltimore, Anne Arundel, Harford, and Cecil Counties.

Output from Government-and-contractor operations, which was used entirely for paving purposes, was up 20 percent contrary to the decline in commercial production. Worcester, Montgomery, and Talbot Counties were the only source of Government-and-contractor production during the year.

TABLE 2.—Sand and gravel sold or used by producers, by uses

Use	1957		1958	
	Short tons	Value	Short tons	Value
Sand:				
Structural	2,032,641	$2,789,502	1,838,404	$2,345,341
Paving	2,504,826	3,175,393	2,200,759	2,728,531
Gravel:				
Structural	1,739,119	2,956,809	1,651,672	3,157,013
Paving	1,896,473	2,138,115	1,538,446	1,458,849
Undistributed [1]	506,330	534,097	635,134	622,118
Total [2]	8,679,389	11,593,916	7,864,415	10,311,852

[1] Includes glass, grinding and polishing, fire or furnace, engine (1958), filter, railroad ballast (1957), and other sands and gravel.
[2] Includes Government-and-contractor paving sand and gravel.

Stone.—Output of crushed limestone, the leading type of stone produced (comprising 85 percent of total stone) increased 9 percent, contributing most to the increased stone total. The bulk of crushed limestone output as in the past was used as concrete aggregate and roadstone and in the manufacture of cement and lime. Oystershell for poultry grit and agstone was produced at a slightly higher rate than 1957.

An increased market for basalt (traprock) for roadstone was noted as basalt production increased 18 percent. Crushed marble production almost doubled over that of the preceding year while output of dimension granite was less than half of 1957 tonnage. No production of crushed granite was reported. Crushed sandstone and miscellaneous stone were produced at a rate slightly less than the preceding year.

Baltimore County ranked first in stone production followed by Washington, Carroll, Frederick, and Allegany.

Talc and Soapstone.—Soapstone for asphalt filler and roofing material was mined at Marriottsville in Carroll County. Interplant shipments of crude soapstone were made from Marriottsville to the company grinding mill at Sykesville and from the company mine at Fairfield, Adams County, Pa., to Marriottsville for grinding. Talc was mined in Harford County near Dublin. A portion of output was crushed for general industrial applications and a portion sawed for use as ceramic material.

Total production of talc and soapstone increased over that of the previous year. Prices held steady despite slight wage increases,

and the market held firm with demand increasing slightly in certain categories.

Vermiculite, Exfoliated.—Vermiculite was exfoliated at a plant in Beaver Heights in Prince Georges County.

MINERAL FUELS

Coal.—Increased strip mining activity in Garrett County where production increased 31 percent caused an overall increase in coal production (12 percent) contrary to the overall national downward trend in coal production. Even underground production, which had been declining steadily, picked up slightly, due to increased deep mining activity in Garrett County. Recent years have seen a transition to increasing production from Garrett County and less from Allegany. Emphasizing this trend was the fact that total production decreased 15 percent in Allegany County while increasing 24 percent in Garrett County. An increasing proportion of total output was strip tonnage (59 percent) which due to relative economics could be sold at prices more attractive to consumers. In 1958 average price of strip coal was $3.13 a ton compared with $4.69 for underground.

Maryland strip mining was mostly contour stripping on the mountain sides with small (less than 3 cubic yard) gasoline and diesel shovels. Average depth reported for overburden excavated was 35 feet, ranging from 18 to 60 feet.

Maryland underground production was characterized by small hand-loading operations. Forty percent of underground production was hand loaded onto conveyors, the balance was hand loaded into mine cars. Eighty-one percent was undercut by machine; the balance was cut by hand; and 79 percent was power drilled. In addition, 50 percent was crushed.

Most of the coal produced was marketed locally for domestic purposes and power manufacture.

Coke and Coal Chemicals.—Bethlehem Steel Corp. produced 2,896,000 tons of coke at its Sparrows Point plant of 758 ovens, a decrease of 16 percent from 1957. Smaller coke output was explained by the curtailed operating rate of the steel plant. Associated coproducts yielded were coke breeze, 156,500 tons; coke oven gas, 44,900 million cubic feet, ammonium sulfate, 38,914 tons; tar, 38 million gallons; and crude light oil, 13.7 million gallons. Light-oil derivatives included benzene (8.4 million gallons), toluene (2.3 million gallons), and xylene (750,000 gallons). No production of solvent naptha was reported.

Natural Gas.—Production of natural gas continued from the Mountain Lake Park field and the Accident field in Garrett County.

METALS

Beryllium.—No mine output of beryl was reported.

Copper.—Kennecott Copper Corp. increased the planned monthly capacity of its electrolytic copper refinery from 7,000 tons to 16,500 tons. The plant, a $30 million project in Anne Arundel County near Baltimore, was expected to be in operation in 1959.[5]

[5] Mining World, vol. 20, No. 4, April 1958, p. 37.

Iron and Steel.—The capacity of Maryland's steel industry remained the same as 1957—8,382,000 tons capacity at three plants. Blast furnace capacity at Sparrows Point however increased to 5,480,000 tons from 5,316,000 tons in 1957.

Iron and Steel Scrap.—Scrap for open hearth and electric furnaces was collected and prepared mostly in the Baltimore area adjacent to the Sparrows Point plant. Main grades of scrap prepared were Nos. 1 and 2 heavy melting and No. 1 electric furnace bundles. Large tonnages of unprepared scrap also were reported.

REVIEW BY COUNTIES

Production of Government-and-contractor sand and gravel although increasing 20 percent was reported from only 3 counties compared with 5 in 1957 and 13 in 1956. The State Roads Commission reported production by contractors in Montgomery County. The county roads departments in Talbot and Worcester Counties reported production of paving material by their own crews.

Allegany.—Coal production as reported by 23 underground and 12 strip mines decreased 15 percent. Underground production dropped 14 percent, and strip dropped 16 percent. Significant producers not operating in 1958 were Queen Georges Creek Coal Co. and Savage Coal Co., both strip mines.

TABLE 3.—Value of mineral production in Maryland, by counties [1] [2]

County	1957	1958	Minerals produced in 1958 in order of value
Allegany	$2,791,680	$2,007,991	Coal, sand and gravel, stone, clays, gem stone.
Anne Arundel	1,095,844	1,226,381	Sand and gravel, clays.
Baltimore	10,289,027	10,525,737	Stone, sand and gravel, clays, gem stone.
Calvert	(3)	(3)	Greensand marl, sand and gravel.
Caroline	1,093		
Carroll	3,643,138	7,452,559	Cement, stone, soapstone, sand and gravel.
Cecil	1,134,441	946,246	Stone, sand and gravel, clays, gem stone.
Charles	170,963	49,645	Sand and gravel.
Dorchester	(3)	(3)	Sand and gravel, stone.
Frederick	(3)	(3)	Cement, lime, stone, clays, gem stone.
Garrett	3,597,635	3,670,763	Coal, natural gas, stone, sand and gravel.
Harford	1,090,105	1,341,736	Sand and gravel, stone, talc.
Howard	(3)	(3)	Sand and gravel.
Kent	(3)	(3)	Sand and gravel, clays.
Montgomery	(3)	148,757	Stone, sand and gravel.
Prince Georges	(3)	3,649,241	Sand and gravel, clays.
Queen Annes	(3)		
St. Marys	(3)	(3)	Sand and gravel.
Talbot	(3)	28,495	Sand and gravel, clays.
Washington	(3)	(3)	Cement, stone, clays, potassium salts.
Wicomico	(3)	(3)	Sand and gravel, clays.
Worcester		59,760	Sand and gravel.
Undistributed [4]	15,811,074	13,571,692	
Total	[5] 39,625,000	44,679,000	

[1] Somerset County is not listed because no production was reported.
[2] Excluded values of clays and stone used in the manufacture of lime and cement.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Includes values indicated by footnote 3 and sand and gravel and gem stone unspecified by counties.
[5] Revised figure.

Crushed limestone for use as concrete aggregate and roadstone was produced by Fry Coal & Stone Co. at quarries near Flintstone, Cumberland, and Corrigansville.

Sand and gravel production was slightly less than 1957. Cumberland Cement & Supply operated its quartzite No. 1 plant near Cumberland to produce glass sand, grinding and polishing sand,

and building sand. The River No. 3 plant on an island on the Potomac River at Cumberland was also operated by this company to produce building and paving sand and gravel.

Fire clay was mined at the underground operations of Big Savage Refractories, Division of Mexico Refractories Co., and Mt. Savage Refractories Co. The latter company also mined fire clay from an open pit. Output was used in the manufacture of firebrick and block.

A small quantity of gem stones, siderite and quartz crystals, was collected by hobbyists near Frostburg and McCoole.

Anne Arundel.—Value of sand and gravel production increased 12 percent. Production as reported from five producers in the area in and around Baltimore and Annapolis was all sand, chiefly for building and paving purposes plus fire and furnace sand.

A small tonnage of fire clay, mined near Glen Burnie, was sold for the manufacture of floor and wall tile and stoneware.

Baltimore and Baltimore City.—The value of mineral production increased 2 percent, and the county remained first ranking in mineral production in the State. Greater stone output offset decreased production of sand and gravel and clays.

Limestone was quarried near Texas and Pikesville and crushed for a wide variety of uses, chief among which were concrete aggregate and roadstone. Production of basalt trap was up considerably over 1957 attesting to use of basalt in road construction. Miscellaneous stone (serpentine) quarried near Riverton was also crushed for the road-building market. The closing of Harry T. Campbell's Sons Gwynn Falls quarry, which yielded considerable tonnages of dimension and crushed granite in 1957, brought about a sharp decrease in output of granite.

The sand and gravel industry, second ranking in the State, decreased during the year. Production from the area surrounding metropolitan Baltimore was reported by five producers for use entirely for structural and paving uses.

The county was the only source of ball clay in the State. In addition to the production of ball clay, which was mined near Baltimore and sold chiefly to floor and wall tile manufacturers, miscellaneous clay for building brick was mined at four open cuts near Baltimore. Excelsior Brick Co., which reported no clay production in 1956, reopened their clay pit in 1958.

Imported gypsum was calcined at a plant near Baltimore for manufacturing wallboard, lath, and base-coat plasters.

Crude perlite was expanded for use chiefly as lightweight plaster aggregate at a Baltimore plant.

The gem specimens, antigorite, siderite crystals, and smoky quartz were collected by hobbyists at the Patapsco River Valley.

Carroll.—Portland and masonry cement produced by Lehigh Portland Cement Co. at Union Bridge were the leading commodities. The company also produced limestone at a quarry near the cement plant and crushed output for feed to the kilns. Shipments were mainly intrastate although significant shipments were made to the neighboring State of Virginia and to the District of Columbia.

Soapstone was mined at an open pit near Marriottsville by the Liberty Stone Co. Output was ground at a plant near the mine at Marriottsville and another company plant at Sykesville and sold for use as roofing material, asphalt filler and foundry facings.

Cecil.—Harbison-Walker Refractories Co. produced crushed quartzite near North East for manufacturing silica brick. Port Deposit Quarries Co. quarried dimension granite for rough construction and rough architectural and for rubble.

Sand and gravel production decreased 21 percent, as in 1957 when all major markets for sand and gravel were depressed except paving sand which increased 68 percent. The major portion of sand and gravel production was from near waterways, Chesapeake Bay, and the Susquehanna and Elk Rivers. Mason-Dixon Sand & Gravel Co. was the leader of eight producers.

Fire clay for manufacturing firebrick and block was mined at two open cuts near North East.

The gem materials, williamsite, serpentine, and cave onyx were collected by hobbyists near Conowingo, Line Pits, and the Susquehanna River.

Charles.—Sand for paving and structural gravel were produced at a stationary plant near La Plata.

Dorchester.—Structural and paving sand, structural gravel and fill sand, and gravel were produced by J. Edwin Rosser, Inc., at a stationary plant near Federalsburg.

Oystershell was crushed for poultry grit and agstone at Cambridge by J. M. Clayton.

Frederick.—Alpha Portland Cement Co. opened a 1.3-million-barrel annual capacity plant at Lime Kiln in April. Using the wet process, two 400- x 11.3-foot rotary kilns operated producing air-entrained and non-air-entrained general and high-early-strength cements. Output was consumed mostly in Maryland, Washington, D.C., Virginia, West Virginia, and Pennsylvania.

Limestone was produced at five locations for use chiefly as concrete aggregate and roadstone and as a raw material for the manufacture of cement and lime. Frederick County was the only lime producing area. Three producers burned lime mostly for the agricultural market. Schetrompf Lime Company did not operate.

Miscellaneous clay was mined near Frederick for manufacturing building brick.

The gem stone cave onyx was collected at Cavetown.

Garrett.—Strip and underground coal mining increased 15 percent and 31 percent respectively. One more underground and three more strip mines were reported active. Significant strip tonnage in Maryland by the Buffalo Coal Co., which had operated just across the State line in Grant County, W. Va., the previous year, contributed much to the increased strip output. Other significant new or reopened mines were Casey Contracting Co., a strip mine, and Drappleman Bros. Coal Co., an underground mine.

Vetter Bros., Inc., operated the Fry & Browning limestone quarries near Oakland and Deep Creek Lake to produce crushed limestone principally for roadwork.

Sand for structural and paving uses was produced at two stationary plants near Oakland.

Harford.—Increased output and increased value a ton for structural and paving gravel and for structural sand created an increase of 40 percent in valuation of sand and gravel output in the county. Production was reported from 11 operations—7 stationary, 3 portable, and 1 dredge. Output was mostly from the areas near Aberdeen, Abington, and Joppa.

Thomas B. Gatch & Sons continued to quarry basalt trap near Churchville, for roadstone. Maryland Green Marble Co. operated a quarry near Cardiff to produce cut and sawed stone for building interiors and crushed marble for terrazzo.

Talc was mined near Dublin by Harford Talc & Quartz Co., for use in a wide variety of industrial applications.

Howard.—Paving sand was produced near Laurel. No production of mica or beryl was reported.

Kent.—The Kent Concrete Co., Inc., continued a dredge operation on the Chester River near Chestertown and produced building and paving sand and gravel.

The Chestertown Brick Co. mined miscellaneous clay near Chestertown for manufacturing building brick.

Montgomery.—Albert D. Battista quarried dimension granite for rough and dressed construction uses, and Stoneyhurst Quarries quarried mica schist near Bethesda for rough and dressed construction and for rubble and flagging.

Prince Georges.—Although production of sand and gravel decreased 17 percent, the county remained in first place among the State's 19 sand and gravel producing counties. Demand for sand and gravel decreased, most notably paving sand and gravel, and structural sand. Structural gravel output was slightly higher than the preceding year. Of the 10 sand and gravel plants, 6 were stationary, 3 portable, and 1 was a dredge. Operations surrounded the District of Columbia.

Miscellaneous clay and fire clay were produced at Muirkirk and Laurel and miscellaneous clay near Washington, D.C. Fire clay was used in foundries and steel works and miscellaneous clay mostly for building brick.

Perlite was expanded at a plant near Washington, D.C., for use chiefly as lightweight plaster aggregate.

Crude vermiculite was processed at a plant near Beaver Heights.

Sales of finished iron oxide pigments, chiefly natural red iron oxide, were reported by Mineral Pigments Corp. at Muirkirk.

St. Marys.—Sand and gravel for structural and paving uses plus filter sand and other gravel was produced at Leonardtown and Hollywood.

Talbot.—Miscellaneous clay was mined at an open cut near Easton for manufacturing building brick. Production was up considerably over the previous year.

Washington.—The county continued to rank second among the State's mineral producing counties owing chiefly to mineral output by the North American Cement Corp. The major portion of county mineral value was derived from the company's Security cement plant near Hagerstown and a limestone quarry nearby. Potassium salt was obtained as a byproduct of the cement operation.

A limestone quarry was operated at Williamsport by Fry Coal & Stone Co. to produce crushed stone for concrete aggregate and roadstone, rock dust for coal mines, and stone sand.

Miscellaneous clay was mined at an open cut near Williamsport for manufacturing building brick and for use as a filter in fertilizers.

Williamsite and cave onyx were reported collected by gem stone hobbyists.

Wicomico.—Paving sand and structural gravel were produced near Hebron.

Miscellaneous clay was mined near Salisbury for manufacturing building brick.

The Mineral Industry of Massachusetts

By Robert W. Metcalf [1] and James R. Kerr [1]

THE VALUE of Massachusetts mineral output in 1958 dropped slightly, but it remained the third highest on record, only 5 percent below the peak year, 1956. Chiefly furnishing this decrease was the decline in value of sales of dimension stone. Tonnage of crushed and broken stone also declined. Middlesex County led in value of mineral production, followed in order by Berkshire, Norfolk, and Essex.

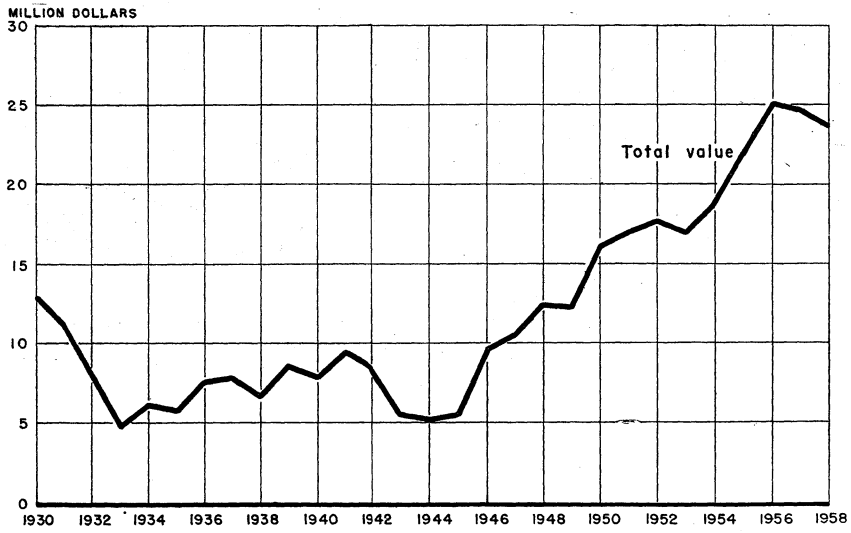

FIGURE 1.—Total value of mineral production in Massachusetts, 1930–58.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

526514—59——30

TABLE 1.—Mineral production in Massachusetts [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Clays	77,577	$98	84,999	$111
Lime	137,284	2,233	139,062	2,121
Peat	600	(2)	1,014	(2)
Sand and gravel	9,899,626	9,691	10,619,801	10,035
Stone	4,876,707	13,165	4,649,067	12,354
Value of items that cannot be disclosed: Mineral fuels and nonmetals		6		9
Total Massachusetts [3]		24,789		23,887

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Total adjusted to eliminate duplicating value of stone.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Production of clay was 10 percent greater than in 1957. As in 1957, four firms mined miscellaneous clay at five places for heavy clay products, chiefly building brick. Plymouth County replaced Hampden County as the leading clay producer; Bristol County remained third.

Gypsum.—Gypsum from Nova Scotia was calcined at Charlestown, Suffolk County, and used to make gypsum products.

Lime.—The value of lime production decreased slightly from the high of 1957 although the quantity increased to the largest tonnage since 1951. The average value per ton also was less than in 1957. Both quick and hydrated lime were produced from high-purity limestone and dolomite. Berkshire was the only producing county. Nearly 70 percent of the quantity was chemical and industrial lime; building and agricultural limes also were produced.

TABLE 2.—Lime (quick and hydrated) sold by producers

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	131,624	$1,855,386	1956	134,248	$2,093,195
1954	127,836	1,709,341	1957	137,284	2,232,731
1955	134,952	1,957,346	1958	139,062	2,120,677

Nitrogen Compounds.—A new plant of the Air Reduction Co., Inc., at South Acton, Middlesex County, began operating to recover nitrogen, oxygen, and argon from air for industrial purposes.

Perlite.—Crude perlite from western States was expanded at Roslindale, Suffolk County. The expanded material was marketed chiefly for building plaster and concrete aggregate. Production did not change substantially, although the average price per unit rose appreciably.

Roofing Granules.—Natural and colored roofing granules were produced at a Norwood mill (East Walpole). Stone used was obtained from three quarries in Norfolk and Suffolk Counties. Production increased as a result of more building activity in late 1958.

Sand and Gravel.—Commercial sand and gravel demand remained steady, despite less residential and nonresidential building. More building sand was produced; less paving sand and gravel was sold than in 1957. Output of commercial paving gravel declined. Building sand and gravel comprised 52 percent of the commercial output and 59 percent of the value. The average value of commercial sand and gravel rose slightly. Government-and-contractor sand and gravel more than doubled in 1958, reflecting a continuing active road-building program.

The leading sand and gravel producing counties were Middlesex, Hampden, Worcester, Norfolk, and Bristol.

TABLE 3.—Sand and gravel sold or used by producers by classes of operations and uses

Use	1957		1958	
	Short tons	Value	Short tons	Value
Commercial operations:				
Sand:				
Molding	(1)	(1)	79,529	$252,776
Structural	2,214,379	$2,384,931	2,529,194	2,558,564
Paving	1,491,244	1,290,255	1,392,715	1,193,985
Blast, fire, and furnace	2,773	4,023	(1)	(1)
Other	438,137	244,953	665,245	339,720
Gravel:				
Structural	1,962,566	2,664,927	2,012,194	2,781,126
Paving	2,134,886	1,699,801	1,393,660	1,505,647
Railroad ballast	39,253	14,334	13,500	5,000
Other	749,545	509,551	948,595	496,760
Undistributed [2]	117,678	306,791	17,679	67,959
Total	9,150,461	9,119,566	9,052,311	9,201,537
Government-and-contractor operations:				
Sand:				
Paving	137,977	32,676	630,951	313,776
Gravel:				
Paving	611,188	539,346	936,539	519,315
Total	749,165	572,022	1,567,490	833,091
Grand total	9,899,626	9,691,588	10,619,801	10,034,628

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes filter sand, ground sand, and uses indicated by footnote 1.

Stone.—Reflecting general decrease in business activity, stone output dropped 5 percent in quantity and 6 percent in value compared with 1957. Types of stone produced were basalt, traprock, granite, limestone, sandstone, and miscellaneous stone.

Dimension stone marketed comprised mostly granite and a small quantity of sandstone. Quantities for all uses were smaller than in 1957. Granite curbing stone supplied the bulk of the volume and the highest total value, although dressed construction, architectural, and monumental stone each represented substantial values. Granite dimension stone was also marketed for rubble, paving blocks, and rough construction, architectural and monumental stone.

The output of crushed and broken stone decreased chiefly because of road and building construction and also because of lessened demand for agricultural limestone, flux, and railroad ballast. Output of riprap more than doubled, owing largely to increased heavy engineering construction that included flood and beach-control projects. Sales of crushed and broken stone comprised 68 percent of basalt and 17 percent granite, compared with 59 and 29 percent, respectively, in 1957. Sizable quantities of crushed and broken limestone also were produced in Berkshire County.

Stone was quarried by 27 producers at 33 commercial quarries: Basalt by 13 firms at 15 quarries, granite by 10 firms at 11 quarries, limestone by 4 firms at 4 quarries, sandstone by 1 firm at 1 quarry, and miscellaneous stone by 1 firm at 2 quarries (1 firm produced both basalt and limestone and another both basalt and granite). Dimension stone was quarried mostly in Middlesex County, and crushed and broken stone in Essex, Norfolk, Middlesex, Suffolk, and Berkshire Counties.

TABLE 4.—Stone sold or used by producers, by uses

	1957		1958	
	Short tons	Value	Short tons	Value
Dimension stone (approximate quantities)	128,083	$4,759,969	119,113	$3,790,374
Crushed and broken stone:				
Concrete aggregate and roadstone	3,839,677	6,408,360	3,435,213	5,686,478
Agricultural (limestone)	175,729	545,054	117,528	351,529
Other uses	448,827	1,045,182	624,416	2,041,210
Undistributed [1]	284,391	406,560	352,797	484,245
Total crushed and broken stone	4,748,624	8,405,156	4,529,954	8,563,462
Grand total (approximate quantities)	4,876,707	13,165,125	4,649,067	12,353,836

[1] Includes riprap, railroad ballast, furnace flux, and limestone for lime.

Vermiculite.—Exfoliated vermiculite was marketed by two companies in Middlesex County. Sales increased due to augumented construction, particularly in the last half of the year. Union of South Africa and domestic vermiculite both were exfoliated.

MINERAL FUELS

Coke.—The only coke ovens in New England were at Everett, Middlesex County. Production declined substantially.

Peat.—Production of peat was limited to humus from bogs near Lawrence, Essex County.

METALS

Steel.—Open hearth steel operations by United States Steel Corp. at Worcester, Worcester County, were discontinued on July 1.

Tantalum.—A plant began producing tantalum metal powder at Cambridge, Middlesex County.

Titanium.—Pilot plant studies of an electrolytic process for making high-purity titanium metal were continued at Malden, Middlesex County.

REVIEW BY COUNTIES

The Commonwealth of Massachusetts, Department of Public Works, produced basalt for riprap in Barnstable and Plymouth Counties and for concrete aggregate and roadstone in Suffolk County. Government-and-contractor crews produced sand and gravel mostly for road construction and maintenance; this commodity was also produced under contract by the Department of Public Works in Barnstable, Dukes, Franklin, Hampden, Hampshire, Nantucket, Plymouth, and Worcester Counties. Several towns and municipalities mined paving sand and gravel in Berkshire, Bristol, Essex, Hampden, Norfolk, and Worcester Counties. Sand and gravel also was mined under contract near Enfield, Hartford County, Conn.

TABLE 5.—Value of mineral production, by counties

County	1957	1958	Minerals produced in 1958 in order of value
Barnstable	$199,721	(1)	Sand and gravel, stone.
Berkshire	3,795,517	$3,680,418	Lime, stone, sand and gravel.
Bristol	1,637,293	1,508,815	Sand and gravel, stone, clays.
Dukes	(1)	(1)	Sand and gravel.
Essex	2,820,047	2,453,029	Stone, sand and gravel, peat.
Franklin	(1)	(1)	Stone, sand and gravel.
Hampden	(1)	(1)	Sand and gravel, stone, clays.
Hampshire	(1)	(1)	Sand and gravel, stone.
Middlesex	(1)	6,972,570	Stone, sand and gravel.
Nantucket	2,172	(1)	Sand and gravel.
Norfolk	(1)	(1)	Stone, sand and gravel.
Plymouth	695,192	(1)	Sand and gravel, stone, clays.
Suffolk	985,837	790,150	Stone, sand and gravel.
Worcester	(1)	(1)	Sand and gravel, stone.
Undistributed [2]	14,653,362	8,481,586	
Total	24,789,141	23,886,568	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes values indicated by footnote 1.

Barnstable.—Sand for use in construction, fill, and concrete masonry building units was produced at Falmouth. Whitehead Bros. Co. excavated and prepared molding sand from a pit near Provincetown. Riprap (granite) was produced near Falmouth.

Berkshire.—New England Lime Co. (Adams), United States Gypsum Co. (Farnams), and Lee Lime Corp. (Lee) quarried limestone and manufactured quick and hydrated lime at nearby kilns. The 3 companies operated 3 rotary and 15 shaft kilns, and 2 continuous hydrators, using bituminous coal, natural and producer gas, and fuel oil for fuel. Chemical, and other industrial, building (finishing and mason's), and agricultural lime was sold and shipped mostly within New England and to neighboring States. The foregoing companies and John S. Lane & Son (West Stockbridge) also quarried and crushed limestone for use as flagstone, roadstone, flux, whiting, and for other purposes. Otis Chester Granite Co. quarried monumental granite.

Sand and gravel was produced at 15 pits. The total quantity and value increased, but some producers reported decreased demand. Among the leading producers, the Berkshire Gravel, Inc., plants at Lee and Pittsfield sold sand and gravel for use in construction.

Road material was produced and processed in stationary plants by Twentieth Century Concrete Works (Stockbridge) and Klein and Gebrowski (Adams). General Sand and Stone Corp. (Dalton) processed material for use in concrete for highway construction and as mason's sand; the company enlarged its crushing facilities. Industrial sand was produced by grinding quartz mined near Chesire.

Bristol.—Production of sand and gravel was slightly less than in 1957; 12 companies were active. The leading producers were Joseph Borge & Sons, Inc. (Swansea), Morse Sand & Gravel Co. (Attleboro), Victor Medieros (South Dartmouth), and Tri-City Concrete Co., Inc. (Raynham). The quantity of sand and gravel consumed in highway construction was about equal to that used in ready-mix concrete for building and concrete blocks.

Stiles & Hart Brick Co. mined miscellaneous clay from an open pit near Taunton for manufacturing into building brick at its own kilns. Warren Bros. Roads Co., quarried and crushed granite for use as roadstone and riprap.

Dukes.—Colby Construction Co. produced sand and gravel for use as building and paving material from a pit at Oak Bluffs.

Essex.—Lynn Sand & Stone Co. (Swampscott) quarried traprock (basalt) for use as roadstone, railroad ballast, riprap, poultry grits, and mineral filler. Essex Sand & Gravel Co. (Peabody) and Trimount Bituminous Products Co. also quarried traprock for roadstone. Most of the Trimount output was used in bituminous concrete, largely for public roads. According to one producer, prices remained about the same as in 1957, although wages were raised about 10 percent. Dimension granite for rubble and rough construction was quarried by Karl A. Persson at Rockport.

Decreased requirements for highway construction largely supplied the 37-percent drop in sand and gravel production as compared with 1957. Output was reported by eight companies. The Arthur L. Hoffman pit, sold during the year, remained idle. Principal producers were Essex Sand & Gravel Co., Inc. (Andover), Miles River Sand & Gravel Co., (Ipswich), Videtta Corp. (W. Peabody), and Yemma Bros., Inc. (Groveland). More sand and gravel was used in building than in highway construction; Yemma Bros., Inc., was again the leading producer. Sand and gravel for use in highway construction was supplied by eight contractors.

Andover Sand & Gravel, Inc., Lawrence (in 1957, the Massachusetts Peat Humus Co.), produced peat humus from bogs near Lawrence, for soil conditioning.

Franklin.—Greenfield Massachusetts Broken Stone Co. quarried traprock for roadstone, railroad ballast, and riprap. Two companies reported production of sand and gravel for use as road material from pits at Orange and Greenfield.

Hampden.—Dimension sandstone was quarried at East Longmeadow by McCormick Longmeadow Stone Co., Inc.; it was used for exteriors, including additions to Drew University, Newark, N.J., and St. Patrick's Church, Hartford, Conn. John S. Lane & Sons, Inc., produced basalt at West Springfield and Westfield for use as concrete aggregate, roadstone, and railroad ballast.

Production of sand and gravel in Hampden County ranked second in the State. Noncommercial production (by governmental agencies) was more than 1.1 million tons and comprised about two-thirds of the county total. The leading commercial producers were Monson Sand & Gravel Corp., N. Wilbraham Sand & Gravel Co., Inc., and D. D. Buxton Co., Inc. (Ludlow) at their gravel pits and stationary treatment plants along the Chicopee River east of Springfield. The output was used as building and moad material and for sanding icy roads.

Miscellaneous clay was mined and burned into building brick by Westfield Clay Products Co. (Westfield), and Hampshire Brick Co. (Chicopee).

Hampshire.—Sand and gravel production was 25 percent higher than in 1957; Hampshire Sand & Gravel, Inc., (Westhampton), and Bill Willard, Inc. (Northampton), were the principal producers. It was treated for use in building, constructing concrete highways, and sanding icy roads. Hampshire Sand & Gravel, Inc., increased crushing capacity during the year.

In Amherst John S. Lane & Sons, Inc., quarried basalt for use as concrete aggregate and roadstone.

Middlesex.—Output of sand and gravel increased 5 percent during the year; Middlesex became the leading county for this commodity with 24 percent of the State production. Seventeen commercial plants were active, seven less than in 1957; nearly the entire output came from the central and southern part of the county near Boston. Fourteen stationary and three portable plants were active. The leading three producers were San-Vel Contracting Co., Acme Sand & Gravel Co., Inc., and Winchester Brick Co. Sixty-seven percent of the total sand and gravel production was washed or otherwise processed.

Rough and dressed granite dimension stone was quarried by H. E. Fletcher Co. and Morris Bros. Granite Co., Inc., both at Westford. The latter company sold granite for curbing stone; Fletcher Co. marketed a wide variety of construction, architectural, and monumental stone. Basalt for roadstone and riprap was quarried by B & M Crushed Stone Co. (Ashland), John P. Condon Corp. (Dracut), and Rowe Contracting Co., (Malden). Crushed stone output was adversely affected by a sharp drop in local construction activity.

Zonolite Co., North Billerica, and California Stucco Products, Inc., in Cambridge exfoliated vermiculite, principally for concrete and plaster aggregate and for insulation, using both imported and domestic raw materials.

The production of the Eastern Gas and Fuel Associates (Boston) 108 slot-type coke ovens at Everett was somewhat over half the rated annual capacity of the ovens (664,000 net tons). This firm also operated a one-stack, 195,000-net-ton-annual-capacity blast furnace in Everett.

Construction of a second nuclear reactor in the Boston area was begun about the middle of the year at Watertown Arsenal, Watertown. The 1,000-kilowatt plant, costing $1.3 million, was planned for mid-1959, mainly for research on heat-resistant metals and other

materials. A plant for producing liquid oxygen, nitrogen, and argon and costing $9 million was to be erected at South Acton. This 70-ton per-day unit of Air Reduction Sales Co. will supply many industrial enterprises in the area, including shipbuilding, electronics, vacuum tube, and domestic lamp firms.

Commercial output of high-purity tantalum metal powder from tantalite ore by a new type vacuum ore-melting process was begun at Cambridge by National Research Corp., which announced plant capacity as 30,000 pounds a year from imported raw material. Hawkridge Metals Corp. in Malden continued pilot plant production of high-purity titanium by electrochemical processes. Noteworthy were the activities of Eastern Gas & Fuel Associates, Inc., Boston, which was expanding its research program in testing coal and coke by building an addition to its Everett laboratories, and the Nuclear Metals, Inc., which built a new, $2-million laboratory at Concord for metallurgical research and development.

Norfolk.—Sand and gravel for building material and fill was produced by six companies chiefly near Boston. The entire output came from stationary plants; about 87 percent of the slightly decreased total output was washed and screened.

Dressed monumental and rough architectural dimension granite were produced by J. S. Swingle, Inc. (Quincy), and by Bates Bros. Seam Face Granite Co. (Weymouth). Crushed granite for roadstone, riprap, and stone dust, were produced by Old Colony Crushed Stone Co. (Quincy), and Stoughton Crushed Stone Co. (Wrentham). Stoughton Crushed Stone Co. (Stoughton), also produced traprock for riprap and roadstone.

Bird & Son, East Walpole, produced miscellaneous stone for roofing granules at Plainville and Wrentham.

Plymouth.—Six stationary plants, two portable plants, and a dredge produced sand and gravel; quantity continued to decrease; and the leading producers were Boston Sand & Gravel Co. and Marshfield Sand & Gravel Co. About 80 percent of the output was washed and marketed, principally as paving material.

Southeastern Stone, Inc. (Hingham), produced traprock for riprap and as aggregate in asphalt mix.

Bridgewater Brick Co. (East Bridgewater), and Stiles and Hart Brick Co. (South Bridgewater) mined miscellaneous clay and produced building brick.

California Stucco Products, Inc., exfoliated vermiculite from the Union of South Africa at the former Munn & Steele facilities at Hingham Air Force Industrial Center, Hingham, acquired in November 1957.

Suffolk.—William J. Barry (Roslindale) and West Roxbury Crushed Stone Co. (West Roxbury) quarried traprock (basalt) for roadstone and roofing granules. Bird & Son, East Walpole, Norfolk County, produced miscellaneous stone for roofing granules at its Barre mines in Suffolk County. D. B. Raymond led in sand and gravel output; the various producers sold it for fill material.

Permalite Division, The Whittemore Co., Roslindale, expanded perlite from Western States for use in building plaster, concrete aggregate, and in filters.

United States Gypsum Co., Charlestown, calcined gypsum imported from Nova Scotia. Most of this material was consumed in gypsum products that were sold in New England.

Worcester.—Output of sand and gravel increased about 20 percent: this county ranked third in producing this commodity. Commercial production came from 1 portable and 10 stationary plants; 80 percent of the total quantity was washed. The leading producers were Worcester Sand & Gravel Co., Inc., Rosenfeld Washed Sand & Stone Co., P. J. Keating Co., and E. L. Dauphinais, Inc., principally in or near Worcester; the output was sold chiefly for fill and paving material.

Holden Trap Rock Co. (Holden) quarried traprock for concrete aggregate and roadstone. H. E. Fletcher Co. (Milford) quarried granite for architectural stone.

Norton Co. began manufacturing a wide variety of special refractory products at its new, $1.5-million plant at Worcester. This two-story building, with its 80,000 square feet of manufacturing space, was intended to augment rather than replace present facilities and was designed for straight line production of heavy refractories for high temperature applications.

The United States Steel Corp., American Steel & Wire Division, announced the suspension of its four open hearths at the Worcester plant on July 1. The combined annual capacity of these open hearths was 287,000 net tons. About 350 employees were affected. The rod and wire finishing mills used billets from the company Fairless Works, Morrisville, Pa.

The Mineral Industry of Michigan

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Michigan Department of Conservation, Geological Survey Division, State of Michigan.

By Donald F. Klyce [1]

THE DECLINE in industrial activity in 1958 adversely affected Michigan minerals production. Reduced demand for steel caused a sharp drop in iron ore output and of limestone for flux. Lower prices for copper reduced the value of the State output. Other mineral commodities, notably sand and gravel, cement, clay, gypsum, petroleum, and salt were also affected by the business decline but to a lesser extent. The demand for chemicals, produced from natural brines, continued at the 1957 rate.

The St. Lawrence Seaway, to be opened in 1959, will have a positive effect on mineral economy of Michigan. The Bureau of Census fore-

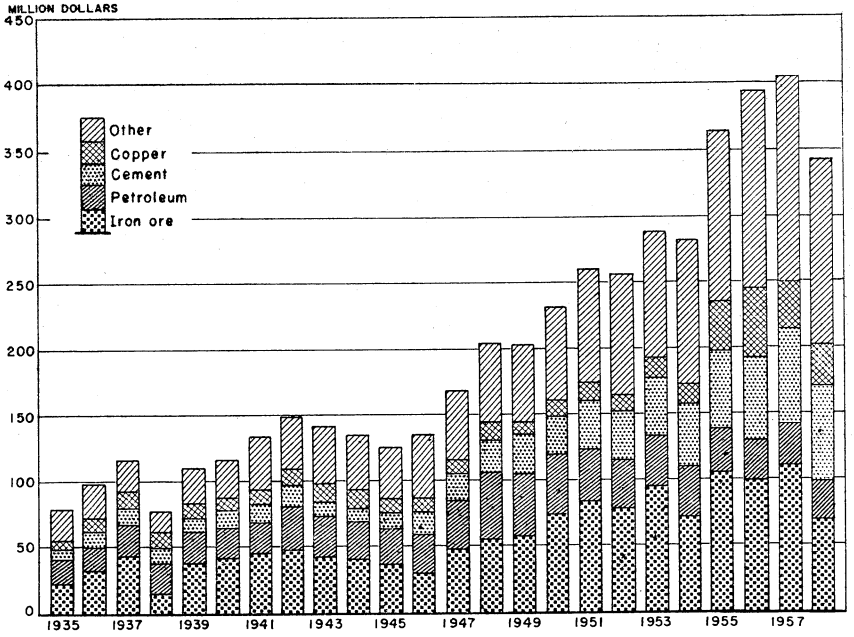

FIGURE 1.—Value of iron ore, petroleum, cement, copper, and total value of all minerals in Michigan, 1935–58.

[1] Commodity-industry analyst, Minneapolis Field Office, Division of Mineral Industries, Region V, Bureau of Mines, Minneapolis, Minn.

casts indicate a population increase for the areas bordering the Great Lakes in the next decade, exceeding the national average and consequently increasing homebuilding and commercial and industrial construction. Anticipation of new and expanded markets for minerals was shown in 1958 by construction of port facilities, expansion of industrial plants, and development of mineral reserves.

TABLE 1.—Mineral production in Michigan [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland—thousand 376-pound barrels	20,590	$65,996	19,691	$65,738
Masonry—do	1,455	5,610	1,221	4,694
Clays—thousand short tons	1,842	1,982	1,663	1,813
Copper (recoverable content of ores, etc.)	58,400	35,157	58,005	30,511
Gypsum—thousand short tons	1,386	4,823	1,331	4,824
Iron Ore (usable)—thousand long tons, gross weight	13,123	111,484	8,111	69,845
Manganiferous ore (5 to 35 percent Mn)—gross weight	123,547	(2)	112,536	(2)
Natural gas—million cubic feet	[3] 9,122	[3] 1,715	[4] 14,243	[4] 2,649
Peat	80,271	1,406	107,342	1,684
Petroleum (crude)—thousand 42-gallon barrels	10,169	31,117	[4] 9,307	[4] 27,363
Salt (common)—thousand short tons	5,225	41,073	4,267	33,018
Sand and gravel [5]—do	41,838	35,144	39,871	34,616
Silver (recoverable content of ores, etc.) thousand troy ounces	430	389		
Stone—thousand short tons	34,495	34,176	27,188	26,846
Value of items that cannot be disclosed: Bromine, calcium chloride and calcium-magnesium chloride, lime, magnesium compounds, natural-gas liquids, potassium salts, and values indicated by footnote 2		[3] 40,324		45,558
Total Michigan [6]		[3] 404,673		343,483

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Revised figure.
[4] Preliminary figure.
[5] Includes friable sandstone.
[6] Total has been adjusted to eliminate duplicating value of clays and stone.

Employment and Injuries.—Preliminary data for the mineral industry indicated a total of 26 million man-hours worked, a decrease of 26 percent from 1957. This drop was due to reduced iron-ore production as well as the general decline in mining activity. Thirteen fatalities were recorded compared with 15 in 1957.

The Grand Rapids mine, Grand Rapids, Kent County, operated by the Bestwall Gypsum Co., won top honors in the nonmetal group of the 1958 National Safety Competition—220,111 man-hours without a lost-time injury. The mine was awarded the Sentinels of Safety trophy for its record.

The Cedarville quarry, St. Ignace, Mackinac County, operated by the Michigan Limestone Division of U.S. Steel Corporation was one of five quarries in the United States, having the lowest injury-severity rates in the quarry group of the National Safety Competition.

All employment and injury data for the mineral industry were collected from companies on a voluntary basis. Data represent virtually complete coverage for most mineral commodities.

Consumption, Trade, and Markets.—Michigan's strategic location at the center of the Great Lakes system facilitated large water ship-

TABLE 2.—Summary of employment and injuries for selected mineral industries in Michigan [1]

Year	Industry	Average number of men working	Total man-hours	Total number of lost-time injuries		Total number of days lost or charged	Injury frequency rate	Injury severity rate
				Fatal	Non-fatal			
1957	Cement [2]	1,839	4,950,624	--	9	(3)	1.82	(3)
	Clay [4]	158	363,187	1	11	6,100	33.04	16,796
	Coke ovens	1,027	2,898,468	--	7	(3)	2.42	(3)
	Copper	1,970	4,201,218	6	207	53,701	50.70	1,278
	Gypsum	303	645,273	--	13	1,284	20.15	1,990
	Iron ore	7,212	13,870,225	5	399	51,536	29.13	3,716
	Limestone [5]	1,946	3,642,619	2	47	(3)	13.45	(3)
	Marl	42	36,157	--	--	--	--	--
	Sandstone	32	47,630	--	2	(3)	41.99	(3)
	Smelters	346	841,792	--	13	667	15.44	792
1958	Cement [2]	1,649	4,623,017	1	14	(3)	3.24	(3)
	Clay [4]	145	320,889	--	7	46	21.81	143
	Coke ovens	795	2,274,451	1	7	(3)	3.52	(3)
	Copper	1,891	3,592,338	3	119	25,185	33.96	7,011
	Gypsum	207	464,978	--	1	17	2.15	37
	Iron ore	6,115	8,073,486	8	183	59,171	23.66	7,329
	Limestone	1,353	2,543,844	--	27	(3)	10.61	(3)
	Marl	47	29,287	--	--	--	--	--
	Sandstone	14	27,925	--	--	--	--	--
	Smelters	342	668,045	--	8	404	11.98	605

[1] Data excludes office workers, are final for 1957, and preliminary for 1958.
[2] Includes cement plants and quarries or pits, producing raw material used in manufacturing cement.
[3] Figure not available.
[4] Excludes pits, producing clay used exclusively in manufacturing cement.
[5] Excludes quarries, producing limestone used exclusively in manufacturing cement and lime.

ments of iron ore, limestone, sand and gravel, and gypsum to consumers in States bordering the Great Lakes. In 1958 about a third of the tonnage of the mineral commodities produced in Michigan was shipped by water. The opening of the St. Lawrence Seaway will permit water transportation to markets on the eastern seaboard and overseas.

Trends and Developments.—During 1958 construction started on the 5-million-barrel plant of the Dundee Cement Co. in Monroe County. The plant will have two kilns each with 8,000-barrel-a-day capacity.

National Gypsum Co. completed development of its new gypsum mine at Tawas City and began production.

Drummond Dolomite, Inc., began development of a new quarry on the south shore of Drummond Island in Chippewa County. The deposit, 2,700 acres in extent and containing a reserve of about 150 million tons, is 6 miles east of the processing plant. A railroad was to be constructed to link the quarry with the plant site.

Legislative and Government Programs.—The Defense Minerals Exploration Administration contract with Calumet & Hecla, Inc., for copper exploration in Ontonagon County was terminated in February 1958 The project began in March 1955.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Although shipments and values declined slightly, cement continued to be Michigan's second ranking mineral commodity. Production was reported in six counties from eight plants, operating at 80 percent of capacity. At the end of 1958 the estimated capacity was

25.5 million barrels. Stocks of portland cement at mills at yearend were 2.3 million barrels, a 6-percent increase from the preceding year. Average mill value of portland cement increased from $3.21 a 376-pound barrel in 1957 to $3.34 in 1958. The price of masonry cement remained steady at $3.85 a barrel.

About two-thirds of the cement produced was used within the State. Out-of-State shipments went principally to Ohio, Wisconsin, New York, Illinois, Minnesota, North Dakota, and Indiana.

Nearly 5 million tons of limestone, 1.4 million tons of clay and shale, plus substantial quantities of gypsum and sand were used to manufacture cement. Small quantities of special materials were also employed as grinding aids. Much of the limestone was shipped by boat from quarries in the northern parts of the State and the other materials were procured locally.

Clay.—Miscellaneous clay was used in manufacturing heavy clay products (building and paving brick, draintile, sewer pipe), art pottery, lightweight aggregate, and as an ingredient in cement. Over four-fifths of the clay mined was used by cement manufacturers; their requirements were 200,000 tons less than in 1957. The only notable increase in the demand for clay was in producing lightweight aggregate.

TABLE 3.—Finished portland cement produced, shipped and in stock

Year	Active plants	Production (thousand barrels)	Shipped from mills		Stocks at mills on Dec. 31 (thousand barrels)
			Thousand barrels	Value (thousands)	
1949–53 (average)	7	14,090	14,066	$34,449	1,411
1954	7	16,671	16,712	45,692	1,266
1955	7	18,205	18,128	52,353	1,525
1956	8	20,485	20,237	61,749	1,779
1957	8	21,015	20,590	65,996	2,204
1958	8	19,841	19,691	65,738	2,342

Clay was produced in 10 counties at 17 pits. Alpena, Wayne, and Saginaw Counties reported the leading production. No fire clay was produced in Michigan in 1958.

Gem Stones.—Small quantities of semiprecious stones, principally agates, were collected on the Lake Superior beaches of Keeweenaw County by hobbyists. A few hundred pounds of native copper, not classifiable as gem stones, were sold by Calumet & Hecla, Inc., to collectors of mineral specimens.

The following minerals and stones are frequently collected in the State; some, when cut and polished, are attractive enough to be classed as semiprecious gem stones:

chlorastrolite
carnelian
prehnite
amethyst
algodonite
jaspilite
pyrolusite
martite
tourmaline
actinolite
celestite
native copper
rose quartz
datolite
chalcocite
chalcopyrite
whitneyite
goethite
psilomelane
grunerite
topaz
pyrite
gypsum
chalcedony
epiodte
bornite
domeykite
natrolite
manganite
verde antique
garnet
tremolite
calcite (dog-tooth spar)
Petoskey stone

A booklet, Rock and Minerals of Michigan,[2] was published by Michigan Department of Conservation. It describes the ordinary rocks and minerals of the State, their origin, location, uses, and importance.

Further detail on the subject is available in a second publication of the Department of Conservation—An Index of Michigan Geology.[3] This publication includes an index of all Michigan Geological Survey publications and maps, an index and chart of the rock-formation names used in Michigan, a list of all reported paleozoic rock outcrops, and a comprehensive listing of references to Michigan geology and mineral resources.

Gypsum.—Gypsum mines were operated in Iosco and Kent Counties, and the crude gypsum was processed in plants at National City, Alabaster, Grand Rapids, and Detroit. Plasterboard, lath, exterior sheathing, and plaster were produced.

A new open-pit mine of National Gypsum Co. near Tawas City began producing. The 60-million-ton deposit insures adequate crude reserves for several decades.[4]

Lime.—Lime production was reported from Bay, Chippewa, Mason, and Menominee Counties by four companies. Quicklime was produced by three manufacturers; the fourth produced both quick and hydrated lime. The chief uses for Michigan lime were in chemical manufacture, water purification, paper manufacture, sugar refining, sewage treatment, and metallurgy.

Natural Salines.—Bromine, calcium chloride, calcium-magnesium chloride, magnesium compounds, and potash were the basic chemicals, on which a large industry was established in Michigan. Natural brines from two geological formations were the source material. Chemical plants in Manistee and Mason Counties used brines from the Filer sandstone of the Detroit River formation for extracting elemental bromine, calcium chloride, calcium-magnesium chloride, and magnesium compounds. Plants in Gratiot, Lapeer, and Midland Counties recovered natural brine from the Sylvania formation for use in manufacturing chemicals. Because of the widespread industrial market for these products, the chemical industry has been more stable than for mineral commodities that were tied more directly to the steel economy. During the past 10 years, the output of Michigan chemicals has grown steadily.

The St. Lawrence Seaway is expected to open new markets for the chemical industry. The Dow Chemical Co., Midland, Mich., constructed a marine terminal on the Saginaw River at Bay City for use when traffic resumed on the Great Lakes in April 1958. The terminal was to facilitate water shipment of products to eastern and foreign markets when the Seaway opens in 1959.

Perlite.—Crude perlite from mines in Colorado, Nevada, and New Mexico was expanded at three plants; two were in the Grand Rapids area, and one was at National City in Iosco County. Most of the expanded product was used in building plaster. Small quantities

[2] Michigan Department of Conservation, Publication 42 Rocks and Minerals of Michigan, Lansing 26, Mich., 1958, 120 pp.
[3] Michigan Department of Conservation, Publication 50 Index of Michigan Geology, Lansing 26, Mich., 1956, 450 pp.
[4] Mining Engineer, February 1957, p. 91.

were sold for use in concrete aggregate, soil conditioning, and for miscellaneous purposes.

Salt.—Michigan salt was produced from one rock-salt mine in Wayne County, the only underground salt mine in the State, and from artificial brines by dissolving salt from the Salina formation at plants in Muskegon, St. Clair, and Wayne Counties. Artificial brines from the Detroit River formation were used at plants in Midland and Manistee Counties. Salt was also produced in Gratiot County from natural brines drawn from the Marshall and Dundee formations.

Nearly two-thirds of Michigan salt was used by the chemical plants in manufacturing soda ash, chlorine, and other chemicals. Over 600,000 tons was purchased by Government agencies (State, county, and other political subdivision) for ice control on highway systems. Over a million tons was used for a wide variety of industrial purposes.

Salt was produced at 11 plants in 6 counties; the 4 plants in Wayne County led in output.

The Solvay Process Division of Allied Chemical & Dye Corp. closed its brine plant in Wayne County.

Sand and Gravel.—Sand and gravel was produced in nearly all of the 83 Michigan counties. In populous southern Michigan, particularly in the Detroit metropolitan area, encroachment of urban areas tended to limit expansion of deposits closest to areas of greatest demand. Further, depletion of some high-grade deposits in southern Michigan required beneficiation of marginal materials to meet highway specifications.

A combination of bad weather for road construction, fewer buildings started, and reduced industrial activity resulted in a decreased demand for sand and gravel. Decline in road construction materials was relatively small (2 percent) and Government-and-contractor activity (largely concerned with highway building) was substantially (18 percent) increased over the preceding year—not quite enough to offset the loss in commercial production for road use.

Demand for building materials also declined—4 percent. The greatest losses were in sands for industrial uses—molding, glass, blast, grinding, and polishing, etc. The decline in this area followed quite closely the trend of decreases in other mineral commodities used by the steel and allied industries.

Most of the sand and gravel (36.4 million tons) produced in Michigan was moved by truck, about 2.1 million tons, by railroad; and 1.3 million tons by water.

In value the leading sand and gravel production came from counties in the Detroit area (Oakland, Macomb, Livingston, Washtenaw, and Wayne) and from Kent, Muskegon, Ottawa, and Tuscola Counties. Nearly three-fifths of the State total was produced in these areas.

Sand and gravel production was reported from 197 commercial and 113 noncommercial or Government-and-contractor operations.

About 40 percent of the State output was reported by the following producers: American Aggregates Corp. (Kalamazoo, Livingston, and Oakland Counties), Construction Aggregates Corp. (Ottawa County), O. E. Gooding & Co. (portable plants), Grand Rapids Gravel Co. (Kent County), Killins Gravel Co. (Washtenaw County), Michigan Silica Co. (Wayne County), Pickit & Schreur (portable plants), Sand Products Corp. (Manistee and Muskegon Counties), Straits Ag-

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

(In thousands)

Class and use	1957		1958	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand: [1]				
Molding	2,237	$3,003	1,792	$2,321
Building	4,335	3,326	4,003	3,227
Paving	4,780	4,005	4,150	3,772
Engine	75	68	41	45
Filter	(2)	(2)	19	12
Railroad ballast	64	32		
Fill	1,515	482	1,404	507
Other	61	56	35	33
Undistributed [3]	613	1,410	454	1,256
Total	13,678	12,381	11,899	11,173
Gravel:				
Building	3,771	4,409	3,951	4,579
Paving	15,779	13,808	14,258	12,743
Railroad ballast	324	256	158	170
Fill	250	138	299	178
Other	202	182	54	54
Total	20,326	18,793	18,721	17,724
Total sand and gravel	34,004	31,174	30,619	28,898
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	43	11	6	3
Paving	1,112	356	1,197	467
Total	1,155	367	1,203	470
Gravel:				
Building	104	41		
Paving	6,574	3,564	8,049	5,248
Total	6,678	3,604	8,049	5,248
Total sand and gravel	7,834	3,971	9,252	5,718
ALL OPERATIONS				
Sand	14,834	12,747	13,102	11,643
Gravel	27,004	22,397	26,770	22,972
Grand total	41,838	35,144	39,871	34,616

[1] Includes friable sandstone.
[2] Included with "Undistributed" to avoid disclosing individual company confidential data.
[3] Includes blast, glass, grinding and polishing, and ground sand (1957-58).

gregate & Equipment Corp. (Presque Isle County), and Whittaker & Gooding Co. (Washtenaw County).

Stone.—Basalt, limestone, and sandstone were produced.

Crushed Limestone.—By far the most important product, limestone was quarried in 18 counties throughout the State. Several very large quarries in Alpena, Chippewa, Mackinac, and Presque Isle Counties shipped over seven-eighths of the State total. Most of these quarries were at or near marine terminals, and the bulk of their output was shipped by water. Over 20 million tons was moved by lake transport to cement plants, steel mills, lime plants, and other industries in downstate Michigan, Minnesota, Wisconsin, Illinois, Indiana, Ohio, New York, and Pennsylvania. On November 18, 1958, the *Carl D. Bradley*, a 17,000-ton limestone carrying vessel owned by the Bradley Transportaion Co., Rogers City, sank near Gull Island in Lake Mich-

igan during one of the most violent storms of recent years. Only 2 of 35 crewmen survived the disaster.

Most of the dimension stone quarried (limestone and sandstone) was used for rough construction, flagging, and rubble. Some limestone was dressed and sawed for building use.

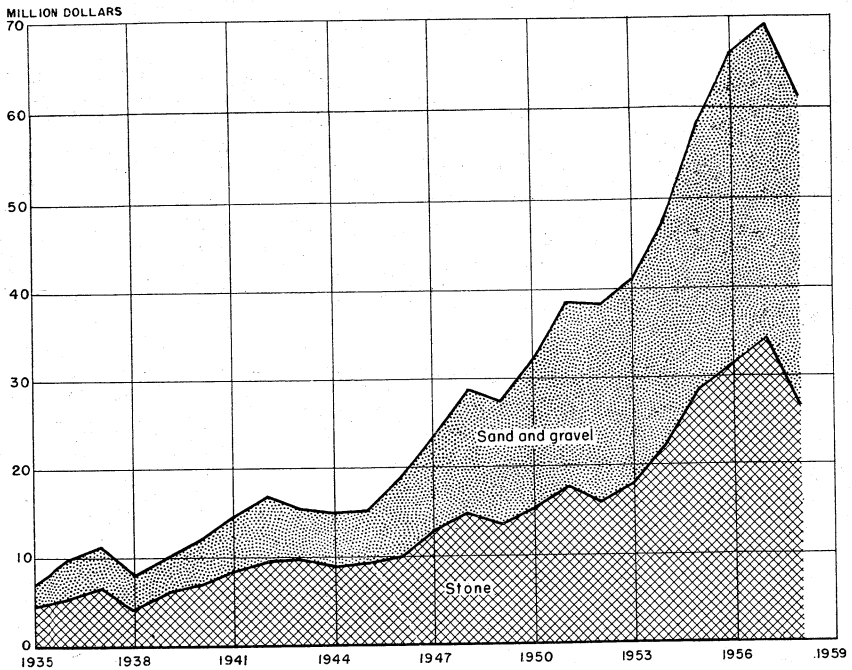

FIGURE 2.—Value of sand and gravel and stone in Michigan 1935–58.

TABLE 5.—Dimension stone sold or used by producers, by kinds

Year	Limestone		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1954	8,938	$68,984	3,524	$31,235	12,462	$100,219
1955	29,907	113,912	9,429	79,410	39,336	193,322
1956	35,017	110,159	11,190	90,820	46,207	200,979
1957	34,741	105,854	17,889	70,142	52,630	175,996
1958	50,965	120,361	18,776	132,981	69,741	253,342

The principal producers of limestone were: Cheney Limestone Co. (Eaton County), Drummond Dolomite, Inc. (Chippewa County), the France Stone Co. (Monroe County), Huron Portland Cement Co. (Alpena County), Inland Lime & Stone Co. (Mackinac County), Michigan Limestone Division of U.S. Steel Corp. (Mackinac and Presque Isle Counties), The Michigan Stone Co. (Monroe County), Penn-Dixie Cement Corp. (Emmet County), Presque Isle Corp.

TABLE 6.—Crushed and broken stone sold or used by producers, by kinds and uses

(In thousands)

Kind and use	1957		1958	
	Short tons	Value	Short tons	Value
Basalt: Concrete aggregate, roadstone: Noncommercial	41	$60	31	$34
Granite: Concrete aggregate, roadstone: Noncommercial	1	1	----------	----------
Limestone:				
Riprap	25	26	(1)	(1)
Flux	14,687	15,369	8,821	9,064
Concrete aggregate, roadstone:				
Commercial	4,673	5,803	5,646	6,290
Noncommercial	256	267	544	657
Agriculture	587	740	487	695
Other [2]	14,031	11,657	11,359	9,722
Total commercial	34,003	33,596	26,313	25,771
Total noncommercial	256	267	544	657
Total limestone	34,259	33,863	26,857	26,428
Marl, calcareous: Agriculture	137	71	230	130
Sandstone:				
Riprap	5	5	----------	----------
Filler	----------	----------	1	(3)
Total sandstone	5	5	1	(3)
Total commercial	34,145	33,671	26,544	25,902
Total noncommercial	297	328	574	691
Grand total	34,442	34,000	27,118	26,592

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Includes limestone for railroad ballast, chemical uses, refractory, whiting or whiting substitutes, asphalt filler, dust for coal mines, mineral food, poultry grit, stone sand, cement, lime, and other miscellaneous purposes.
[3] Less than a thousand.

(Chemstone Corp.) (Presque Isle County), The Wallace Stone Co. (Huron County).

Marl.—The principal marl production was from Calhoun, Kalamazoo, Isabella, and Osceola Counties, but 18 counties reported output. Marl produced in Michigan was used for agricultural purposes. Because of its low cost, its market was limited to usually less than 25 miles. Farm income and Federal aid to farmers for soil enrichment were factors affecting demand.

Sulfur.—Output of byproduct sulfur was reported by Aurora Gasoline Co. of Detroit. Sulfur was recovered from crude petroleum, using a Parson design of the Clauss process.

METALS

Copper.—Production of copper was the same as in 1957. Output was reported from 11 underground mines and 2 tailing-reclamation plants. Calumet & Hecla, Inc., operated nine mines and one reclamation plant in Houghton and Keweenaw Counties; Copper Range Co., the Champion mine and Freda concentrator in Houghton County; and the White Pine Copper Co. (Copper Range Co. subsidiary), the White Pine mine, mill, and smelter in Ontonagon County.

Three mines and one tailing-reclamation plant active in 1957 were closed all or part of 1958. This action reflected in part cost reduction programs begun during 1957 and continued into 1958.

The national annual weighted price dropped from 30.1 cents a pound in 1957 to 26.3 cents a pound in 1958.

The primary producers quoted price for electrolytic copper, delivered, opened 1958 at 27 cents a pound, reached a low of 25 cents in January, rose to 26.5 cents in July, and to 29 cents in October where it remained beyond the close of the year.

Michigan copper mining was part of an integrated industry. Producing companies mined and processed the ore and used most of the refined metal in wholly owned fabricating plants. Michigan copper is free of other metals, except silver. Virtually all output was fire-refined and marketed as "Lake copper". The small quantity of silver contained is advantageous for some uses and the copper sold received a slight premium in price.

TABLE 7.—Mine production of copper in 1958, by months, in terms of recoverable metal

Month	Short tons	Month	Short tons
January	5,600	August	4,300
February	5,350	September	4,075
March	5,920	October	4,825
April	5,580	November	4,715
May	4,935	December	4,770
June	4,500		
July	3,435	Total	58,005

TABLE 8.—Mine production of copper, in terms of recoverable metal

Year	Mines producing		Material treated		Copper	
	Lode	Tailing	Ore (short tons)	Tailing (short tons)	Short tons	Value
1949–53 (average)	9	3	2,012,039	2,080,676	23,178	$10,952,424
1954	13	2	2,478,085	1,812,695	23,593	13,919,870
1955	11	2	5,319,699	1,488,854	50,066	37,349,236
1956	12	3	6,427,095	2,233,599	61,526	52,297,100
1957	14	3	5,939,034	2,369,546	58,400	35,156,800
1958	11	2	5,957,879	1,336,077	58,005	30,510,630

Iron Ore.—Iron-ore production declined to a 10-year low, obtained from 27 underground and 9 open-pit mines. Decreased production resulted from curtailed output rather than fewer mines.

The operating rate of the steel industry fell below 50 percent of average ingot capacity during the first part of 1958 (47 percent in April). During the latter part of the year the operating rate increased to 75 percent. As demand from the steel industry improved, mining activity increased.

Mining costs, particularly in underground mines, continued to rise, reaching an alltime high. A study [5] by the Geological Survey Division, Michigan Department of Conservation, indicated that average costs a ton for underground mines rose from $10.22 in 1957 to $10.68 in 1958. A breakdown of the total cost figure showed labor costs

[5] Michigan Department of Conservation, 1958 General Statistics Covering Costs And Production of Michigan Iron Mines, Geol. Survey Div., Lansing, Mich., June 1959, p. 10.

rising from $2.97 to $3.12, supplies $1.30 to $1.39, taxes (excluding Federal income tax) $0.47 to $0.82, transportation $3.24 to $3.30. Costs varied substantially for underground mines on the different ranges. In 1958, for example, average cost a ton on the Gogebic range was $13.22, Marquette range, $10.79, Menominee range $9.52.

Underground mines furnished nearly 86 percent of the crude ore mined. Average iron content of usable ore produced was 53.07 percent natural.

TABLE 9.—Production, shipments, and stocks of crude iron ore in 1958, by counties and ranges [1]

(Thousand long tons)

County and range	Stocks of crude ore, Jan. 1, 1958	Production		Shipments		Stocks of crude ore, Dec. 31, 1958
		Underground	Open pit	Direct to consumers	To beneficiation plants	
County:						
Dickinson	4	----------	15	15	----------	4
Gogebic	397	1,397	(2)	1,394	----------	401
Iron	810	2,959	----------	2,944	92	732
Marquette	1,418	3,391	1,279	3,095	1,135	1,859
Total	2,628	7,747	1,295	7,448	1,227	2,996
Range:						
Gogebic	397	1,397	(2)	1,394	----------	401
Marquette	1,418	3,391	1,279	3,095	1,135	1,859
Menominee	814	2,959	15	2,960	92	736
Total	2,628	7,747	1,295	7,448	1,227	2,996

[1] Exclusive of iron ore that contains 5 percent or more manganese.
[2] Less than 1,000 tons; adjustment compensates for overrun of stocks.

TABLE 10.—Usable iron ore shipped from mines, by ranges [1]

(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total
1949–53 (average)	4,989	4,240	3,275	12,504
1954	3,675	3,656	2,378	9,709
1955	6,640	4,326	3,178	14,144
1956	5,689	3,889	2,958	12,536
1957	5,993	4,297	2,833	13,123
1958	3,722	2,995	1,394	8,111

[1] Exclusive of iron ore containing 5 percent or more manganese, natural.

Shipments of jaspilite concentrate increased 55 percent over 1957. Concentrates of these low-grade ores, from open-pit mines, comprised nearly 8 percent of the total iron-ore output, compared with 3 percent in 1957.

Trends indicate a gradual shift from high-cost underground mines, producing direct shipping ores, to low-cost open-pit mines, producing low-grade ore amenable to concentration.

Estimated reserves of direct-shipping ores in Michigan totaled about 141 million tons at the end of 1958.[5a] Over 1,800 million tons of low-grade hematitic ore was available on the Michigan ranges.

[5a] Work cited in footnote 5.

Table 11.—Usable iron ore produced, 1949–53 (average), 1954–58, and total 1854–1958, by ranges [1]

(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total
1949–53 (average)	5,110	4,231	3,302	12,643
1954	4,671	3,640	2,440	10,751
1955	5,413	4,018	2,879	12,311
1956	5,869	4,264	2,910	13,043
1957	6,557	4,201	2,868	13,626
1958	4,111	2,896	1,397	8,404
Total 1854–1958	299,966	[2] 247,982	[2] 240,452	788,400

[1] Exclusive of iron ore containing 5 percent or more manganese, natural.
[2] Distribution by ranges partly estimated before 1906.

These ores will yield over 700 million tons of concentrate.[6] Some crude ores are amenable to concentration by flotation. For the remainder a magnetizing roast and later magnetic separation or a high-tension electrostatic separation may be required.

The average weighted mine value of Michigan iron ore, without respect to grade, was $8.61 a long ton, compared with $8.50 in 1957.

Except for a small quantity of crude ore shipped to manufacturers of iron oxide pigments, most of the iron ore was used to manufacture pig iron and steel.

Over 97 percent of the iron ore shipped was transported by rail to ore docks at Ashland, Wis.; Escanaba, Mich.; and Marquette, Mich.; then by vessel to lower Lake ports. The rest was transported by rail to consuming districts.

Dates of first and last Lake shipments of ore in 1958 from Michigan and Wisconsin ports were: Ashland—C&NW–S00, May 18–November 20; Escanaba—C&NW, May 1–December 5; Marquette—DSSA, June 10–October 27; Marquette—LS&I, April 26–December 7; Superior—GN, May 2–December 1; Superior—NP–SOO, May 11–November 29.

Manganiferous Ore.—Manganiferous ore (containing 5 to 35 percent manganese, natural) was shipped from the Cannon mine, operated by Hanna Iron Ore Division of the National Steel Corp. in Iron County. Its production was not significant as a source of manganese. It was sold as an iron ore and a premium was paid for manganese content.

Pig Iron and Steel.—The Michigan steel-manufacturing industry was based in Wayne County. Five companies (Allegheny Ludlum Steel Corp., Ford Motor Co., Great Lakes Steel Co. of National Steel Corp., McLouth Steel Corp., Jones & Laughlin Steel Corp.) had a rated annual ingot capacity of 7.9 million tons, January 1, 1959.[7] This capacity increased 766,000 tons over 1958. Michigan steel capacity represented 5.4 percent of the United States total and ranked as the 7th steel producing State in the Nation.

[6] Pardee, F. G., and Kennedy, B. E., Low-Grade Ore Occurrences in Michigan. Univ. of Minnesota, 9th Ann. Min. Symposium, 1948, p. 24.
[7] American Iron and Steel Institute, Annual Statistical Report: May 1959, p. 8.

TABLE 12.—Manganiferous iron ore (containing 5 to 10 percent manganese, natural) and ferruginuous manganese ore (containing 10 to 35 percent manganese, natural) shipped from mines

Year	Long tons	Year	Long tons
1949–53 (average)	[1] 50,998	1957	110,310
1954	13,715	1958	100,479
1955–56			

[1] No shipments during 1949.

Individual data on steel production for Michigan were not available in statistics published by the American Iron and Steel Institute. The output of the five Michigan plants and one plant in Minnesota totaled 5,153,333 short tons.

Annual blast-furnace capacity of companies producing pig iron in Michigan (Ford Motor Co., Great Lakes Steel Co. of National Steel Corp., and McLouth Steel Corp.) was 4,843,000 net tons, January 1, 1959. In 1958 shipments of pig iron were nearly 23 percent less than in 1957. For the same period value of pig iron shipped decreased 27 percent. Basic and Bessemer types were produced. The decrease in 1958 indicated the effect of lower industrial production, particularly automobile manufacture, on the demand for the commodity.

In addition to domestic iron ore, substantial quantities of imported iron ores and domestic and imported manganiferous ores were consumed.

Production of pig iron required large amounts of coke and limestone as well as flue dust, mill cinder, roll scale, scrap, and slag in addition to the ores.

MINERAL FUELS

Natural Gas and Natural Gas Products.—Natural gas production increased 56 percent to 14,243 million cubic feet. The leading output came from the Overisel field in Allegan County and the Northville field in Wayne and Washtenaw Counties. Natural-gasoline and liquid-petroleum gases were produced about the same rate as in 1957.

In the lower peninsula of Michigan the Antrim shales have produced gas in some quantities. These deposits, Mississippian in age, contain varying quantities of carbonaceous material. Investigation and research was conducted to use commercially the fuel potential in the form of gas. Research was directed toward gasification in place. The work remained basic research, and an economic process was probably several years away.

Peat.—Production of peat increased for the 6th consecutive year. With an estimated reserve of 1,000 million tons,[8] Michigan will share in this growing market depending on its ability to meet competitive operator's production costs. Output from bogs in Kalamazoo, Lapeer, Mason, St. Clair, Sanilac, and Tuscola Counties was sold principally as a soil conditioner.

[8] Averitt, Paul, Berryhill, Louise R., and Taylor, Dorothy A., Coal Resources of the United States: Geol. Survey Circ. 293, Oct. 1, 1953, p. 38.

Petroleum.—Although petroleum production declined, the current trend in exploration and development well activity indicated a possible reversal or, at least, a slowing rate of decline for the industry. Undeveloped acreage under lease increased substantially over the preceding year.

Exploratory wells resulted in five new oilfields, two new gasfields, five extensions, and six new pools. The discovery of five oil pools and one gas-pool extension by drilling or reworking development wells provided additional encouragement. Application of subsurface geology continued to be the major tool of exploration. A substantial number of exploratory tests were drilled as a result of gravity surveys. According to the Oil and Gas Section, Geological Survey Division, Michigan Department of Conservation, favorable developments in the Trenton-Black River formation of the Ordovician system resulted in increased activity in southern Michigan, principally in Branch, Calhoun, Jackson, and Hillsdale Counties. Leasing programs in this area were intensified and the Scipio field (Hillsdale County), discovered in 1957, underwent substantial development. In 1958, 19 new wells were added to the 6 completed in 1957. Over 527,000 barrels of oil was produced for an accumulated total of 614,000 barrels. Production was from a secondary dolomite and confined to a fracture zone. The field was ½ mile wide and 2 miles long, trending south-southeast to north-northwest; its limits were not established.

Another Trenton-Black River discovery was drilled in December in Albion Township in Calhoun County. The well is 12 miles away but alined with the general Scipio trend. The structure and general characteristics of the new Albion field, similar to those in the Scipio field, suggest the possibility of a fracture zone at least 20 miles in length. Continued exploration and development of this area will have a direct bearing on the future of the Michigan oil industry.

Petroleum was produced in 41 counties. Largest production came from Montcalm, Isabella, Bay, Osceola, Ogemaw, Arenac, Clare, and Hillsdale Counties, each producing more than half a million barrels. The Basin District, comprising 22 counties in central Michigan, was the most important producing area with an output of 7.2 million barrels. Fifteen refineries, with a rated capacity of 179,000 barrels daily, were operated.

The proved recoverable crude-oil reserve, December 31, 1958, was estimated at 45 million barrels.[9]

REVIEW BY COUNTIES

All 83 counties in Michigan reported some mineral production in 1958.

Sand and gravel was produced in 81 counties and was the only mineral commodity reported in 13 counties. Petroleum was the only mineral commodity reported for Clare County.

Value of mineral products exceeded $1 million in 39 counties.

Wayne County led in minerals production. Total values increased in 33 counties and decreased in 50. The greatest losses were in counties producing iron ore, copper, and limestone, reflecting decreased demand by industrial consumers.

[9] Committee on Petroleum Reserves, American Petroleum Institute, vol. 13, Dec. 31, 1958, p. 9.

TABLE 13.—Value of minerals produced in Michigan, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Alcona	$65,610	$118,886	Sand and gravel.
Alger	(2)	214,809	Do.
Allegan	982,962	955,010	Petroleum, sand and gravel, stone.
Alpena	35,531,428	33,557,919	Cement, stone, clays, sand and gravel.
Antrim	(2)	85,701	Sand and gravel.
Arenac	2,983,196	2,031,964	Petroleum, stone, sand and gravel.
Baraga	984,329	39,530	Sand and gravel.
Barry	630,563	473,367	Sand and gravel, petroleum, stone.
Bay	(2)	(2)	Cement, petroleum, lime, sand and gravel.
Benzie	2,160	13,342	Sand and gravel.
Berrien	265,514	457,954	Sand and gravel, stone.
Branch	(2)	(2)	Do.
Calhoun	294,593	327,948	Do.
Cass	(2)	173,298	Do.
Charlevoix	16,850	58,767	Do.
Cheboygan	42,637	62,327	Do.
Chippewa	(2)	(2)	Stone, lime, sand and gravel.
Clare	2,444,238	1,774,819	Petroleum.
Clinton	401,941	387,251	Sand and gravel, clays.
Crawford	(2)	616,990	Petroleum, sand and gravel.
Delta	323,428	322,219	Sand and gravel, stone.
Dickinson	270,863	389,550	Sand and gravel, stone, iron ore.
Eaton	382,743	418,644	Stone, sand and gravel, clays.
Emmet	6,906,000	9,195,437	Cement, stone, clays, sand and gravel.
Genesee	549,472	459,132	Sand and gravel, petroleum.
Gladwin	(2)	1,493,077	Petroleum, sand and gravel.
Gogebic	23,964,081	11,916,190	Iron ore, sand and gravel.
Grand Traverse	(2)	(2)	Sand and gravel.
Gratiot	(2)	(2)	Salines, salt, sand and gravel, petroleum, clays.
Hillsdale	816,459	2,136,795	Petroleum, sand and gravel, stone.
Houghton [3]	35,875,776	30,946,690	Copper, sand and gravel, stone.
Huron	907,025	1,049,293	Stone, sand and gravel, petroleum.
Ingham	657,065	641,421	Sand and gravel.
Ionia	(2)	824,789	Sand and gravel, petroleum.
Iosco	(2)	(2)	Gypsum, stone.
Iron	35,979,274	25,331,024	Iron ore, manganiferous ore, sand and gravel.
Isabella	3,420,435	2,942,892	Petroleum, sand and gravel, stone.
Jackson	512,118	595,851	Sand and gravel, stone.
Kalamazoo	783,431	771,997	Sand and gravel, stone, peat, petroleum.
Kalkaska	(2)	152,381	Petroleum, sand and gravel.
Kent	3,292,099	2,996,081	Sand and gravel, gypsum, petroleum.
Lake	135,500	102,847	Sand and gravel, petroleum.
Lapeer	707,206	921,294	Peat, sand and gravel, salines, petroleum.
Leelanau	(2)	57,307	Sand and gravel.
Lenawee	3,647,353	3,691,986	Cement, sand and gravel, clays.
Livingston	3,524,001	2,669,798	Sand and gravel.
Luce	19,431	174,787	Do.
Mackinac	(2)	(2)	Stone, sand and gravel.
Macomb	1,413,951	1,198,716	Sand and gravel.
Manistee	11,261,619	11,925,724	Salt, salines, sand and gravel.
Marquette	52,104,695	34,148,536	Iron ore, sand and gravel.
Mason	5,732,846	(2)	Salines, lime, petroleum, sand and gravel, peat.
Mecosta	405,157	296,874	Petroleum, sand and gravel, stone.
Menominee	1,063,470	(2)	Lime, sand and gravel.
Midland	(2)	(2)	Salines, salt, petroleum, sand and gravel.
Missaukee	1,458,635	1,307,090	Petroleum, sand and gravel, stone.
Monroe	1,656,279	1,437,952	Stone, petroleum, clays, sand and gravel.
Montcalm	3,257,409	2,957,505	Petroleum, sand and gravel.
Montmorency	33,576	30,068	Sand and gravel, petroleum.
Muskegon	1,866,742	1,668,065	Sand and gravel, salt, petroleum.
Newaygo	(2)	399,436	Petroleum, sand and gravel, stone.
Oakland	5,970,354	5,617,678	Sand and gravel, petroleum.
Oceana	1,426,022	891,202	Petroleum, sand and gravel, stone.
Ogemaw	2,227,166	1,971,834	Petroleum, sand and gravel.
Osceola	2,178,732	2,335,279	Petroleum, sand and gravel, stone.
Oscoda	(2)	15,895	Sand and gravel, petroleum.
Otsego	101,019	37,679	Do.
Ottawa	2,318,681	2,139,083	Sand and gravel, petroleum, stone.
Presque Isle	(2)	(2)	Stone, sand and gravel.
Roscommon	(2)	1,311,090	Petroleum, sand and gravel.
Saginaw	(2)	(2)	Clays, petroleum, sand and gravel.
Saint Clair	13,281,160	12,875,153	Salt, cement, peat, petroleum, sand and gravel, clays.
Saint Joseph	255,218	(2)	Sand and gravel, stone.
Sanilac	160,055	313,942	Sand and gravel, peat.
Schoolcraft	68,029	(2)	Sand and gravel.
Shiawassee	474,389	299,914	Sand and gravel, clays.
Tuscola	1,920,049	1,449,806	Sand and gravel, petroleum, peat.

See footnotes at end of table.

TABLE 13.—Value of minerals produced in Michigan, by counties [1]—Continued

County	1957	1958	Minerals produced in 1958 in order of value
Van Buren	$319,817	$252,069	Sand and gravel, petroleum, stone.
Washtenaw	1,552,106	1,917,101	Sand and gravel, petroleum.
Wayne	40,241,243	35,582,807	Cement, salt, sand and gravel, clays, stone, petroleum.
Wexford	100,141	110,048	Sand and gravel.
Undistributed [4]	90,225,243	85,118,028	
Total [5]	404,673,000	343,483,000	

[1] Gem stones, natural gas, and natural-gas liquids not listed by counties as data are not available. Value included with "Undistributed."
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes value of mineral production in Keweenaw and Ontonagon Counties (1957–58).
[4] Includes value of items referenced in footnotes 1 and 2 sand and gravel (0957–58) and stone (1958) not assignable to specific counties.
[5] Total has been adjusted to eliminate duplicating value of clays and stone.

Allegan.—Petroleum valued at $679,000 was produced from 20 fields. Largest output came from the Dorr and Salem fields. The Salina formation of the Diamond Springs field was opened during the year, and the Cheshire and Otsego fields were abandoned. Sand and gravel, mostly for road construction and building use, was mined from eight pits. Small quantities of marl from pits near Dorr, Fennville, and Hopkins were sold for agricultural use.

Alpena.—At Alpena the Huron Portland Cement Co., operating one of the largest cement plants in the country with 26 kilns, produced portland and masonry cement. It also mined clay and limestone for use in manufacturing cement. As a part of the celebration of its 50th anniversary the company held a 7-day exhibit at Detroit to demonstrate how cement is made, tested, and used.

Sand and gravel for building and road use was produced near Alpena by Gilliland Construction Co. and Percy McKinnon.

Arenac.—Limestone for road use was quarried by the Arenac County Road Commission and the Bay County Road Commission. Petroleum, valued at $1.8 million, was produced at six fields; the Deep River and Sterling fields contributed the major part. Sand and gravel was produced at two pits.

Baraga.—Sand and gravel was produced by the county road commission and the Michigan Highway Department. The Ohio open-pit mine of The Cleveland-Cliffs Iron Co. was closed.

Barry.—Six sand and gravel pits contributed the major part of the county mineral production. Marl was dug from two pits near Nashville and Kalamazoo. The Hope field produced about 25,000 barrels of petroleum. Small production came from the Johnstown and Thornapple fields.

Bay.—Aetna Portland Cement Co. produced portland and masonry cement at Bay City. Monitor Sugar Division of Robert Gage Coal Co. produced lime for use in sugar refining. Over 750,000 barrels of petroleum was produced at eight fields in the county. The bulk of the production came from the Kawkawlin and Essexville fields. A small quantity of sand and gravel was produced by the Michigan State Highway Department.

The Bay Refining Corp. refined crude oil in Bay City.

An electric generating plant to cost $150 million and to provide virtually unlimited electric energy for industrial development was under construction.

A $17-million expressway connecting Bay City and Midland was under construction.

Beginning in 1958 the Federal Government planned to spend nearly $6 million to deepen and widen the bay and river channels into the port of Bay City. This expansion will allow freighters of more than 20,000 tons to dock at Bay City. Existing facilities limited dockage to vessels of less than 10,000 tons. The Dow Chemical Co., Midland, completed the first facility in the port of Bay City for handling foreign shipments by way of the St. Lawrence Seaway.

Berrien.—Most of the mineral production came from seven sand and gravel pits. Sand for molding and engine use as well as gravel for road construction were produced. A small quantity of marl was dug from pits near Benton Harbor and Three Oaks.

The Niles oilfield was abandoned. It had been opened in 1940 and had produced about 30,000 barrels of petroleum. Last production was reported in 1955.

Branch.—Case Brothers, Sherwood, dug marl from five leased pits. Sand and gravel for building and road construction was produced near Allegan and Coldwater. Near Coldwater, Climax Molydenum Co. started constructing a $1-million plant to produce molybdenum metal and molybendum-base alloys.

Calhoun.—Marl pits were operated near Athens, Burlington, and Union City. Sand and gravel valued at over $300,000 was produced at five pits. Most of the material was used in road construction.

Cass.—Marl was produced by Otto Poehlman, Jr., near Cassopolis and by Richard Grabemeyer near Dowagiac. Sand and gravel production was reported from four operations.

Charlevoix.—Limestone for flux and agricultural use and a small quantity of rough construction stone was produced by Charlevoix Lime & Stone Co. at Vanderbilt. Sand and gravel was produced at two pits.

Cheboygan.—Afton Stone and Lime Co. quarried limestone near Afton for concrete aggregate and road use. Sand and gravel was produced by two operators.

Chippewa.—Drummond Dolomite, Inc., produced limestone for a variety of uses, principally for flux, concrete aggregate and roadstone, and for agricultural use. During the year it began developing a new quarry on Drummond Island and also installed a sinter process at its mill.

Sand and gravel was produced by the I. L. Whitehead Co. at Sault Ste. Marie and by the county road commission.

Clare.—Petroleum, valued at near $1.8 million, was produced at nine fields. More than 50,000 barrels each was produced at the Cranberry Lake, Freeman-Redding, Hamilton, Headquarters, and Skeels fields. Natural gas was produced from gas and oil wells in the North Hamilton and Headquarters fields.

Clinton.—Clay for use in manufacturing heavy clay products was mined at Grand Ledge by the Grand Ledge Clay Product Co. Sand and gravel was produced at six pits.

Crawford.—The Beaver Creek field produced over 180,000 barrels of petroleum and nearly a billion cubic feet of natural gas. Sand and gravel was produced by the county and State highway departments for road use.

Delta.—Limestone, for concrete aggregate and roadstone, was quarried at Escanaba by Bichler Bros. and at Hancock by the Thornton Construction Co., Inc. Sand and gravel for building and road construction was produced at five pits and contributed a major part of the county mineral output.

Dickinson.—Iron ore was produced from the open-pit Bradley mine by Jackson Iron & Steel Co. The Cornell mine remained closed. The M. A. Hanna Co. continued developing its Groveland low-grade iron project begun in August 1957 near Randville. The project was to consist of an open-pit mine and concentrating plant, which was to have an estimated annual capacity of approximately 700,000 tons. The current rate of progress indicated that concentrate would be produced in time for the opening of the 1959 ore-shipping season in the Great Lakes by way of Escanaba. Output from the Metro-Nite Co. of Milwaukee, Wis., limestone quarry near Felch was shipped to its mill in Milwaukee for use in manufacturing paint, putty filler, and other products.

The Superior Rock Products Co., Randville quarry near Sagola, produced limestone for ornamental concrete. It installed a hammer mill and larger crusher and replaced old trucks with larger ones.

Sand and gravel for road use was produced at three sites.

Eaton.—Clay for heavy clay products was mined by American Vitrified Products Co. (Cleveland, Ohio) and Grand Ledge Clay Product Co. (Grand Ledge).

Near Bellevue, Cheney Limestone Co. quarried limestone for rubble, roadstone, and agricultural use. Sand and gravel was produced at five pits.

Emmet.—In Petoskey, Penn-Dixie Cement Corp. (Nazareth, Pa.) manufactured portland and masonry cement at its plant where it installed an 11 by 25-foot Nordberg two-compartment mill; it also produced shale and limestone used in manufacturing cement.

Road gravel was produced at one pit.

Genesee.—A small quantity of petroleum was produced at the Otisville field.

Nine sand and gravel pits contributed the bulk of county mineral output mostly for building purposes and road use.

Gladwin.—Output of petroleum valued at nearly $1.5 million came from 12 fields, the major production from Buckeye North and South, Grant, and Skeels fields. Road material was produced from two sand and gravel pits by the county and State highway departments.

Gogebic.—Iron ore was produced from four underground mines and one open pit. North Range Mining Co. produced direct-shipping ore from the Penokee underground mine, and Pickands Mather & Co., from the Geneva-Newport, Peterson, and Sunday Lake mines. Pittsburgh Pacific Co. made shipments from stocks at the Wakefield mine. Its lease on the Wakefield was canceled.

United States Metals Refining Co., subsidiary of American Metal-Climax, Inc., conducted exploration on the Nonsuch shale in an area

north of Wakefield. Diamond drilling indicated substantial quantities of copper-bearing material.

Sand and gravel was produced at six sites in the county.

Gratiot.—Michigan Chemical Corp. produced a variety of chemicals from natural well brines at St. Louis. The output included bromine compounds, calcium chloride, magnesium compounds, and salt.

Clay Products Co. (St. Louis) mined clay for manufacturing heavy clay products.

Petroleum was produced from the Elba and Sumner fields. The Pine River field was abandoned. Two crude oil refineries were operated at Alma by Leonard Refineries, Inc.

Sand and gravel was produced at six sites.

Hillsdale.—The most notable mineral development in the county was at the Scipio oilfield, discovered in 1957. Nineteen new wells were put into production in 1958, and more than half a million barrels of petroleum was recovered.

A small quantity of marl was dug from a pit near Reading.

Twelve sand and gravel operations reported production.

Houghton.—Copper was produced by Calumet & Hecla, Inc., Calumet, and Copper Range Co., Painesdale. Limestone for agricultural use was quarried by the Limestone Mountain Co., Hancock. The county road commission quarried basalt for use as roadstone. Sand and gravel was produced at two places.

Calumet & Hecla, Inc., operated the Ahmeek No. 2, Ahmeek No. 3, Allouez, Centennial No. 2, Peninsula, Seneca, Centennial No. 3, and Osceola No. 6 mines throughout the year. The Caledonia mine, active until June 1, was closed for the remainder of the year. The Iroquois and Osceola No. 13 mines, closed October 1957, did not produce in 1958. In November, development at Osceola No. 6 was stopped, and the crews were transferred to Osceola No. 13, where a crosscut was being driven from this shaft to mine a part of the Calumet conglomerate.

The overall grade of ore mined was about 10 percent higher than in 1957 and the highest since 1945.

The Tamarack reclamation plant produced about the same quantity of copper as in 1957. The grade increased slightly.

At the Caledonia exploration near Mass, test stoping continued for part of the year but was stopped to appraise the results.

Exploration in the Calumet area indicated a limited reserve of ore at the 9th level of Centennial No. 3. Results of test stoping at the 37th level drift of Centennial No. 2 were disappointing, and work was suspended.

Activity at Champion mine of the Copper Range Co. was reduced because of lower copper prices. The Freda concentrator milled ore from the Champion mine and tailings from the Redridge sands. The Quincy Mining Co. tailing-reclamation plant closed on December 31, 1957, and resumed operations in November. No shipments were reported for 1958.

Huron.—Limestone for concrete aggregate and roadstone, railroad ballast, and agricultural use, as well as rough construction stone, was quarried at Bay Port by The Wallace Stone Co.

Sand and gravel was produced at four sites. A small quantity of petroleum came from the Dwight and Grant fields.

Ingham.—Sand and gravel, valued at over $600,000, was produced at 10 places and used mostly for building and road construction.

Ionia.—Petroleum was produced at the Bloomer and Hubbardston fields.

The county mineral output came mostly from four sand and gravel pits and was valued at over $800,000.

Iosco.—A new operation of National Gypsum Co. at Tawas City on Lake Huron included a quarry 6 miles from a natural harbor at Tawas Bay and two railroad spurs; one spur connected the quarry and the harbor, the other linked the quarry and the products plant at National City with port facilities. The crude gypsum was crushed, screened, and stockpiled at the quarry. A reclaiming tunnel conveyor transferred the material to railroad cars for shipment to plant or port. At the port an automatic rail unloading station was installed inshore from the dock. A ½-mile conveyor-belt system moved the gypsum from a stockpile at the unloading station to the 1,100-foot dock, a fully automatic shiploading terminal. This equipment supplied crude gypsum to the National Gypsum Co. products plant at National City and was to supply plants under construction at Waukegan, Ill., and Lorain, Ohio.

United States Gypsum Co. operated a mine and products plant at Alabaster.

The county highway commission produced limestone for its own use.

Iron.—Iron ore was produced at nine underground mines. The M. A. Hanna Co. mined direct-shipping ores from the Cannon, Hiawatha 1 and 2, Homer, and Wauseca mines. The new circular Homer-Wauseca shaft reached a depth of over 2,400 feet in November and was expected to be completed at 2,700 feet early in 1959. It was to serve both mines and replace the original Homer and Wauseca shafts. The company also produced manganiferous ore from the Cannon mine. Inland Steel Co. operated the Bristol and Sherwood mines. North Range Mining Co. produced direct-shipping ore from the Warner mine until April 30. The leases were surrendered, and the property was abandoned later in the year. The company also mined and concentrated ore from the Book mine. Pickands Mather & Co. operated the Buck Unit mine. Shipments were made from stocks at the Fortune Lake mine, but the mine was not operated. The Tobin-Columbia-Monongahela mine was not operated during the year.

The county and State highway departments produced road gravel.

Isabella.—Petroleum valued at over $2.7 million was produced in 13 fields. The Fremont field was abandoned. Output of nearly 700,000 barrels, the major production, as well as a quantity of natural gas came from the Coldwater field. Leonard Refineries, Inc., operated a crude oil refinery at Mt. Pleasant. Marl was dug from three pits near Mt. Pleasant and Weidman.

Sand and gravel was produced at three sites.

Jackson.—At Napoleon The Original Sandstone Quarry, Ray's Stone Quarry and the Star Stone Co. produced flagging, rubble, and rough

construction stone. The sandstone, quarried from the Marshall sandstone, was the only commercial production in the State.

Marl was dug from two pits near Hanover and Horton.

Limestone for concrete aggregate, roadstone, and agricultural use was quarried and crushed near Parma by the Jeffrey Limestone Co.

Sand and gravel was produced at eight places and was used principally for building and road construction.

The Concord oilfield, discovered in 1953 and its last production reported in 1956, was abandoned. Cumulative production totaled 6,437 barrels of petroleum.

Kalamazoo.—Reed-sedge peat, dug from a bog near Kalamazoo by Craven's Peat Farm, was used for horticultural purposes. Pits near Climax, Kalamazoo, and Vicksburg yielded marl for soil conditioning.

A small quantity of petroleum was produced from the Alamo field. The Lakeside Refining Co. refined crude oil at Kalamazoo. Over 700,000 tons of sand and gravel was produced at six places.

Kalkaska.—Petroleum was produced from the Beaver Creek and Excelsior fields. The county road commission operated a sand and gravel pit for producing road materials.

Kent.—Bestwall Gypsum Co. and Grand Rapids Plaster Co. mined and processed crude gypsum into wallboard, lath, sheathing, and plaster at plants in the Grand Rapids area.

Rockford, Walker, and Wyoming Park oilfields yielded over 100,000 barrels of petroleum. Marvel Refining Co. refined crude oil at Grand Rapids.

Over 1.7 million tons of sand and gravel was produced in the county at 18 operations. The Grand Rapids Gravel Co. was the leading producer at its three plants.

Lake.—Petroleum was produced at the Chase, Reed City, and Sauble fields.

The county and State highway departments pits produced sand and gravel for road material.

Lapeer.—The Wilkinson Chemical Co. produced calcium chloride from natural brines near Mayville.

Kenneth J. Anderson dug peat from a bog near Imlay City.

Sand and gravel was produced at three sites.

A small quantity of petroleum was produced from the Marathon field.

Lenawee.—Consolidated Cement Corp. produced portland and masonry cements at Cement City and mined clay near Rollin for use in manufacturing cement. The Comfort Brick & Tile Co. (Tecumseh) mined clay for use in manufacturing heavy clay products.

Sand and gravel was produced at eight places.

Livingston.—Natural gas was produced in the Howell field.

Sand and gravel valued at nearly $2.7 million was produced in the county. American Aggregates Corp., the leading producer, used a dense-medium process to beneficiate part of its output.

Mackinac.—Inland Lime and Stone Co. operated a limestone quarry in Mackinac County and a mill and port facilities in adjacent Schoolcraft County. Michigan Limestone Division of U.S. Steel Corp. quarried and milled limestone at Cedarville. Thornton Construction Co., Inc., operated the Hendricks quarry near Garnot.

A large part of the county output of limestone was shipped by water to various industrial consumers; it was sold for flux, concrete aggregate and roadstone, agricultural and other purposes and to chemical plants and paper mills.

Sand and gravel was produced at four sites.

Macomb.—The county was one of the larger sand- and gravel-producing areas in the State. About 1.4 million tons was produced by 16 operators. The bulk of the output was used by the building industry and for road construction.

Manistee.—Natural brine drawn from the Filer sandstone of the Detroit River formation was used to produce bromine and magnesium compounds. Artificial brine, produced by dissolving salt from the Detroit River formation, was used to extract salt.

Morton Chemical Co., subsidiary of the Morton Salt Co. (Chicago, Ill.), produced bromine and magnesium compounds at Manistee. The Morton Salt Co. produced salt at its Manistee plant. Michigan Chemical Corp. (St. Louis, Mich.) produced bromine at its East Lake plant. Standard Lime & Cement Co. (Baltimore, Md.) produced magnesium compounds. Manistee Salt Works (St. Louis, Mo.) produced salt at Manistee. Great Lakes Chemical Corp. produced bromine. The company drilled a new brine well at its Manistee plant.

Sand and gravel was produced at four places. Molding and grinding and polishing sand as well as materials for building and road construction were produced.

Marquette.—Iron ore was produced from 10 underground and 4 open-pit mines. Both direct-shipping ore and lower grade jaspilite ores were mined. The Cleveland-Cliffs Iron Co. operated six underground mines and three open-pit mines. The Humboldt open pit was mined until March 15 when it was closed for the remainder of the year. Its output was concentrated. The Republic open pit, mined by Cleveland-Cliffs Iron Co. for the Marquette Iron Mining Co., produced jaspilite ore, which was concentrated at the flotation plant and shipped to the Eagle Mills plant for pelletizing. Inland Steel Co. operated the Greenwood and Morris underground mines.

Jones & Laughlin Steel Corp. mined direct-shipping ore from the Tracy underground mine.

North Range Mining Co. produced from the Champion mine (underground), and Pickands Mather & Co. operated the Volunteer-Maitland open-pit mine.

Mason.—The Dow Chemical Co. (Midland) produced bromine, calcium chloride, and magnesium compounds from natural brines at its Ludington plant. It also produced quicklime at Ludington for use in chemical processing, in steel plants, in paper manufacturing, and for water purification. Harbison-Walker Refractories Co. (Pittsburgh, Pa.) produced refractory magnesium at Ludington.

Irving L. Pratt & Son dug moss peat from a bog near Scottsville.

Molding and grinding and polishing sand and road materials were produced from sand and gravel pits in the county.

Petroleum was produced at six fields. The Oxbow field, opened in 1958, produced 3,000 barrels. The Hamlin and Victory fields were abandoned after yielding about 1,200 barrels in 1958. The Hamlin field, opened in 1952, had produced a cumulative 60,500 barrels, and

the Victory field, opened in 1957, about 600 barrels. Major production in 1958 came from the Eden and Riverton fields (230,000 barrels).

Mecosta.—Marl for agricultural use was dug from pits near Blanchard and Mecosta. Sand and gravel was produced at three places. About 75,000 barrels of petroleum was produced from four fields. Natural gas was produced in the Martiny field.

Menominee.—The Limestone Products Co., purchased by Northwestern-Hanna Fuel Co. (Minneapolis, Minn.) on April 1, was continued as Limestone Products Division, producing quick and hydrated lime for chemical and industrial uses. Sand and gravel was produced at three places in the county.

Midland.—Natural brine from the Sylvania formation was processed by The Dow Chemical Corp. into bromine and magnesium compounds, calcium chloride, and potash. It also produced salt from artificial brine, by dissolving salt from the Detroit River formation.

Petroleum valued at $1 million was produced from seven fields. Major production came from the Porter and Mt. Pleasant fields.

Sand and gravel was mined at three sites. Molding sand as well as materials for building and road construction were produced.

Missaukee.—Four oilfields yielded 440,000 barrels of petroleum. Largest production came from the East Norwich and Enterprise fields. Some natural gas was produced in the East Norwich field.

Marl was dug from a pit near Cadillac. Road gravel was produced at one pit.

Monroe.—Limestone was quarried near Monroe by The France Stone Co. (Toledo, Ohio) and Edward Kraemer & Sons (Plain, Wis.). The Michigan Stone Co. quarried at Ottawa Lake. The county highway commission operated the Grape quarry, producing material for concrete aggregate and road use. Limestone produced in the county was also used for riprap, flux, railroad ballast, and agricultural purposes.

F. W. Ritter Sons Co. mined miscellaneous clays at South Rockwood for use in manufacturing pottery. A small quantity of road gravel was produced at one place. Petroleum came from the Deerfield and Summerfield fields; the latter field was opened in 1958 and yielded a few hundred barrels.

The Dundee Cement Co. continued to construct its multimillion dollar cement plant partly because of large deposits of limestone and clay.

Montcalm.—Petroleum valued at $2.8 million was produced at 10 fields. The Reynolds and Edmore fields, the major producers, yielded over 800,000 barrels. Crude oil was refined at Carson City by the Crystal Refining Co. of Carson City, Ind.

Sand and gravel was produced at four places.

Muskegon.—Hooker Electrochemical Co. produced salt from artificial brines at Montague.

Sand and gravel was mined at five places. Production included molding sand as well as gravel for road use. Petroleum was produced at five fields. Crude oil refineries were operated at Muskegon by Aurora Gasoline Co. and Naph-Sol Refining Co.

Newaygo.—Petroleum was produced at seven fields. Output was 122,000 barrels. The Sheridan field was opened by a single well in

1958 and abandoned after having produced 136 barrels of petroleum. The Croton field, opened in 1951, also was abandoned; its cumulative production was 92,000 barrels.

Marl was produced from a pit near Grant. Sand and gravel was mined at three sites.

Oakland.—Nearly 5.8 million tons of sand and gravel were produced at 28 operations.

American Aggregate Corp. (Greenville, Ohio) plant at Oxford was the leading producer. Much of the material was used in building and highway construction in the Detroit area. A small quantity of petroleum came from the Oakland County part of the Northville field.

Oceana.—About 300,000 barrels of petroleum was produced at seven fields; the largest production was reported from the Pentwater and Stony Lake fields. A small quantity of marl and road gravel was produced.

Ogemaw.—Petroleum and natural gas were the major mineral commodities produced in the county. Sand and gravel, obtained at five places, was used largely for road material.

The Rose City field produced nearly three-quarter billion cubic feet of natural gas and over 285,000 barrels of petroleum. The West Branch field yielded 329,000 barrels of petroleum. Petroleum production was also reported from the Clayton and Mio fields.

Crude oil was refined at West Branch by West Branch Refineries, Inc.

Ontonagon.—The White Pine Copper Co. reduced the work schedule at its mine, mill, and smelter during the second and third quarters of the year, bringing copper production into line with consumption; full production was resumed in the last quarter. Ore production was slightly higher than in 1957. In April experimental production from the full column of copper-bearing material was begun in the northeast area of the mine and later extended to some of the southeast headings. The conveyor-belt system in the mine was expanded by completing the extension of the northeast belt and by starting an extension to the southeast belt. The system substantially reduced the problem of long hauls by truck in the mine.

The Old White Pine mine was dewatered and connected to the present workings and also to the Schact Shaft experimental mine.

At the mill, metallurgical recoveries were increased because of the continuing research program. The tailings dam was extended, and late in the year construction was started on an additional dam, which was to be adequate for all tailings until 1973, at the current rate of production. Installation of a dust precipitator at the smelter was completed in March. A substantial quantity of copper that otherwise would be lost in flue gases was to be recovered annually. Construction was started on a second refining furnace, which was to permit expanded production at reduced costs when it goes into operation in 1959. Modifications increased the capacity of the waste-heat boiler by 25 percent. A bypass was installed from the exhaust end of the smelter reverberatory furnace around the waste-heat boiler, permitting the furnace to operate independently of the boiler if necessary.

Sand and gravel for road use was produced at three places in the county.

Osceola.—Marl was produced from two pits, and sand and gravel at three sites.

Over 700,000 barrels of petroleum was produced at eight fields. Largest output was from Reed City field, which also produced ⅓ billion cubic feet of natural gas. Osceola Refining Co., Inc., refined crude oil at Reed City.

Ottawa.—Over 1.7 million tons of sand and gravel was produced at eight operations. The Construction Aggregates Corp. (Chicago, Ill.) plant at Ferrysburg was the largest operation. Nearly half of the tonnage produced in the county was shipped by water to consumers in other areas. Industrial sands as well as materials for building and road construction were produced.

Marl was produced from pits near Jenison and West Olive. Petroleum was produced at five fields; the major output came from the Walker field.

Presque Isle.—The Michigan Limestone Division of U.S. Steel Corp. limestone quarries and mills at Rogers City were some of the largest in the United States. A second large quarry near Presque Isle was operated by the Chemstone Corp. for the Presque Isle Corp. Nearly the entire output of these quarries was shipped by water. The crushed limestone was used for flux, cement, concrete aggregate, lime and agricultural, chemical, and other industrial purposes.

The Onaway Stone Co. quarried dimension limestone (rough construction stone, sawed stone, and flagging) near Onaway.

Sand and gravel was produced at two operations.

Roscommon.—Over $1 million of petroleum was produced at five fields. East Norwich, Enterprise, Headquarters, and St. Helen fields each yielded over 100,000 barrels. The St. Helen field produced over ¾ billion cubic feet of natural gas.

Road gravel was produced at two sites.

Saginaw.—Miscellaneous clay was mined by Aetna Portland Cement Co., for use in cement manufacture at its plant at Bay City, and by Minco Products Corp. (Saginaw) for use in foundry refractories and as fertilizer filler and oil-well-drilling mud.

A small quantity of road gravel was produced at two places.

Petroleum output from five fields totaled over 90,000 barrels. Birch Bela and Birch Run fields contributed a major part of the production.

St. Clair.—Peerless Cement Co. (Detroit), division of the American Cement Corp., produced portland cement at Port Huron and mined clay used in manufacturing cement.

Diamond Crystal Salt Co. at St. Clair and Morton Salt Co. at Marysville produced salt from artificial brine by dissolving salt from the Salina formation.

Green Thumb Peat Humus Co. and Michigan Peat, Inc., produced reed-sedge peat from bogs near Capac.

Sand and gravel was produced at five pits.

Petroleum was produced at three fields and natural gas at three fields. The Boyd field, opened in 1952 as a gasfield, began producing petroleum. The county produced about 76,000 barrels of petroleum and 550 million cubic feet of natural gas.

St. Joseph.—Two marl pits were operated near Three Rivers. Material for building and road construction was produced at two sand and gravel pits.

Sanilac.—The Great Lakes Peat Moss Co. produced moss peat from a bog near Sandusky. It was sold for horticultural use.

Sand and gravel was produced at four sites, mostly for building construction and road use.

Shiawassee.—The Michigan Vitrified Tile Co. mined miscellaneous clays at Corunna for use in manufacturing heavy clay products. Sand and gravel was produced at six sites.

Tuscola.—The county continued to be one of the major sand- and gravel-producing areas in the State. Production totaled 1.1 million tons and included molding sand as well as materials for building and road construction.

Moss peat was produced from a bog near Caro by Rushland Peat Co.

Over 150,000 barrels of petroleum was produced at four fields. Largest output came from the Akron field (126,000 barrels).

Van Buren.—Industrial sands (molding and engine) as well as materials for road construction were produced from sand and gravel pits in the county. Near Paw Paw, Clarence Harter produced marl for agricultural use.

Petroleum was produced at four fields.

Washtenaw.—Sand and gravel valued at over $1.7 million was produced by 10 operators. Part of the material was beneficiated at two plants. At Ann Arbor, Killins Gravel Co. used a dense-medium process, and at Ypsilanti, Whittaker & Gooding Co. used elastic fractionation.

Petroleum and natural gas were produced at the Northville field.

Wayne.—In 1958, Wayne County led in the value of mineral commodities—cement, clay, salt, sand and gravel, limestone, petroleum, natural gas, and sulfur.

Peerless Cement Co., division of American Cement Corp., operated two cement plants in Detroit and produced portland and masonry cements. Four kilns were operated. The company mined the clay used in producing cement but purchased the other raw materials. At Wyandotte, the Wyandotte Chemicals Corp. produced portland and masonry cement and it operated two kilns. The plant was closed during all of December for installing coal-firing equipment.

Flat Rock Clay Products Co. mined miscellaneous clay near Flat Rock for use in manufacturing draintile. At Livonia, the Light Weight Aggregate Corp. mined and used clay for producing lightweight aggregate.

International Salt Co. produced salt from an underground mine in Detroit. Salt was produced from artificial brine by Pennsalt Chemicals Corp. and Wyandotte Chemical Corp. at Wyandotte, and in Detroit by the Solvay Process Division of Allied Chemical & Dye Corp. The last plant ceased operations in 1958.

Salt produced in the county was used for making chlorine, soda ash, and many chemical and industrial purposes.

Limestone produced by Edward Kraemer & Sons and by the Michigan Foundation Quarry at Trenton, was used for concrete aggregate and roadstone.

Over 2 million tons of sand and gravel was produced by 11 operators. In addition to materials for building and road construction, a large tonnage of industrial sand (glass, molding, and blast) was produced.

Byproduct sulfur was produced from crude petroleum by the Aurora Gasoline Co. Petroleum (31,000 barrels) and natural gas (1.5 billion cubic feet) were produced at the Northville field.

Aurora Gasoline Co. operated two crude-oil refineries in Detroit; Petroleum Specialties, Inc., operated a refinery at Flat Rock; and Socony-Mobil Oil Co., Inc., operated a refinery at Trenton.

The Mineral Industry of Minnesota

By Matthew G. Sikich [1]

MINNESOTA mineral output in 1958 was valued at approximately $396 million, a 32-percent decline from the record high of 1957. The chief reason for this marked drop was the reduced demand for iron ore by the Nation's steel industry, adversely affected by lower economic activity part of the year. Shipments of iron ore from Minnesota mines were the lowest since 1939. Decreases in value of production from the previous year were recorded for clays, iron ore, lime, manganiferous ores, peat, and tube-mill liners. Contrary to the decline in output for most minerals in the State, records were established for sand and gravel and stone, mainly because of the high level of road construction in the State in 1958.

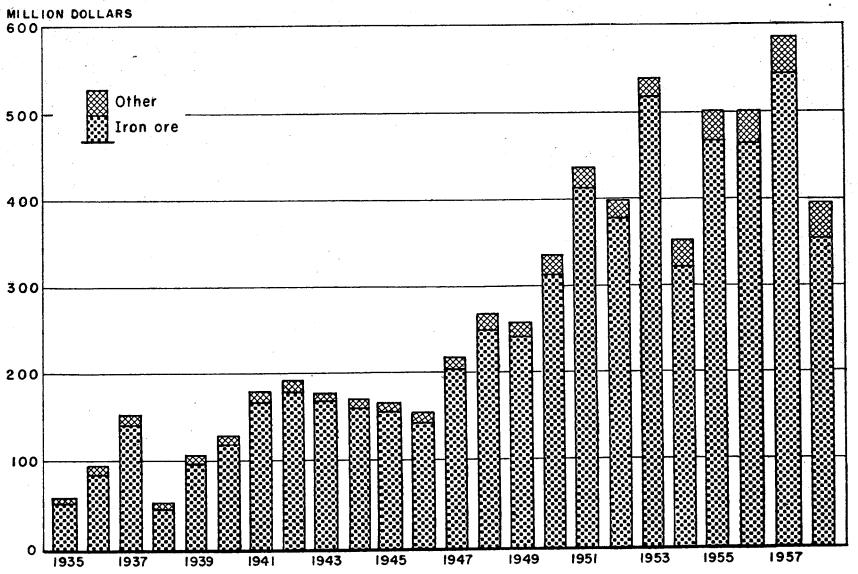

FIGURE 1.—Value of iron ore shipments and total value of all minerals produced in Minnesota, 1935–58.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.

TABLE 1.—Mineral production in Minnesota [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Clays.....thousand short tons	[2] 97	[2] $113	92	$150
Iron ore (usable).....thousand long tons, gross weight	67,656	541,474	42,502	354,528
Manganiferous ore (5 to 35 percent Mn) thousand short tons, gross weight	692	[3]	371	[3]
Peat	1,300	[3]	[3]	[3]
Sand and gravel.....thousand short tons	28,493	19,385	29,634	21,680
Stone.....do	[4] 2,968	[4] 8,175	3,519	9,560
Value of items that cannot be disclosed: Abrasive stones, cement, fire clay (1957), gem stones, lime, manganese ore (1957), stone (crushed sandstone and calcareous marl 1957), and values indicated by footnote 3	----------	[5] 15,107	----------	10,154
Total Minnesota [6]	----------	[5] 584,038	----------	395,880

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Incomplete figure; fire clay included with "Items that cannot be disclosed."
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Excludes certain stone, value of which is included with "Items that cannot be disclosed."
[5] Revised figure.
[6] Total adjusted to eliminate duplicating the value of stone.

Employment and Injuries.—Preliminary data indicated a total of 30 million man-hours worked in the State mineral industry in 1958, an 18 percent decrease from 1957. The drop was due primarily to the cutback in iron-ore production. Only one fatality—in the granite industry—was recorded in the State mining and processing activities in 1958, a marked improvement over the seven reported in 1957. The total number of nonfatal lost-time injuries increased from 256 in 1957 to 386 in 1958.

For the first time in the history of iron-ore mining in Minnesota, not a single fatality or injury resulting in permanent-total disability was recorded for that industry. Nearly 24 million man-hours were worked in the iron-mining industry in 1958 compared with about 32 million in 1957. Two iron mines in the State won top honors in their respective groups of the 1958 National Safety Competition. They were the Erie Commercial mine operated by Pickands Mather & Co., winner in the open-pit group, and the Pioneer mine operated by Oliver Iron Mining Division of United States Steel Corp., winner in the underground metal-mine group. Both mines were operated the entire year of 1958 without a lost-time injury.

All employment and injury data for the mineral industry of the State were collected from operating companies on a voluntary basis. Data represent virtually complete coverage for most of the mineral commodities, although data for limestone and sand and gravel operations represented less coverage.

Legislation and Government Programs.—Minnesota prepared to sell leases on 120,000 acres in Cook, Lake, and St. Louis Counties to explore copper-nickel deposits. The Minnesota Division of Lands and Minerals began preparing rules and regulations governing these leases and issued a Copper-Nickel Mining Unit Book containing legal descriptions of the land involved.

In August construction was begun on a new $1.7 million experiment station of the Federal Bureau of Mines at Fort Snelling. The station was to be headquarters for Bureau research activities—mining, metallurgical, and other mineral-industry research—embracing the North Central States. Work on the new facilities was expected to be completed in October 1959.

REVIEW BY MINERAL COMMODITIES

METALS

Iron Ore.—Shipments of iron ore from Minnesota mines (excluding ore containing 5 percent or more manganese, natural) decreased 37 percent below 1957 and was the lowest in 20 years. The decline in output principally was due to the lessened demand for ore by the steel industry, whose operating rate fell as low as 47 percent of average rated ingot capacity in April. However, consumption of iron ore and steel production increased steadily the latter part of 1958. Steel plants were operating at an average rate of about 75 percent capacity at the close of the year. The average operating rate for the year was 60.6 percent, compared with 84.5 percent in 1957. Average rated capacity for blast furnaces fell from 91.4 percent in 1957 to 72.6 percent in 1958. Minnesota continued its lead among the iron-ore producing States and supplied 65 percent of the total usable iron ore shipped from mines in the United States.

With the cutback in production, operations at many of the mines in the State were curtailed or suspended. Most of the mines operated worked on reduced schedules. Some were able to hold to a 5-day workweek. Iron ore was shipped by 21 companies operating mines in Crow Wing, Fillmore, Itasca, and St. Louis Counties. Mines in the Mesabi range (in Itasca and St. Louis Counties) supplied approximately 94 percent of the total usable iron ore shipped. Nearly 98 percent of the crude ore mined was from open-pit mines; the remainder, from underground mines. Over 74 percent of the total tonnage of crude material mined was beneficiated. Concentrate constituted 55 percent of the total usable ore shipped. Direct-shipping grades comprised 45 percent of the total compared with 55 percent in 1957. Average iron content of usable ore produced was 54.0 percent, natural analysis, compared with 52.5 percent in 1957.

Shipments of taconite concentrate were nearly 9 million long tons and comprised 21 percent of the total iron-ore output, compared with 10 percent in 1957. In its first full year of operation, the Hoyt Lakes Plant of Erie Mining Co. (operating agent, Pickands Mather & Co.) produced nearly 3 million tons of pelletized taconite concentrate. However, because of the lesser demand for ore, the plant was not operated on a full production basis. Other producers of taconite concentrate were Oliver Iron Mining Division of United States Steel Corp. and Reserve Mining Co.

More than 99 percent of the ore shipped was for use in manufacturing pig iron and steel. A small quantity of magnetite concentrate was used as a dense medium for mineral beneficiation. Some was sold for use in manufacturing cement. Approximately

98 percent of the iron ore shipped from Minnesota mines was hauled by rail to Lake Superior harbors, transported by vessel to lower Lake ports, and thence to consuming districts. The remainder was shipped by rail to consumers. Some Minnesota iron ore was consumed at blast and steel furnaces at Duluth by Interlake Iron Corp. and the American Steel and Wire Division of United States Steel Corp. Both companies also operated coke ovens at Duluth.

The 1958 navigation season for Minnesota ore shipments opened April 26 at Silver Bay. The final vessel cargo of the season left the Superior, Wis., harbor on December 1. The season was opened later than usual because of the high stock level at lower lake ports, which precluded the need to start shipping early.

TABLE 2.—Dates of first and final cargoes of iron ore at United States upper lake ports [1]

Port and dock	1956		1957		1958	
	First	Final	First	Final	First	Final
Ashland, Wis.:						
C&NW	Apr. 25	Nov. 28	Apr. 28	Nov. 23	May 18	Nov. 20
Soo Line	Apr. 23	Nov. 25	Apr. 28	Nov. 23	May 18	Nov. 20
Duluth, Minn.: DM&IR	Apr. 8	Dec. 15	Apr. 9	Nov. 11	May 17	Oct. 26
Escanaba, Mich.: C&NW	Apr. 7	Dec. 3	Apr. 1	Nov. 29	May 1	Dec. 5
Marquette, Mich.:						
DSS&A	Apr. 26	Nov. 11	May 17	Oct. 21	June 10	Oct. 27
LS&I	Apr. 9	Dec. 5	Apr. 27	Nov. 26	Apr. 26	Dec. 7
Silver Bay, Minn.: Reserve	Apr. 6	Dec. 14	Apr. 10	Nov. 19	Apr. 26	Nov. 27
Superior, Wis.:						
G.N	Apr. 5	Dec. 8	Apr. 17	Dec. 3	May 2	Dec. 1
NP-Soo Line	Apr. 8	Nov. 25	Apr. 21	Oct. 30	May 11	Nov. 29
Taconite Harbor: Erie	----------	----------	Sept. 26	Nov. 19	May 6	Nov. 29
Two Harbors, Minn.: DM&IR	Apr. 8	Dec. 19	Apr. 9	Nov. 23	May 14	Nov. 19

[1] Source: Skillings' Mining Review, Dec. 13, 1958, p. 22.

Lake Erie base prices for iron ore in effect throughout the entire year were the same as in 1957. In 1958 the average weighted mine value for Minnesota iron ore was $8.34 a long ton compared with $8.00 the preceding year. The 4-percent increase was attributable to the higher percentage of taconite concentrate shipped and the repeal of the 3-percent Federal Transportation Tax on rail and lake freight rates. Increases in rail freight rates and dock handling charges tended to affect the mine value adversely.

Ore sizing gained importance in providing a better feed for blast furnaces. Oliver Iron Mining Division's two large ore-sizing plants at the Rouchleau and Sherman group mines completed their first full year of operation. Work was underway to double the capacity of the crushing and screening facilities at Oliver's Stephens mine near Aurora. The company also put into operation a large heavy-medium separation unit at the Trout Lake concentrator near Coleraine and added a heavy-medium section to the Hull-Rust beneficiation plant near Hibbing.

TABLE 3.—Usable iron ore produced (direct-shipping and all forms of concentrate), by ranges in thousands of long tons [1]

Year	Cuyuna	Mesabi	Vermilion	Spring Valley district	Total
1949-53 (average)	2,446	64,332	1,597	317	68,691
1954	1,497	45,725	1,372	158	48,752
1955	2,771	64,860	1,454	271	69,356
1956	2,242	59,346	1,285	350	63,222
1957	2,018	64,537	1,349	382	68,286
1958	1,119	39,833	1,027	241	42,221

[1] Exclusive of iron ore containing 5 percent or more manganese.

TABLE 4.—Production, shipments, and stocks of usable iron ore, by counties and ranges, thousands of long tons [1]

County or range	Stocks Jan. 1, 1958	Production	Shipments	Stocks Dec. 31, 1958	Iron content of production
County:					
Crow Wing	218	1,119	1,147	191	555
Fillmore	----------	241	241	----------	116
Itasca	1,022	10,006	10,273	755	5,337
St. Louis	1,663	30,854	30,841	1,676	16,785
Total [2]	2,904	42,221	42,502	2,622	22,793
Range:					
Cuyuna	218	1,119	1,147	191	555
Mesabi	2,518	39,833	40,037	2,315	21,535
Vermilion	167	1,027	1,077	117	587
Spring Valley district (Fillmore County)	----------	241	241	----------	116
Total [2]	2,904	42,221	42,502	2,622	22,793

[1] Exclusive of ore containing 5 percent or more manganese.
[2] Data do not add to totals shown because of rounding.

TABLE 5.—Production, shipments, and stocks of crude ore, by counties and ranges, in thousands of long tons [1]

County or range	Stocks Jan. 1, 1958	Production		Shipments		Stocks Dec. 31, 1958
		Underground	Open pit	Direct to consumers	To beneficiation plants	
County:						
Crow Wing	61	315	1,162	426	1,069	44
Fillmore	----------	----------	378	----------	378	----------
Itasca	----------	----------	22,495	352	22,143	----------
St. Louis	1,006	1,452	48,449	18,435	31,634	837
Total [2]	1,067	1,767	72,484	19,214	55,224	881
Range:						
Cuyuna	61	315	1,162	426	1,069	44
Mesabi	838	426	70,943	17,710	53,777	720
Vermilion	167	1,026	1	1,077	----------	117
Spring Valley district (Fillmore County)	----------	----------	378	----------	378	----------
Total [2]	1,067	1,767	72,484	19,214	55,224	881

[1] Exclusive of ore containing 5 percent or more manganese.
[2] Data do not add to totals shown because of rounding.

TABLE 6.—Salient statistics of iron ore shipped from mines in Minnesota, in thousand long tons [1]

Year	Crude ore to concentrators	Beneficiated			Total usable ore [2]	Proportion of beneficiated to total usable ore (percent)
		Agglomerates	Other	Total		
1949–53 (average)	38,397	514	19,523	20,037	68,617	29.20
1954	38,470	1,335	17,859	19,195	48,613	39.48
1955	50,734	1,793	23,988	25,781	69,419	37.14
1956	59,425	5,309	21,948	27,257	62,637	43.52
1957	68,439	6,836	23,539	30,375	67,656	44.90
1958	55,224	8,829	14,460	23,289	42,502	54.79

[1] Exclusive of ore containing 5 percent or more manganese.
[2] Direct-shipping and beneficiated ore.

The M. A. Hanna Co. continued the stripping of overburden at the Pierce group near Hibbing that had started in mid-1957. More than 3 million cubic yards of material was moved in 1957–58. Shipments from the mine were expected to begin in 1959. A beneficiation plant, with heavy-medium and spiral circuits, was to be constructed on the property. The M. A. Hanna Co. also resumed stripping at the Robert mine in the Cuyuna range late in 1958. A crushing plant was under construction at this property.

The Zenith mine at Ely, operated by Pickands Mather & Co., was closed and its lease surrendered by the company. Shipments had been recorded from this mine in virtually every year since its opening in 1892.

Statistical data for iron ores containing 5 percent or more manganese, natural, are not included with iron-ore data in this chapter but are treated separately as "Manganiferous Ore."

Manganese Ore.—Manganese carbonate, manganese dioxide, and other manganese products were produced by Manganese Chemicals Corp. at its plant near Riverton. The company used an ammonium carbamate leaching process to recover manganese from Cuyuna-range manganiferous ores. Experiments were made on the production of metallic manganese. Total sales of all products decreased from 1957.

Manganiferous Ore.—Shipments of manganiferous ore (containing 5 to 35 percent manganese, natural) decreased 46 percent below 1957 because of the reduced demand for ore by the steel industry. The entire output was from seven mines in Crow Wing County in the Cuyuna range. Producing companies during the year were The M. A. Hanna Co., Pickands Mather & Co., and Pittsburgh Pacific Co. (Zontelli Brothers Division).

Shipments consisted of 73,000 short tons of direct-shipping grade and 298,000 short tons of concentrate. Over 91 percent of the 816,000 short tons of crude manganiferous ore mined was beneficiated by washing, jigging, and heavy-medium processes. Manganiferous iron ore (containing 5 to 10 percent manganese, natural) constituted 86 percent of the total shipments. Ferruginous manganese ore (containing 10 to 35 percent manganese, natural) comprised the remainder. Average manganese content of the total shipments was 7.16 percent, compared with 7.94 percent in 1957.

Total value of manganiferous ore shipped from Minnesota decreased 44 percent. Ores containing over 5 percent manganese, natural, generally have been priced as Old Range Non-Bessemer on the combined natural iron and manganese content, plus a premium for the natural manganese exceeding 5 percent. Most of the ore shipped was for use in blast or steel furnaces. Some was sold to Manganese Chemicals Corp. for processing at their Riverton plant.

TABLE 7.—Shipments, with average iron and manganese contents, of usable [1] manganiferous iron ore (containing 5 to 10 percent Mn, natural) and ferruginous manganese ore (containing 10 to 35 percent Mn, natural) from mines in the Cuyuna range, in long tons

Year	Manganiferous iron ore			Ferruginous manganese ore			Total shipments
	Shipments	Contents (natural)		Shipments	Contents (natural)		
		Fe, percent	Mn, percent		Fe, percent	Mn, percent	
1949–53 (average)	819,431	37.50	5.90	47,680	33.47	11.49	867,111
1954	443,308	40.65	5.65	6,743	30.22	10.96	450,051
1955	669,056	39.63	5.90	102,933	33.47	13.15	771,989
1956	481,946	38.01	6.58	84,053	[2] 31.82	11.93	565,999
1957	438,820	39.58	6.28	179,301	34.20	12.02	618,121
1958	285,995	41.47	6.22	44,901	34.51	13.14	330,896

[1] Direct-shipping and beneficiated ore.
[2] Partly estimated.

The Federal Bureau of Mines published a report of investigations for 1949–56 of manganese deposits in the Cuyuna range.[2]

Nickel and Copper.—The Minnesota Division of Lands and Minerals began preparation of rules and regulations governing leases on State-owned lands that it planned to sell for exploration of copper-nickel deposits. The lands involved were 13,000 acres in Cook County, 8,000 in Lake County, and nearly 100,000 in St. Louis County.

The copper and nickel sulfide mineral occurrences in this area were discovered in 1948. The area has since been investigated by Government agencies and private companies. International Nickel Co. did exploratory diamond drilling. Several reports on fieldwork have been published.[3]

NONMETALS

Abrasives.—Grinding pebbles and tube-mill liners were produced by the Jasper Stone Co., of Sioux City, Iowa, from its quartzite deposit in Rock County. Output of grinding pebbles increased over 1957, but that of tube-mill liners decreased. Unit value for tube-mill liners decreased considerably, whereas that for grinding pebbles rose

[2] Lewis, W. E., Heising, L. F., Pennington, J. W., and Prasky, C., Investigation of Cuyuna Iron-Range Manganese Deposits, Crow Wing County, Minn., Progress Report 1: Bureau of Mines Rept. of Investigations 5400, 1958, 49 pp.

[3] Schwartz, G. M., and Harris, J. M., Notes on Field Work in the Copper-Nickel Prospect Area, Lake County, Minn.: Minnesota Geol. Survey Summary Rept. 6, November 1952, 8 pp.

Harris, J. Merle, Further Notes on Field Work in the Copper-Nickel Prospect Area, Lake and St. Louis Counties, Minn.: Minnesota Geol. Survey Summary Rept. 7, June 1954, 4 pp.

Grosh, W. A., Pennington, J. W., Wasson, P. A., and Cooke, S. R. B., Investigation of Copper-Nickel Mineralization in Kawishiwi River Area, Lake County, Minn.: Bureau of Mines Rept. of Investigations 5177, 1955, 18 pp.

slightly. Sales were affected by the recession and by imports. Waste material from the operation was sold to a railroad company for use as riprap.

Cement.—The Universal Atlas Cement Co. produced portland and masonry cements at Duluth, in St. Louis County. The company was the sole producer of cement in the State. Total output was slightly greater than in 1957, principally because of the increase in highway construction. Portland-cement output was comprised of types I and II (general use and moderate heat) and portland-slag cement. Masonry cement was marketed under the name of Atlas Mortar. Principal raw materials used were limestone, gypsum, blast-furnace slag, and iron dust. Production at the plant was curtailed for about 6 weeks early in the year to permit the installation of new equipment. The plant has one 200-foot and two 150-foot kilns.

Clays.—Production of clays for manufacturing building brick, art pottery, floor tile, vitrified sewer pipe, and other products was reported by five companies. Operations were in Brown, Carlton, Goodhue, Ramsey, Redwood, and Winona Counties. Markets for the clay products were chiefly in Minnesota and neighboring States. Products were shipped to consumers by truck or rail; truck haulage was common for shorter distances.

Red Wing Potteries, Inc., produced high-quality semivitrified dinnerware and art pottery at Red Wing from raw materials produced in other States.

Gem Stones.—A small quantity of semiprecious gem stones, consisting chiefly of agate and thomsonite, was collected by hobbyists. Gem materials were found principally along the north shore of Lake Superior, along the Mississippi River, and in gravel pits in Winona County. Collection of gem stones has gained in popularity as a hobby. The material was used primarily for personal gem collections or in handmade jewelry.

Lime.—Quicklime and hydrated lime were produced by Cutler-Magner Co. at its plant in Duluth, the only lime plant in the State. Total output increased slightly over 1957; however, value decreased slightly from the preceding year. Nearly 91 percent of total sales was for chemical and industrial purposes, principally paper manufacture, water purification, and metallurgical uses. The remainder was sold for building and agricultural purposes. Calcining at the plant was performed in a rotary kiln, with bituminous coal as fuel.

Perlite.—Crude perlite from Western States was expanded at plants in Minneapolis operated by Minnesota Perlite Corp. and Western Mineral Products Co. Total output of the expanded product increased nearly 8 percent in quantity over 1957. The material was sold for use as lightweight aggregate in building plaster and concrete, loose fill insulation, soil conditioning, and for other purposes.

Sand and Gravel.—A new alltime high was established in the production of sand and gravel in Minnesota. Output was 4 percent greater in quantity and 12 percent greater in value over the previous record year of 1957. Increased road-construction activity was the chief reason for the record output, with approximately 1.3 million more tons used for paving and road use in 1958 than in the preceding year. A 10-percent increase in the amount of material for building use furnished part of the gain in total output. A considerable

decrease in consumption of material for railroad ballast partially offset gains recorded for building and paving use.

Production was reported from virtually every county. Major producing counties were Becker, Hennepin, St. Louis, Stearns, and Washington.

Of the quantity produced, 76 percent was for paving use. Sand and gravel for building purposes constituted 20 percent of the total output. Some output was used as railroad ballast. Lesser quantities of special types of sands were consumed for molding, sandblasting, engine use, and glass manufacture. Commercial operations furnished 55 percent of the total production; Government-and-contractor operations supplied the remainder. Methods of transportation to consumers consisted chiefly of truck haulage, comprising over 90 percent of the total. About 6 percent of the total production was transported by rail, 3 percent by river barge, and the remainder unspecified.

TABLE 8.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1957		1958	
	Short tons (thousand)	Value (thousand)	Short tons (thousand)	Value (thousand)
COMMERCIAL OPERATIONS				
Sand:				
Building	2,928	$2,452	3,151	$2,748
Paving	1,216	1,005	1,781	1,379
Fill	240	181	193	128
Other	98	392	(1)	(1)
Undistributed [2]	201	306	190	519
Total	4,683	4,335	5,316	4,774
Gravel:				
Building	2,377	3,552	2,567	3,685
Paving	7,484	5,066	7,744	6,190
Railroad ballast	1,025	533	379	280
Fill	155	52	383	188
Other	127	95	3	1
Total	11,169	9,298	11,077	10,344
Total sand and gravel [3]	15,852	13,634	16,392	15,118
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	4	1	22	8
Paving	626	160	520	206
Total	630	161	542	214
Gravel:				
Building			111	47
Paving	12,011	5,591	12,589	6,300
Total	12,011	5,591	12,700	6,348
Total sand and gravel [3]	12,641	5,752	13,242	6,562
ALL OPERATIONS				
Sand	5,313	4,496	5,858	4,988
Gravel	23,180	14,889	23,776	16,692
Grand total [3]	28,493	19,385	29,634	21,680

[1] Figures withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes blast sand (1958); glass, molding, railroad ballast, and engine sand (1957–58) to avoid disclosing individual company confidential data.
[3] Data do not add to totals shown because of rounding.

Stone.—Combined output of basalt, granite, limestone, marl, and sandstone (or quartzite) was 3.5 million short tons, which set a new record for stone production. The previous high was in 1956. Chief reason for the gain in output was the half-million ton increase in production of crushed limestone for concrete aggregate and roadstone, reflecting the high level of road construction activity in the State. A marked increase of approximately 150,000 tons over 1957 was also recorded in output of crushed limestone for agricultural purposes.

Limestone was produced from deposits in the south-central and southeastern part of the State. Total output of dimension and crushed limestone increased 25 percent in quantity and 26 percent in value over 1957. About 81 percent of the crushed material was used for concrete aggregate and roadstone, and 16 percent for agricultural purposes. Smaller quantities of crushed or broken limestone were used for railroad ballast, riprap, flux, asphalt filler, mineral food, and poultry grit. Output of dimension limestone was over 42,000 tons valued at $1,385,000, compared with 24,000 tons valued at $1,018,000 in 1957. The material was used chiefly for structural and architectural use. Demand for cut stone was very slow the first part of the year because of the depressed economy in certain parts of the country. However, demand picked up considerably the second half of the year.

Granite was quarried in central Minnesota, the upper Minnesota River Valley, and in the northeastern part of the State. Dimension granite was used principally for building and monumental purposes.

Most of the rough material was cut, dressed or polished at finishing plants operated in Cold Spring, Delano, and St. Cloud. Sales for architectural use increased over 1957, whereas those for monumental purposes declined. Market for the latter use was affected by poor economic conditions in the industrial centers of Michigan, Illinois, and Indiana. In addition, foreign material was imported at competitive prices. Sales in agricultural areas improved over 1957. Crushed or broken granite production was 16 percent lower than in 1957, primarily because of lesser sales of the material for railroad ballast and concrete aggregate or roadstone.

Sandstone, or quartzite, was produced in Nicollet and Rock Counties. Total output increased over 1957 because of greater demand for the crushed material for concrete aggregate and seal coating of bituminous-surfaced streets or highways. Some sized material was sold to sewage-treatment plants for filter use. Use for another material, turkey grit, was expected to increase steadily. Waste material from an operation producing grinding pebbles and tube-mill liners was sold as riprap. Sales for this use decreased considerably below 1957.

Crushed basalt for concrete aggregate or roadstone was produced in St. Louis County by the Zenith Dredge Co. Output was slightly less than 1957.

Production of calcareous marl, which has been included with stone products since 1957, decreased. Sole producer of the material was Tweed Bros., who operated a pit near Pequot Lakes, in Crow Wing County.

Sulfur.—Byproduct sulfur was recovered by the Great Northern Oil Co. at its refinery in Dakota County. Output increased slightly in quantity and total value over 1957. Value of production is not included in the State totals shown for those years in table 1.

TABLE 9.—Granite sold or used by producers, by uses

Use	1957		1958	
	Quantity (thousand)	Value (thousand)	Quantity (thousand)	Value (thousand)
Dimension:				
Rough construction:				
Noncommercial—short tons	[1] 332	$12	[1] 208	$13
Rubble:				
Commercial—do	24	16	----------	----------
Noncommercial—do	[1] 125	3	----------	----------
Rough architectural—cubic feet	[2] 204	[2] 1,980	(2)	(2)
Rough monumental—do	64	197	(2)	(2)
Dressed architectural—do	(2)	(2)	(2)	(2)
Dressed monumental—do	131	1,120	121	1,179
Undistributed—do	----------	----------	293	2,281
Total dimension equivalent short tons [3]	57	3,328	34	3,473
Crushed and broken:				
Riprap:				
Noncommercial—short tons	(4)	(4)	[1] 400	[1] 400
Concrete aggregate and roadstone—do	126	226	(4)	(4)
Railroad ballast—do	347	336	(4)	(4)
Other—do	[4] 39	[4] 162	[4] 431	[4] 773
Total crushed and broken—do	512	724	431	773
Grand total—do	569	4,053	466	4,247

[1] Actual figure, not rounded to thousands.
[2] Figures for dressed and rough architectural use combined (1957). Architectural and rough monumental categories (1958) included with "Undistributed" to avoid disclosing individual company confidential data.
[3] Average weight of 166 pounds per cubic foot used to convert cubic feet to short tons.
[4] Figures for noncommercial riprap (1957), concrete aggregate and roadstone, railroad ballast, (1958) are combined with "Other" to avoid disclosing individual company confidential data.

TABLE 10.—Crushed and broken limestone sold or used by producers, by uses

Use	1957		1958	
	Short tons (thousand)	Value (thousand)	Short tons (thousand)	Value (thousand)
Crushed and broken:				
Riprap	30	$20	24	$15
Flux	(1)	(1)	(1)	(1)
Concrete aggregate and roadstone:				
Commercial	1,527	1,819	2,097	2,413
Noncommercial	322	352	288	341
Agriculture:				
Commercial	328	518	471	766
Noncommercial	----------	----------	6	6
Other uses [2]	139	350	43	209
Total	2,345	3,060	2,930	3,751

[1] Less than 1,000 tons: 150 tons—$525 (1957); 200 tons—$700 (1958).
[2] Includes railroad ballast, asphalt, mineral food, and poultry grit.

Vermiculite.—Sales of exfoliated vermiculite from plants in Minnesota increased 10 percent in quantity and 12 percent in total value over 1957. Output was sold for use as lightweight aggregate in plaster and concrete, insulating material, and other purposes. Crude vermiculite mined in Montana was processed at plants in Minneapolis and St. Paul.

MINERAL FUELS

Peat.—Two companies reported production of peat from bogs in Itasca and Koochiching Counties. Total output decreased both in quantity and value below 1957. The peat was sold chiefly for horticultural purposes in 1958.

Research continued toward development of methods for utilizing the vast resource of peat, estimated at nearly 7 billion tons. Several companies were expected to begin commercial production of peat in Carlton and St. Louis Counties. The Red Wing Peat Corp. began

construction of a plant near Corona, approximately 30 miles west of Duluth, late in 1958. The company was leasing approximately 1,000 acres from the State. Stripping operations commenced late in the year, enabling equipment to operate more efficiently on frozen ground. Production was expected to begin in 1959.

REVIEW BY COUNTIES

Mineral output was reported from all counties except Waseca. St. Louis County with its many iron mines continued to rank first in value of minerals produced, furnishing 68 percent of the value for all minerals produced in the State. Eleven counties recorded total value of mineral production in excess of $1 million. Total values increased for 51 counties but decreased in 36 counties from 1957. Total values for Crow Wing, Fillmore, Itasca, and St. Louis Counties decreased considerably below 1957 because of the severe drop in iron-ore shipments. Greater demand for road-construction materials was the chief reason for production gains in most counties recording increases over 1957. Sand and gravel output was common in all counties reporting production in 1958.

Becker.—Sand and gravel was produced chiefly in the vicinity of Detroit Lakes. Becker County Sand and Gravel Co. produced material for building and road construction, railroad ballast, and engine use at a stationary plant. Ernest Anderson operated a portable plant and reported output of road gravel. The State and county highway departments produced and contracted for gravel for road use.

TABLE 11.—Value of mineral production in Minnesota, by counties

County	1957	1958	Minerals produced in 1958 in order of value
Aitkin	$90,420	$119,087	Sand and gravel.
Anoka	15,293	14,537	Do.
Becker	(1)	(1)	Do.
Beltrami	11,818	126,714	Do.
Benton	(1)	(1)	Do.
Big Stone	(1)	(1)	Stone, sand and gravel.
Blue Earth	646,519	1,153,356	Do.
Brown	323,881	413,962	Sand and gravel, clays.
Carlton	218,183	199,564	Do.
Carver	136,100	202,574	Sand and gravel.
Cass	(1)	(1)	Do.
Chippewa	(1)	(1)	Do.
Chisago	158,002	(1)	Do.
Clay	466,919	443,787	Do.
Clearwater	15,303	4,150	Do.
Cook	6,761	26,975	Do.
Cottonwood	90,448	189,515	Do.
Crow Wing	22,223,989	10,901,794	Iron ore, manganiferous ore, sand and gravel, stone.
Dakota	(1) (2)	779,143	Sand and gravel, stone.
Dodge	63,220	175,027	Stone, sand and gravel.
Douglas	128,380	104,518	Sand and gravel.
Faribault	287,870	106,307	Do.
Fillmore	3,108,570	2,101,860	Iron ore, stone, sand and gravel.
Freeborn	215,677	(1)	Sand and gravel.
Goodhue	280,824	412,362	Stone, sand and gravel, clays.
Grant	35,802	63,948	Sand and gravel.
Hennepin	3,185,651	3,315,024	Sand and gravel, stone.
Houston	119,312	(1)	Stone, sand and gravel.
Hubbard	46,091	57,972	Sand and gravel.
Isanti	(1)	42,023	Do.
Itasca	135,486,623	83,543,278	Iron ore, sand and gravel, peat.
Jackson	110,454	141,180	Sand and gravel.
Kanabec	(1)	(1)	Sand and gravel, stone.
Kandiyohi	445,293	368,832	Sand and gravel.
Kittson	(1)	(1)	Do.
Koochiching	100,247	(1)	Sand and gravel, peat.
Lac qui Parle	695,843	318,152	Stone, sand and gravel.
Lake	23,029	34,319	Sand and gravel.
Lake of the Woods	24,908	14,181	Do.

TABLE 11.—Value of mineral production in Minnesota, by counties—Continued

County	1957	1958	Minerals produced in 1958 in order of value
Le Sueur	$1,529,490	$1,208,038	Stone, sand and gravel.
Lincoln	48,110	71,869	Sand and gravel.
Lyon	(1)	201,615	Do.
McLeod	(1)	115,066	Do.
Mahnomen	147,571	258,528	Do.
Marshall	73,384	207,410	Do.
Martin	71,876	325,439	Do.
Meeker	204,112	288,614	Do.
Mille Lacs	(1)	(1)	Stone, sand and gravel.
Morrison	196,281	270,458	Sand and gravel.
Mower	287,785	492,055	Stone, sand and gravel.
Murray	129,953	1,906	Sand and gravel.
Nicollet	154,191	336,357	Sand and gravel, stone.
Nobles	137,387	104,231	Sand and gravel.
Norman	482	72,238	Do.
Olmsted	251,259	279,440	Sand and gravel, stone.
Otter Tail	122,368	128,875	Sand and gravel.
Pennington	11,390	27,034	Do.
Pine	50,675	12,767	Do.
Pipestone	(1)	(1)	Do.
Polk	287,285	523,652	Do.
Pope	81,594	62,728	Do.
Ramsey	140,387	401,566	Sand and gravel, clays.
Red Lake	1,608	2,769	Sand and gravel.
Redwood	69,286	90,356	Sand and gravel, stone, clays.
Renville	428,558	1,055,215	Sand and gravel, stone.
Rice	526,540	282,909	Do.
Rock	259,582	212,413	Abrasives, sand and gravel, stone.
Roseau	88,387	(1)	Sand and gravel.
St. Louis	397,818,478	269,627,025	Iron ore, cement, sand and gravel, lime, stone.
Scott	793,131	641,451	Stone, sand and gravel.
Sherburne	69,215	48,138	Sand and gravel.
Sibley	(1)	(1)	Do.
Stearns	3,340,825	3,417,959	Stone, sand and gravel.
Steele	428,994	375,201	Sand and gravel, stone.
Stevens	50,762	(1)	Sand and gravel.
Swift	80,058	157,847	Do.
Todd	222,975	375,960	Do.
Traverse	983	1,017	Do.
Wabasha	74,009	37,020	Stone, sand and gravel.
Wadena	(1)	(1)	Sand and gravel.
Waseca	(1)		
Washington	1,986,297	1,831,461	Sand and gravel, stone.
Watonwan	62,577	113,296	Sand and gravel.
Wilkin	48,706	68,708	Do.
Winona	563,185	660,957	Stone, sand and gravel, clays.
Wright	168,964	231,081	Sand and gravel.
Yellow Medicine	255,407	405,382	Stone, sand and gravel.
Undistributed	[2] 4,012,083	5,479,524	
Total	[2] 584,038,000	395,880,000	

[1] Figure withheld to avoid disclosing individual company confidential data; value included with "Undistributed."
[2] Revised figure.

Beltrami.—Sand and gravel was produced by Ritchie & Tell and the State and county highway departments. Ritchie & Tell operated a fixed plant about 3 miles west of Wilton, and a portable plant elsewhere in the county. Most of the pits worked were leased from the county or State. Demand for material was fairly good because of the widening of U.S. Highways Nos. 2 and 71 through Bemidji, two new buildings for Bemidji State Teachers College, and an addition to the hospital in Bemidji.

No output of clay was reported by the Bemidji Brick Co. Demand for brick was seriously affected by the high cost of bricklaying and competition of concrete block. The company had a substantial inventory of brick manufactured in 1957. Common brick produced was used principally for "backup" purposes.

Big Stone.—Granite for architectural and monumental purposes was produced by the Cold Spring Granite Co. from its Agate quarry near Ortonville and by the Delano Granite Works, Inc., from its quarry near Odessa. Material quarried by the companies was

processed at their plants in Cold Spring, Stearns County, and in Delano, Wright County. Rausch Bros. Granite Co. operated a custom-sawing plant at Ortonville. Material processed at the plant was quarried chiefly in Grant County, S. Dak.

Hallett Construction Co. sold a quantity of stockpiled sand and gravel for building and road construction. Road gravel was produced by and for the Minnesota Highway Department.

Blue Earth.—Dimension limestone was quarried in the vicinity of Mankato by the Mankato Stone Co. and Vetter Stone Co. Output was principally for architectural and construction use. Some broken material was sold as riprap. Sales of cut stone were adversely affected the first half of the year by lessened business activity in Eastern States, which normally comprise a substantial share of the market for that product. Demand, however, increased considerably the latter part of the year. Lundin Construction Co. and Ed. Swartout produced broken and crushed limestone for road surfacing, agricultural use, and riprap. Output in the county gained considerably over the previous year because of the increase in road construction in the area. Sales of crushed limestone for agricultural use decreased due to the wet season.

Sand and gravel for building and road purposes was produced in the Mankato area. Producers included Hallett Construction Co., Hiniker Gravel & Sand Co., Jeffries Construction Co., North Star Concrete Co., Ed. Swartout, and the State Highway Department.

Brown.—Sand and gravel for building and road construction was produced in the county. Portable plants were operated by Carlson Brothers, Inc., and Roberts Bros., near Comfrey and New Ulm, respectively. Math N. Schumacher, Wallner Construction Co., and M. M. Youngman operated stationary plants near Springfield, New Ulm, and Sleepy Eye, respectively. Road gravel was produced by the Minnesota Highway Department and by contract for both the State and county highway departments.

Miscellaneous clay, used for manufacturing building brick and tile, was produced near Springfield by the Ochs Brick & Tile Co. The company operated its new 270-foot tunnel kiln and 15 beehive-type kilns during the year. All kilns were gas-fired with oil used for standby purposes. The market for brick was favorable chiefly because of the new air-base project at Grand Forks, N. Dak., and the Federal Housing redevelopment project in Minneapolis. Finished products were shipped to consumers by truck and rail; markets were principally in Midwestern States.

Carlton.—Several producers reported output of sand and gravel from operations near Carlton, Cloquet, and Moose Lake. Material was used for railroad ballast, building, and road construction, and for fill. The State and county highway departments produced and contracted for road gravel.

The Nemadji Tile & Pottery Co. produced clay near Moose Lake and used the material for manufacturing floor tile and art pottery.

Late in the year the Red Wing Peat Corp. began stripping operations at a peat deposit near Corona. Construction of a plant to process and bag the peat also was begun. The company has leased about 1,000 acres from the State.

Chisago.—P. O. Pederson, Inc., operated a portable plant near North Branch and produced road gravel. The State and county highway departments also reported output of sand and gravel. Material was used for building and road purposes.

William Danner ceased production of marl, and no output was reported for 1958.

Cook.—About 2.7 million tons of taconite-concentrate pellets was shipped from Taconite Harbor, the Erie Mining Co. shipping port on the north shore of Lake Superior. The pellets were produced at the company Hoyt Lakes plant and hauled over the 73-mile company-owned railroad to Taconite Harbor. The company 150,000-kilowatt rated-capacity powerplant was completed. The plant was to provide power for Erie's entire taconite project.

The State and county highway departments produced road gravel.

Crow Wing.—A considerable decrease in shipments of iron and manganiferous ores was the chief reason for the 51-percent drop in total value of mineral output from Crow Wing County, compared with 1957. Except for the Armour No. 1 and the Brown (formerly called Pennington) mines, all mines were open-pit operations. Inland Steel Co. continued sinking a new production shaft and constructing surface buildings on its Armour No. 2 property. Hoisting from the new shaft was expected to begin in 1959. First shipments were made from the M. A. Hanna Co. Musser mine. The company continued development of the Robert mine and began construction of a crushing plant at the property. A crude-ore stockpile at the Section 6 mine was treated in 1958, although the property had been mined-out in 1957. M. A. Hanna Co. was engaged in dismantling the pit conveyor at its Portsmouth group and installing a custom pocket at the Portsmouth concentrating plant to handle outside ores. The company continued operation of the Portsmouth sintering plant. Pickands Mather & Co. operated its Mahnomen mine, and also shipped a quantity of stockpiled material from the Sagamore. The company Rabbit Lake mine was inactive. The Zontelli Bros. Division of Pittsburgh Pacific Co. conducted mining activities at its Manuel and West Airport mines. The company also shipped manganiferous ore from stockpiles at the Merritt, Mangan-Joan, and Mangan-Stai properties.

Manganese Chemicals Corp. operated its plant near Riverton, producing manganese carbonate, manganese dioxide, and other manganese products. The company sold a small quantity of manganese metal which had been produced experimentally.

Stockpile shipments of sand and gravel for building and road construction were reported by Hallett Construction Co. Sand and gravel for road use was produced by and for the State and county highway departments.

Marl was produced by Tweed Bros., approximately 9 miles east of Pequot Lakes. The material was mined from a shallow pit with a three-eighths cubic yard, gasoline-powered dragline mounted on a half-track. Entire output was sold to farmers in the area for agricultural use.

Dakota.—Dimension and crushed limestone was produced by J. L. Shiely Co. at its Mendota quarry. Output was used chiefly as building stone, flagging, railroad ballast, concrete aggregate, and roadstone, and for agricultural use.

Sand and gravel production was reported by several commercial companies and the State and county highway departments. Material was used for building and road purposes, including asphalt mix.

Elemental sulfur was recovered as a byproduct at the Great Northern Oil Co. refinery at Pine Bend.

Fillmore.—M. A. Hanna Co., agent for The Hanna Mining Co., shipped 176,000 long tons of concentrate from its group of open pits

near Spring Valley. Schroeder Mining Co. shipped 65,000 long tons of concentrate from the Krueger mine near Chatfield. The latter company installed a Wemco classifier and a Remer jig in its concentrating plant. The bulk of the output of iron ore from the county was shipped by rail to consuming furnaces at Granite City, Ill.

Limestone quarries were operated near Fountain, Harmony, and Ostrander. Output was used chiefly for agricultural and road purposes.

Sand and gravel for building use was produced at fixed plants near Chatfield and Peterson. Road gravel was produced by the State highway department.

Goodhue.—Fire clay was produced by the Red Wing Sewer Pipe Corp., operating two pits near Goodhue. Output was used by the company chiefly for manufacturing vitrified sewer pipe at its Red Wing plant. The company also manufactured drain tile, flue liners, and filter blocks. Both pits and the plant were worked year-round. Total employment at the pits varied from 8 men to a peak of about 20 during the summer months. Clay was mined by dragline, and some blasting was performed. Material was hauled by truck to the plant for processing. The company operated eight kilns, which were gas-fired in the summer and coal-fired in the winter. Markets for the products were principally in Minnesota, North and South Dakota, and Wisconsin. Demand was fairly high for vitrified filter block used for floors of filter beds at sewage treatment plants.

Red Wing Potteries, Inc., produced high-quality dinnerware and art pottery. The principal raw materials used and sources of each were: Ball clays, Kentucky and Tennessee; china clays, Georgia and South Carolina; kaolin, North Carolina; ground flint, Illinois; ground feldspar, South Dakota and Tennessee; talc, New York; and dolomite, Connecticut.

Mann Construction Co. operated a portable crushing plant and produced limestone from six quarries. The company also produced paving sand and gravel. Valley Limestone Co. quarried limestone from a quarry near Zumbrota. Output of limestone in the county was used for agricultural and road purposes.

Sand and gravel was produced by five commercial operators and the Minnesota Highway Department. Output was used for building and road construction and fill.

Hennepin.—Approximately 3 million tons of sand and gravel was produced. Output was for various purposes but chiefly for building and road construction. Commercial operators reporting production were: Anderson Aggregates, Barton Contracting Co., Concrete Service, Inc., Consolidated Materials Co., Chas. M. Freidheim Co., Glacier Sand & Gravel Co., J. V. Gleason, Hedberg & Sons Co., Hopkins Sand & Gravel Co., Industrial Aggregate Co., Keller Bros. Gravel Co., Landers-Norblom-Christenson Co., Mapco Sand & Gravel Co., and Oscar Roberts Co. Most of the material was produced in suburban areas of Minneapolis. Sand and gravel for building and paving was also produced by the State and Hennepin County.

Landers-Norblom-Christenson Co. purchased limestone produced in another county. The material was crushed by the company and sold for use as asphalt filler.

Crude perlite from Western States was expanded at Minneapolis plants by Minnesota Perlite Corp. and Western Mineral Products Co. The product was used as lightweight aggregate in plaster and concrete, and for insulation, soil conditioning, and other purposes. Exfoliated vermiculite was produced in Minneapolis at plants op-

erated by B. F. Nelson Mfg. Co. and Western Mineral Products Co. Crude material processed at the plants was mined in Montana. Output was used chiefly as lightweight aggregate in plaster and concrete and for loose-fill insulation.

Work began on a new experiment station of the Federal Bureau of Mines at Fort Smelling. The new station was to be headquarters for mining, metallurgical, and other research relative to the Bureau programs of investigation, research and development of mineral commodities, mining research, mining methods and cost studies, and mineral-industry surveys in North Central States.

Itasca.—Value of mineral production decreased 38 percent compared with 1957, because of a marked decline in shipments of iron ore. Some mines were operated on a 4-day-week basis because of the low demand for ore. All mines were open-pit operations, no underground mines having been operated since 1953. About 97 percent of the iron ore was beneficiated before shipment to consumers. Oliver Iron Mining Division began operating its new heavy-medium separation unit at the Trout Lake concentrator near Coleraine. Mines operated by the company were the Arcturus group, King group, and Plummer.

The Sargent mine, formerly operated by Cleveland-Cliffs Iron Co., was inactive, the company having surrendered its lease on the property at the end of 1957. There was no mining activity at the Cleveland-Cliffs Iron Co. Hill-Trumbull mine, but concentrate was shipped from stock. Other mines from which the company shipped ore in 1958 were the Canisteo, Hawkins, Holman-Cliffs, and Sally. Concentrating plants were operated at all these mines, except the Sally; ore from the Sally was treated at the Canisteo plant.

No ore was shipped from the Bennett mine of Pickands Mather & Co. A minor amount of stripping was done. Shipments from the West Hill mine were only from stockpile. Mining and concentrating were reported from the company Danube and Tioga No. 2 mines.

M. A. Hanna Co. shipped ore from the Argonne group, Carlz No. 2, Harrison group, Hunner, Mississippi group, Patrick group, and Patrick "C" in 1958. Shipments of concentrate from the Patrick "C" were from stockpile. The Buckeye, Perry, and Wyman mines were inactive. M. A. Hanna Co. was the operating agent for Butler Bros., Hanna Ore Mining Co., and The Hanna Mining Co. (formerly Hanna Coal & Ore Corp.).

Jones & Laughlin Steel Corp. operated the Hill Annex mine and concentrating plants near Calumet. Approximately 20 percent of the total shipments was recovered at the new company reclamation plant from the Hill Annex tailing basin.

Other shippers of iron ore were Jessie H. Mining Co., operating the Jessie mine and concentrating plant near Grand Rapids, and Pacific Isle Mining Co., which shipped ore from stockpile at the St. Paul mine. No shipments were recorded for the Mississippi No. 1, St. Paul-Day, and Shada mines.

Road gravel was produced by Hawkinson Construction Co., Inc., near Grand Rapids, Gerald Henry near Cohasset, and by the State and county highway departments.

Peat was produced from a bog near Wawina by the Colby Pioneer Peat Co. Output was used for horticultural purposes.

Kanabec.—Dimension granite for architectural and monumental use was produced by the Cold Spring Granite Co. from its Mora Grey quarry. The rough stone was processed at the company plant in

Cold Spring. The State highway department produced and contracted for road gravel.

Koochiching.—Peat was produced near Northome by the Moss Products Co. Entire output was sold for horticultural purposes. Road gravel was produced by and for the State highway department.

Lac qui Parle.—Cold Spring Granite Co. produced dimension granite for architectural and monumental use from the Cold Spring Red quarry near Odessa. Output was finished at the company plant in Stearns County. The North Star Granite Corp. operated its No. 9 quarry near Odessa and produced granite for monumental purposes. The company processed the rough stone at its St. Cloud plant. Granite for monumental use was also produced by the Dakota Granite Co. near Bellingham and the Liberty Granite Co., Inc., near Louisburg.

Road gravel was produced by the State and county highway departments.

Lake.—Reserve Mining Co. continued operation at its large taconite-processing plant at Silver Bay. Approximately 5 million long tons of taconite-concentrate pellets was shipped. The company processed 13 million tons of crude taconite mined near Babbitt, in St. Louis County. The plant was operated on a reduced-operation basis, 4 weeks on and 1 week off, from March to August, because of the drop in consumption of iron ore. Before the cutback in production rate, the plant had been on a 24-hour, 7-day-week schedule since 1955. The 1958 navigation season for Minnesota ore shipments opened April 26 at Silver Bay. The final cargo of pellets shipped from the port in 1958 was loaded on November 27. During the year, approximately 1.5 million tons of pellets were offered for sale on the open market. Most of the output was shipped to Armco Steel Corp. and Republic Steel Corp., joint owners of Reserve Mining Co.

The Minnesota Division of Lands and Minerals prepared to sell leases on 8,000 acres of State-owned land in Lake County for exploration of copper-nickel deposits.

The State and county highway departments produced and contracted for road gravel.

Le Sueur.—Dimension limestone was produced and processed by The Babcock Co. near Kasota. Principal products were veneer and special stone cut to architectural specifications. A portion of the output was marketed as "marble" for interior trim and facings. Other products were sold for rough construction, flagging, and riprap. Output of cut stone in 1958 decreased below 1957 because of the economic decline in certain industrial areas of the country. Market for the company principal products was nationwide. Products generally were transported by truck to distances up to 500 miles and by rail to more distant points.

Silica sand was produced near Le Sueur by Gopher State Silica, Inc. Output was sold for engine use, glass manufacture, oilfield fracturing, molding, and building purposes. The Glander Washed Sand & Gravel Co. produced sand and gravel for building and road use at its fixed plant near Le Sueur. Ed. Swartout and Zarnott Construction Co. produced road gravel. The State Highway Department produced and contracted for gravel for road use.

Mille Lacs.—Cold Spring Granite Co. produced dimension granite from the Diamond Grey quarry near Isle. Output was processed at the company plant in Cold Spring and sold for architectural and monumental purposes.

Sand and gravel for building use was produced at the fixed plant at Mille Lacs Sand & Gravel Co. near Milaca. The State highway department produced and contracted for road gravel.

Mower.—Crushed limestone for agricultural and road use was produced by Martin Bustad Construction Co. and Osmundson Bros. near Austin and Adams, respectively. Hickok Calcium White Rock Co. produced dimension limestone for rubble, and crushed and ground limestone for flux, roadstone, agricultural use, mineral food, and poultry grit. The State and county highway departments contracted for crushed limestone and sand and gravel for road use.

Austin Ready-Mix Concrete Co. operated a portable plant near Austin and produced sand and gravel for building and road purposes. Paving sand was produced by the Brownsdale Sand & Gravel Co., operating a portable plant near Brownsdale. Ulland Brothers, Inc., produced road gravel. George Kolpin operated a fixed plant and produced sand and gravel for building and road construction and fill.

Nicollet.—Crushed sandstone (quartzite) was produced by the New Ulm Quartzite Quarries, Inc., at a quarry near New Ulm. The company purchased the property from the New Ulm Red Stone Quarry Co., the former operator, early in 1958. A substantial gain in output over 1957 was attributed to increased sales for concrete aggregate and seal-coating of asphalt pavement. Some output was sold for filter use to water and sewage-treatment plants in 3½- or 4½-inch size, depending on specifications. The turkey-grit market was expected to increase. All sizes of material marketed were stockpiled. A crew of 10 men worked the quarry, which had a single face about 45 feet high. Quarried material was hauled by truck a short distance to the crushing and screening plant. An impact crusher was used for primary crushing and two cone crushers for secondary crushing. Vibrating screens were used for sorting various sizes, which were dropped into 23-cubic yard shipping bins. Maintenance costs at the operation were high because of the abrasive wear of the material. Much of the working time consisted of maintenance or repair work.

Sand and gravel was produced by four companies, operating principally near Courtland, Kasota, and St. Peter. Output was used for building and road use, railroad ballast, and fill. The State and county highway departments contracted for road gravel.

Ramsey.—Silica sand was produced by the Ford Motor Co. from an underground mine in St. Paul. The material was used by the company solely for manufacturing glass. Operations ceased early in 1958. They were resumed later in the year because of the shortage of glass, brought about by a strike in the glass industry in Eastern States. A new sand and gravel plant was put into operation by the Arsenal Sand & Gravel Co. near New Brighton. Estimated capacity of the plant was 150 tons an hour. Output was for building and road construction and other uses.

The Twin City Brick Co. produced miscellaneous clay for manufacturing building brick and other clay products at its St. Paul plant.

Vermiculite was exfoliated by the MacArthur Co. at its plant in St. Paul. Output was sold for use as lightweight aggregate in plaster and concrete and for insulation.

Redwood.—Sand and gravel for building use and other purposes was produced near Walnut Grove and Belview.

Dimension granite for monumental purposes was produced by the View Quarry Co. near Belview.

Ochs Brick & Tile Co. produced miscellaneous clay near Morton. Output was hauled by truck to the company brick plant in Springfield for processing.

Renville.—Dimension granite was quarried near Morton for architectural and monumental purposes. The rough stone was finished at plants in Cold Spring and St. Cloud.

Several companies produced sand and gravel near Danube, Hector, and Sacred Heart for building and road construction. The State highway department produced and contracted for road gravel.

Rock.—Grinding pebbles and tube-mill liners were produced by the Jasper Stone Co. from a quartzite deposit near Jasper. Waste material from the operation was sold for use as riprap.

Sand and gravel was produced near Luverne for building and road construction and fill.

St. Louis.—Total values of mineral production decreased 32 percent from 1957 because of the cutback in iron-ore shipments. Tonnage of usable iron ore shipped was 38 percent less than in 1957. Mines in the county supplied nearly 73 percent of the total usable iron ore shipped from the State. Approximately 60 percent of the total shipments from the county was direct-shipping grade; the remainder was beneficiated.

All mines operated were in the Mesabi range, except the Pioneer, Soudan, Zenith, and South Chandler mines, which were in the Vermilion range. Shipments from the South Chandler, an open-pit mine, were from stocks. The Pioneer, Soudan, and Zenith mines were underground operations. Other active underground mines were the Albany, Godfrey, and Leonidas. Pickands Mather & Co. ceased operations at the Zenith mine in May and surrendered its lease on the property. The company worked its Albany mine until May 9, and the mine was inactive the remainder of the year.

Production at many of the iron mines was curtailed or suspended because of the drop in demand for ore. However, shipments of taconite concentrate increased over 1957, primarily because the Hoyt Lakes Plant of Erie Mining Co., operated by Pickands Mather & Co., produced throughout the year, although not at full capacity. Nearly 3 million long tons of taconite-concentrate pellets was produced at the plant, and 2.7 million tons shipped. The taconite was mined at two open pits near Hoyt Lakes. The pellets were hauled by company-owned railroad to Taconite Harbor on Lake Superior and shipped by boat to lower lake ports. Production activities at Erie's Preliminary Taconite plant ceased early in 1958. A small quantity of pellets was produced and shipped from the plant.

Reserve Mining Co. mined over 13 million tons of crude taconite at its Peter Mitchell mine near Babbitt. The material was crushed to minus-3-inch and transported by rail to the company plant at Silver Bay for concentrating and pelletizing. In August over 1.1 million tons of taconite was shattered in a single blast at the mine. Nearly 800 holes were drilled in an area covering about 7 acres. Approximately 625,000 pounds of explosives, consisting chiefly of fertilizer-grade prilled ammonium nitrate, was used in the blast. The use of ammonium nitrate prills has reduced secondary breakage.

Taconite concentrate also was shipped by the Oliver Iron Mining Division of United States Steel Corp., operating its Pilotac taconite mine and mill near Mountain Iron. Concentrate produced at the Pilotac plant was agglomerated at the company Extaca plant at Virginia.

M. A. Hanna Co. continued stripping at the Pierce group of mines near Hibbing. A 3-mile beltline was about the longest stripping conveyor operated by the company. Average depth of overburden was approximately 100 feet. Nearly 2.7 million cubic yards of overburden were moved at the property in 1958.

Oliver Iron Mining Division added a heavy-medium section to its Hull-Rust concentrator near Hibbing. Work was underway to double the capacity of crushing and screening facilities at the Stephens mine near Aurora. Oliver's two large ore-sizing plants at the Rouchleau group near Virginia and Sherman group near Chisholm completed their first full year of operation in 1958.

The Carmi-Carson Lake mine of Pickands Mather & Co. was not operated. Shipments from the company Mahoning mine were all direct-shipping grades. The new heavy-medium and washing plant constructed at the Mahoning in 1957 was not operated.

No shipments were recorded from the Susquehanna mine of Republic Steel Corp.

No mining was done by Cleveland-Cliffs Iron Co., but a quantity of ore was shipped from stocks at the Wanless mine, near Buhl.

First shipments of iron ore were made from the Pearsall mine, operated by Rhude & Fryberger, near Eveleth in conjunction with the company Troy mine. Most of the ore from the Pearsall was treated at the Troy concentrating plant.

Oreclone Concentrating Corp. began operating a new pilot plant near Virginia and tested some material from the Prindle mine tailings basin. A small quantity of concentrate was shipped.

The American Steel & Wire Division of United States Steel Corp. and the Interlake Iron Corp. operated blast furnaces and coke ovens at Duluth. The former company also operated basic open-hearth steel furnaces.

Universal Atlas Cement Co. produced portland and masonry cements at its Duluth plant. The company curtailed operations for a 6-week period early in 1958 to install new equipment.

Cutler-Magner Co. produced quicklime and hydrated lime at Duluth.

Dimension granite for rough monumental use was quarried near Mountain Iron by the Mesaba Granite Co.

The Zenith Dredge Co. produced crushed basalt near Duluth for use as concrete aggregate or roadstone.

Sand and gravel output was reported by nine commercial companies, the State and county highway departments, and the city of Duluth. Output was used for building and road construction, railroad ballast, engine use, sandblasting, fill, and other purposes.

The Minnesota Division of Lands and Minerals prepared to offer leases for sale on nearly 100,000 acres of State-owned land in St. Louis County for exploration of copper-nickel deposits.

Scott.—Crushed and broken limestone was produced by Bryan Rock Products, Inc., from its Merriam Junction quarry near Shakopee. Material was sold for agricultural use, roadstone, and riprap. In September a new quarry was opened near Shakopee by B. & R. Rock Products Co. Output was crushed for use chiefly as roadstone.

Sand and gravel was produced in the vicinities of Belle Plaine, Chaska, Prior Lake, and Shakopee by four commercial operators. Output was for building and road construction. The State and county highway departments produced and contracted for road gravel.

Stearns.—Cold Spring Granite Co. operated five quarries near Cold Spring, Rockville, St. Cloud, and St. Joseph, and a large sawing and finishing plant in Cold Spring. Output of the company was chiefly for architectural and monumental purposes. Some granite was crushed at the Cold Spring plant and sold for poultry grit. Melrose Granite Co. operated two quarries near St. Cloud and its rock-dressing plant in St. Cloud. Both rough and finished stone were sold, chiefly for architectural and monumental use. Royal Granite Co. operated a plant in St. Cloud and marketed dimension granite for monumental purposes. North Star Granite Corp. produced granite from the Nos. 4 and 5 quarries near St. Cloud and processed the material at its St. Cloud plant. The finished stone was sold chiefly for monumental use. Crushed granite was produced by Shiely-Petters Crushed Stone Co., operating a quarry at Waite Park, west of St. Cloud. Output was used chiefly for railroad ballast and seal-coating bituminous-surfaced streets. Sales for railroad ballast decreased substantially from 1957. Granite was quarried by the Minnesota State Reformatory at St. Cloud and was used for riprap and rough construction.

Megarry Bros. and A. C. Petters Co., Inc., produced sand and gravel principally for building and road construction. The State highway department produced and contracted for road gravel.

Washington.—J. L. Shiely Co. operated its fixed plant at Grey Cloud Island near St. Paul and produced material for building and road use and other purposes. Gemstone Products Co. and Moelter Construction Co. produced sand and gravel near Lakeland and Stillwater, respectively, chiefly for building use. Road gravel was produced by Shalander & Shaleen near Scandia, and also under contract for the State and county highway departments.

Bryan Rock Products, Inc., and Nienaber Contracting Co. produced crushed limestone for agricultural and road use.

Winona.—Limestone for architectural use was quarried and processed near Winona by the Biesanz Stone Co.

Crushed limestone for agricultural use and roadstone was produced by Fred Fakler near Winona. Crushed limestone and gravel for road use were produced under contract for the State.

Winona Sand & Gravel Co. produced sand and gravel for building and road construction at its dredging operation near Winona.

The Biesanz Brick Yards used miscellaneous clay for manufacturing building brick at Winona.

Wright.—The Delano Granite Works, Inc., operated its sawing and finishing plant at Delano, where rough granite quarried by the company in Big Stone County was processed.

Several companies produced sand and gravel for building or road use, near Delano, Hanover, and South Haven. The State and county highway departments produced and contracted for road gravel.

Yellow Medicine.—Crushed granite for railroad ballast was produced by the Great Northern Railway Co., near Granite Falls. Dimension granite for architectural use was produced by August A. Evanson.

Deutz & Crow Co. operated a fixed sand and gravel plant at Canby and used the material in its ready-mix concrete plant. Road gravel was produced by Burdett C. Long near Hazel Run and by the Minnesota Highway Department. The county highway department produced gravel for building use.

The Mineral Industry of Mississippi

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Mississippi Geological Survey.

By Harry F. Robertson [1] and Tracy W. Lusk [2]

MISSISSIPPI mineral production in 1958 reached a record total value of $149 million. Decreases, chiefly in total values of clays and petroleum, were offset by marked increases in value of construction materials and natural gas.

A State-sponsored program to attract new industry, known as "Balance Agriculture With Industry" (BAWI), continued its successful operation with more industries taking advantage of the program in 1958 than in any previous year. The establishment of new industries and the expansion of existing industries also resulted in increased production of the mineral industries to furnish construction materials, power, and raw materials.

TABLE 1.—Mineral production in Mississippi [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays.....thousand short tons..	616	$3,635	576	$3,338
Iron ore.....thousand long tons..	(2)	1	(2)	(3)
Natural gas.....million cubic feet..	169,967	17,507	[4] 160,143	[4] 22,260
Natural-gas liquids:				
Natural gasoline and cycle products thousand gallons..	25,152	1,469	[4] 25,738	[4] 1,658
LP-gases.....do....	10,044	472	[4] 9,208	[4] 503
Petroleum (crude).....thousand 42-gallon barrels..	38,922	113,263	[4] 38,551	[4] 110,256
Sand and gravel.....thousand short tons..	5,172	4,344	6,545	6,240
Stone.....do....	[5] 60	[5] 54	[5] 102	[5] 92
Value of items that cannot be disclosed: Certain metals and nonmetals.....	----------	4,694	----------	4,829
Total Mississippi [6].....	----------	[7] 144,950	----------	148,663

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Less than 1,000 long tons.
[3] Less than $1,000.
[4] Preliminary figure.
[5] Excludes certain stone, value included with "Value of items that cannot be disclosed."
[6] The total has been adjusted to eliminate duplication in the value of clays and stone.
[7] Revised figure.

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[2] Director, Mississippi Geological Survey, University, Mississippi.

Construction was completed in March, of a deep draft channel and turning basin serving the newly developed industrial area on Bayou Casotte, about 4 miles west of the mouth of the Pascagoula River. An entrance channel in Mississippi Sound, 30 feet deep, 225 feet wide, and about 3 miles long, was connected with the Pascagoula ship channel. The harbor area proper on Bayou Casotte will be served by an inner channel 300 feet wide and about 4,850 feet long, and a turning basin 1,000 feet wide and about 1,750 feet long—both dredged to a depth of 30 feet. Work had started early in 1957 and the project cost about $2 million.

H. K. Porter Co. began production at its new $8 million chemical and refractory plant at Bayou Casotte near Pascagoula.

Highway construction in Mississippi moved forward at a rapid pace in 1958 as $46.3 million in State, primary, and secondary rural road projects were put under contract or completed. New highway construction completed amounted to 410 miles. Mississippi became a leader in the interstate highway system by putting 135 miles of the system under contract during the year and completing the first link of the highway in the South built to interstate specifications.

Another step forward in the industrialization of the State was reflected in the establishment of the Mississippi Industrial Research Center under Dr. W. Paul Brann, formerly associate director of the Arkansas Industrial Research and Extension Center.

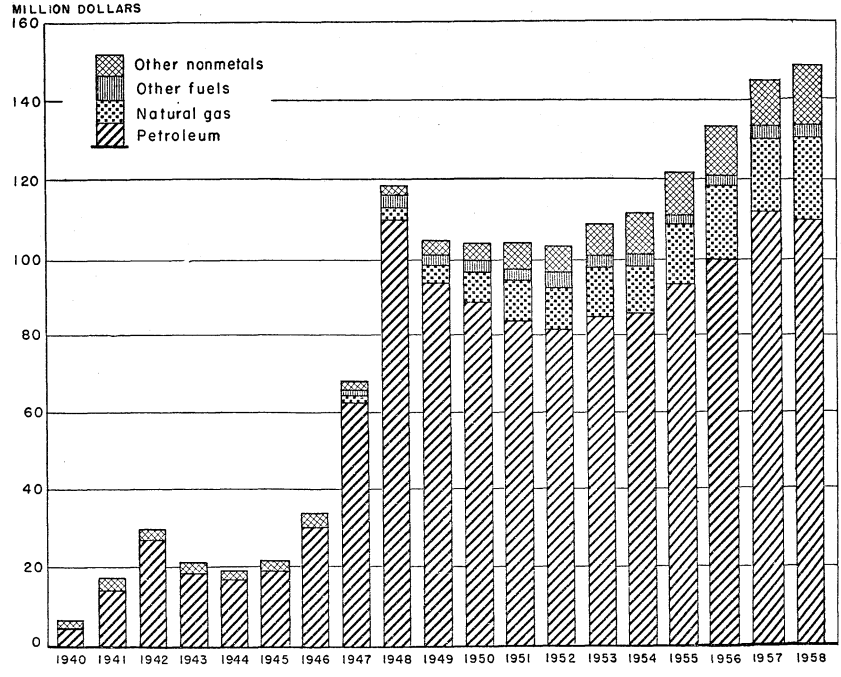

FIGURE 1.—Value of petroleum, natural gas, and total value of mineral production in Mississippi, 1940–58.

Employment and Injuries.—As a result of the increased industrial activity in the State, average employment for the year showed a corresponding moderate increase, according to the Mississippi Employment Security Commission. Employment in the petroleum and natural gas industries averaged 4,611 workers and the nonmetallic mining and processing industries employed 805 workers.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Currently ranked as ninth leading oil producer and ninth in natural gas production, Mississippi has produced a cumulative total of 600 million barrels of oil and established large reserves. Daily average production of about 125,000 barrels of oil and 750 million cubic feet of natural gas came from an increasing number of wells and fields. The 1958 production was in 32 of the 82 counties, mostly in the southern half of the State. There was some exploration, leasing, and drilling in the northern part of the State.

In the last 5 years the trend in Mississippi has been toward deep drilling to 10,000 feet or better. Most of the deep wells lie in a pattern that runs southeasterly from Bolton, just west of Jackson, to the Alabama line and have multiple production zones. These deep wells furnish well over one-third of the output.

The Mississippi State Oil and Gas Board fixes allowables for all fields on the basis of maximum efficient rate of production for the reservoirs. All of the oilfields during most of 1958 produced below the authorized allowables due to decreased purchases by the pipelines.

The number of wells drilled in the State totaled 423—33 more than in 1957. This does not include 25 producers completed as dual wells. Exploratory and field drilling was markedly successful in developing new oil and gas reserves.

There were 13 new field discoveries. They were Anchorage, North Esperance Point, Gallilee, and Moss Hill in Adams County; Junction City in Clarke County; Dry Bayou and North Flat Rock in Franklin County; Bryan and Reedy Creek in Jones County; Little Creek in Lincoln and Pike Counties; Stewart in Pearl River County; and Boykin Church and Magee in Smith County.

The Little Creek Field developed into one of the finest Lower Tuscaloosa oil reservoirs in the State. At the end of the year it continued to be the most active area with a monthly oil production in excess of 400,000 barrels.

According to the Mississippi State Oil and Gas Board, 177 oil pools and 41 gas pools were producing in 148 fields in the State at yearend. Producible wells totaled 2,582, an increase of 127 wells over 1957.[3]

Natural Gas.—Marketed production of natural gas resumed the upward trend that had been interrupted in 1957. The counties leading in production of the commodity in 1958, in order of value, were: Forrest, Jefferson Davis, Pearl River, Monroe, and Lamar.

[3] Mississippi State Oil and Gas Bulletin, Petroleum Engineering Report on the Oil and Gas Reservoirs of Mississippi, year ending Dec. 31, 1958.

TABLE 2.—Total well completions in 1958, by counties[1]

County	Proved field or development wells			Exploratory wells			Grand total
	Oil	Gas[2]	Dry	Oil	Gas[2]	Dry	
Adams	27		18	4		28	77
Chickasaw						1	1
Claiborne						2	2
Clarke	2		3	1		4	10
Clay		1				1	2
Forrest	1	13	2			2	18
Franklin	8		3	2		8	21
George						1	1
Greene						4	4
Hancock						3	3
Hinds	3	1	1			2	7
Issaquena						1	1
Itawamba						1	1
Jasper	3		1			4	8
Jefferson	1	2	6			11	20
Jefferson Davis		1				3	4
Jones	3			2		7	12
Lamar	10					1	11
Lauderdale						1	1
Lawrence						3	3
Leflore						1	1
Lincoln	41		5	1		7	54
Madison						4	4
Marion		1				4	5
Monroe						2	2
Pearl River	1	8	1		1	5	16
Perry						1	1
Pike	11		6			2	19
Rankin						3	3
Sharkey			1			3	4
Simpson	5	1				3	9
Smith	5	5	3	2		4	19
Stone						2	2
Tallahatchie						2	2
Walthall	1					2	3
Warren						2	2
Washington						3	3
Wayne	18	2	9			12	41
Wilkinson	2		3			12	17
Yazoo	3		1			5	9
Total: 1958	145	35	63	12	1	167	423
1957	101	22	77	10	1	179	390

[1] Mississippi State Oil and Gas Bulletin, Jackson, Miss., vol. 58, No. 1, March 1958 through No. 12, February 1959.
[2] Includes condensate.

At the end of 1958 first stages of construction were underway on the 40-mile-long Mississippi coast segment of a 202-mile, 30-inch pipeline from gasfields of southern Louisiana to near Mobile, Ala. This segment of the pipeline, being built by Williams Brothers Co. for United Gas Pipeline Co., will parallel U.S. Highway 90 about 10 miles north of Biloxi.

Of the total gas withdrawn in 1958 about 61 billion cubic feet was returned to producing reservoirs of the Cranfield, Brookhaven, and Hub fields.

Natural-Gas Liquids.—About 38 percent of the gross production of natural gas was processed in two natural-gasoline and cycle plants, the Brookhaven Gas Cycling Plant in Lincoln County and the Cranfield Gas Cycling Operations in Adams and Franklin Counties.

Shell Oil Co. announced plans to construct a refrigeration-type gasoline plant in the Little Creek Field, Pike County, 10 miles northeast of McCombs, Miss. The plant was designed to process 5 million

cubic feet of solution gas a day with provision for doubling its capacity if desirable. Some 15,000 gallons of natural gasoline and propane will be recovered daily from the gas. The wet gas received in the plant will be compressed and chilled to 30° below zero. At that temperature natural gasoline is separated from the wet gas. The remaining dry gas will be compressed to 1,000 pounds a square inch for sale as fuel.

TABLE 3.—Estimated proved recoverable reserves of crude oil, natural-gas liquids, and natural gas [1]

	Proved reserves, Dec. 31, 1957	Changes in proved reserves, due to extensions and new discoveries in 1958	Proved reserves, Dec. 31, 1958 (production was deducted)	Percent change from 1957
Crude oil.....thousand barrels..	359,550	57,203	378,688	+5
Natural-gas liquids [2].....do....	54,401	3,841	55,182	+1
Natural gas.....million cubic feet..	2,297,740	482,742	2,598,377	+13

[1] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural-Gas Liquids and Natural Gas: Vol. 13, Dec. 31, 1958, pp. 9, 10, 19.
[2] Includes condensate, natural gasoline, and LP-gases.

TABLE 4.—Gross withdrawals and disposition of natural gas, in million cubic feet

Year	Withdrawals [1]			Disposition			
	From gas wells	From oil wells	Total	Repressuring	Vented and wasted [2]	Marketed production [3]	
						Quantity	Value (thousands)
1954	167,000	70,000	237,000	58,645	37,907	140,448	$11,657
1955	193,000	73,000	266,000	62,598	40,235	163,167	15,664
1956	206,000	82,000	288,000	66,654	36,209	185,137	18,143
1957 [4]	193,000	81,000	274,000	66,608	37,425	169,967	17,507
1958	179,000	79,000	258,000	73,204	24,653	160,143	22,260

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Includes direct waste on producing properties and residue blown to air (partly estimated).
[3] Comprises gas sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas in pipelines.
[4] Revised figures.

TABLE 5.—Natural-gas liquids produced

Year	Natural-gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)
1949–53 (average)	32,380	$2,388	20,069	$756	52,449	$3,144
1954	27,804	1,944	15,288	528	43,092	2,472
1955	22,382	1,573	12,242	396	34,624	1,969
1956	24,829	1,751	10,698	580	35,527	2,331
1957	25,152	1,469	10,044	472	35,196	1,941
1958	25,738	1,658	9,208	503	34,946	2,161

Salt domes in Forrest County were being used for underground storage of propane, LPG, and butane. Capacity, as of October 1958, was as follows: Propane—476,000 barrels, butane—324,000 barrels, and LPG—1,250,000 barrels.[4]

Petroleum.—Crude-petroleum production for the first half of 1958 was about 11 percent less than the comparable period in the previous year. The second half of the year averaged 5 percent more than the last 6 months of 1957. For the year output was 1 percent less than in 1957.

TABLE 6.—Production of crude petroleum

Year	Production (thousand barrels)	Value (thousands)	Year	Production (thousand barrels)	Value (thousands)
1949–53 (average)	37,034	$85,946	1956	40,824	$100,019
1954	34,240	85,600	1957	38,922	113,263
1955	37,741	92,840	1958 [1]	38,551	110,256

[1] Preliminary figures.

TABLE 7.—Indicated demand, production, and stocks of crude petroleum in 1958, by months, in thousand barrels

Month	Indicated demand	Production	Stocks originating in Mississippi
January	2,882	3,059	2,638
February	2,981	2,899	2,556
March	3,552	3,281	2,285
April	2,659	2,643	2,269
May	3,043	2,789	2,015
June	2,913	2,985	2,087
July	3,200	3,335	2,222
August	2,491	3,427	3,158
September	4,014	3,330	2,474
October	3,870	3,552	2,156
November	3,446	3,652	2,362
December	3,578	3,599	2,383
Total: 1958	38,629	[1] 38,551	
1957	39,358	38,922	

[1] Preliminary figure.

TABLE 8.—Production of crude petroleum, by fields, in thousand barrels

Field	1954	1955	1956	1957	1958 [1]
Baxterville	5,137	5,301	5,874	4,939	4,993
Bolton			842	1,148	1,248
Brookhaven	3,724	3,511	3,019	2,541	2,218
Cranfield	1,776	1,497	1,299	1,206	982
Eucutta	1,352	1,355	1,484	1,318	1,611
Heidelburg	3,098	3,253	3,641	3,395	2,916
La Grange	2,269	2,128	2,137	1,936	1,649
Mallalieu	1,252	1,117	1,021	841	739
Soso	748	3,110	4,289	4,241	4,174
Tinsley	4,326	4,475	4,399	3,884	3,830
Yellow Creek	1,526	1,433	1,494	1,323	1,054
Other fields	9,032	10,561	11,325	12,150	13,137
Total	34,240	37,741	40,824	38,922	38,551

[1] Preliminary figures.

[4] Oil and Gas Journal, vol. 56, No. 39, Sept. 29, 1958, p. 40.

Approximately 16 percent (11 percent in 1957) of crude petroleum production was refined at 3 plants in the State: Southland Oils, Inc. at Sandersville; Paluxy Asphalt Co. at Crupp Station; and Pontiac Eastern Corp. at Purvis.

The Barnwell Production Co. planned construction of a $2.5 million refinery near McComb, Pike County, to refine crude oil from the nearby Little Creek Field. Gas was to be recycled into the ground for storage.

The Pontiac Eastern Corp. processed 14,500 barrels a day of high-gravity Mississippi crude oil into gasoline and other petroleum products.

NONMETALS

Cement.—The Mississippi Valley Portland Cement Co. completed construction of a plant at Redwood, about 15 miles north of Vicksburg. The plant was officially started on October 20, 1958, but various operating difficulties prevented any cement production until January 2, 1959. The Marquette Cement Manufacturing Co. produced portland and masonry cement at Brandon.

Clays.—The lightweight aggregate producing plant of Jackson Ready-Mix Concrete Co. was completed and began operations in July. Locally mined clay was used as raw material.

Ball clay production, all from Panola County, decreased slightly in both quantity and value. Bentonite production from Monroe, Itawamba, Smith, and Pearl River Counties, decreased in both quantity and value. Production of fuller's earth, used for absorbents, increased in quantity but decreased in value, probably due to competition from activated bentonite, activated bauxite, and other similar materials. Fire clay production increased 6 percent.

The Atlas Tile & Brick Co., a newly formed Mississippi corporation, announced plans for a plant at Yazoo City to produce glazed ceramic structural tile. The plant will initially have one kiln with a capacity of 100 tons of tile a day. A second kiln was planned. Raw materials for the plant will come from clay deposits in Kemper and Noxubee Counties. The company also announced plans to build a $1 million brick manufacturing plant at Shuqualok in Kemper County. The new plant, which was scheduled for operation in 6 months, will have a capacity to produce 18- to 20-million bricks annually. Approximately 140 workers will be employed at the new plant.

TABLE 9.—Clays sold or used by producers, by kinds, in thousand short tons and thousand dollars

Year	Bentonite		Ball clay, fire clay, and fuller's earth		Miscellaneous clay		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1949–53 (average)	242	$1,911	56	$612	265	$262	563	$2,785
1954	185	1,998	58	770	316	335	559	3,103
1955	227	2,558	80	959	394	396	701	3,913
1956	219	2,360	94	931	299	299	612	3,590
1957	220	2,372	101	968	295	295	616	3,635
1958	177	2,081	106	964	293	293	576	3,338

Magnesium Compounds.—The H. K. Porter Co., Inc., completed a plant at Bayou Casotte near Pascagoula to produce magnesium compounds from seawater and dolomite and to manufacture basic refractories. The capacity of the chemical plant was 125 tons of periclase a day. Output included chrome magnesite, magnesite chrome, and periclase type brick in burned, unburned and steel-clad bodies; also a line of chrome and periclase specialties. The plant utilized three rotary kilns for calcining and dead-burning; kiln lengths vary from 170 to 300 feet with diameters from 8 to 9½ feet. Dolomite quarried near Birmingham, Ala., was shipped about 300 miles by rail to the plant. Chromite ore was obtained from the Philippine Islands and Southern Rhodesia. Facilities at the plant include docks for rail, river barge, and deep-water transportation.

Nitrogen Compounds.—Coastal Chemical Corp. completed all sections of a new fertilizer plant at Bayou Casotte, a few miles east of Pascagoula, Jackson County. The company invested nearly $15 million in manufacturing facilities consisting of a 600-ton-a-day sulfuric acid plant, a 75-ton-a-day phosphoric acid plant, a 300-ton-a-day ammonium phosphate plant, and a 200-ton-a-day anhydrous ammonia plant. Additional facilities for the receiving and storage of raw materials and shipping of finished products also were installed. Additional expansion of the fertilizer facilities was underway.

Mississippi Chemical Corp., Yazoo City, completed the construction of plant facilities that added 150 tons a day to its nitric acid capacity and 30 tons a day to its ammonia capacity. Construction of a 100-ton-a-day prilled urea plant started in December and was scheduled for completion in June 1959.

HEF, Inc., a joint venture of Hooker Chemical Corp. and Foote Mineral Co., began operation of a new 4 million pound annual capacity ammonium perchlorate plant near Columbus. Ammonium perchlorate is used as an oxidizer in solid propellants for rockets and missiles. The Hooker Chemical Co. expanded its ammonium chlorate capacity to supply the basic raw material.

Sand and Gravel.—Increased activity in highway and industrial construction in Mississippi caused a corresponding increase in the production and value of sand and gravel. The total value of sand and gravel used for paving increased 11 percent. Sand and gravel production was reported from 24 of the 82 counties in the State; the leading counties, in order of value, were: Washington, Adams, Lowndes, Copiah, and De Soto.

Sodium Compounds.—American Potash & Chemical Corp. completed the construction of a sodium-chlorate plant at Hamilton, Monroe County and started production in late December. The estimated annual capacity of the plant was 15,000 tons of sodium chlorate. The chemical is used for bleaching pulp and paper, as a cotton defoliant and as weed killer. Rock salt, the major raw material, was obtained from Jefferson Island, La. Electrical energy was supplied by the TVA system.

Stone.—The State of Mississippi Lime Plant Board was the only producer of crushed limestone for agricultural purposes. Calcareous marl was the raw material used for the manufacture of cement.

TABLE 10.—Sand and gravel sold or used by producers, in thousand short tons and thousand dollars

Year	Commercial		Government-and-contractor		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1949–53 (average)	2,108	$1,641	575	$332	2,683	$1,973
1954	5,209	4,179	233	108	5,442	4,287
1955	5,027	4,336	598	267	5,625	4,603
1956	4,991	4,554	324	147	5,315	4,701
1957	4,484	3,920	688	424	5,172	4,344
1958	5,614	5,149	931	1,091	6,545	6,240

METALS

Aluminum.—A $300,000 metal extrusion plant was established at New Albany about the middle of 1958 by the First Mississippi Corp.

The Dixie Aluminum Corp. plant at Hattiesburg was officially closed in October. The Company's directors were attempting to sell the complete plant to a larger firm for possible reopening.

Iron Ore.—The Kilmichael Ore Corp. was essentially idle but sampling was done to evaluate the deposits.

REVIEW BY COUNTIES

Adams.—Natchez Gravel Co. produced structural sand and gravel for the building industry. St. Catherine Gravel Co. produced sand and gravel for both paving and structural purposes. Exploratory drilling resulted in discovery of four new oilfields in the county: Moss Hill, North Esperance Point, Anchorage, and Gallilee. Adams County ranked first in the value of petroleum produced.

Alcorn.—Corinth Brick & Tile Co. manufactured building brick from miscellaneous clay mined near Corinth.

Attala.—Bell's Brick Yard mined miscellaneous clay for common and face brick.

Bolivar.—The portable plant of Clay Carter Gravel Co. produced mostly pit-run gravel for road construction purposes. Misceramic Tile Co. began the production of floor and wall tile in February.

Carroll.—Delta Brick & Tile Co., Inc., produced building brick from miscellaneous clay mined in the vicinity of Carrollton. Leflore County Engineer produced pit-run gravel for highway construction.

Chickasaw.—Two small gasfields, the Trebloc and Coleville, were responsible for the county's mineral production.

Clay.—West Point Gravel Co. produced sand and gravel for structural and paving purposes. The State of Mississippi Lime Plant Board produced agricultural limestone from its quarry. One producing development well was completed in the Siloam field.

Coahoma.—The Coahoma County Highway Dept. produced paving sand for county road construction.

Copiah.—Production of paving sand and gravel was reported by Traxler Gravel Co., Inc., Greene Brothers Gravel Co., Inc., and the Lewis Gravel Co. The Gateville Gravel Co. furnished material for railroad ballast.

TABLE 11.—Value of mineral production in Mississippi, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Adams	$25,412,325	$22,598,713	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Alcorn	(2)	(2)	Clays.
Amite	55,739	47,160	Petroleum, natural gas.
Attala	4,800	3,375	Clays.
Bolivar		63,482	Sand and gravel.
Carroll	338,000	51,152	Sand and gravel, clays.
Chickasaw	70,300	86,325	Natural gas.
Clarke	485,432	507,212	Petroleum, natural gas.
Clay	(2)	91,351	Stone, sand and gravel.
Coahoma	20,004	(2)	Sand and gravel.
Copiah	546,213	605,327	Do.
De Soto	396,459	528,781	Do.
Forrest	8,884,140	12,304,531	Natural gas, petroleum, sand and gravel, clays.
Franklin	2,923,004	2,601,689	Petroleum, natural gas, natural-gas liquids.
George	74,250	(2)	Sand and gravel.
Greene	7,398	4,707	Petroleum.
Grenada	10,800	(2)	Sand and gravel.
Hancock	448,194	618,140	Natural gas, petroleum, sand and gravel.
Harrison	4,872	9,745	Sand and gravel.
Hinds	4,007,544	3,880,676	Petroleum, sand and gravel, clays, natural gas.
Holmes	(2)	(2)	Sand and gravel.
Issaquena	1,972		
Itawamba	(2)	(2)	Clays.
Jasper	15,847,315	14,993,842	Petroleum, natural gas.
Jefferson	7,904,295	5,993,516	Do.
Jefferson Davis	6,569,577	4,984,857	Natural gas, petroleum.
Jones	4,289,202	3,949,071	Petroleum, natural gas, clays.
Lamar	10,682,328	10,347,899	Petroleum, natural gas.
Lauderdale	(2)	(2)	Clays.
Lee	19,175	(2)	Clays.
Lincoln	13,253,671	15,160,231	Petroleum, natural-gas liquids, natural gas, clays.
Lowndes	261,700	703,330	Sand and gravel, clays.
Madison	1,321,874	1,042,592	Petroleum, natural gas.
Marion	2,437,527	2,072,069	Petroleum, natural gas, sand and gravel.
Marshall	66,000	140,000	Clays.
Monroe	2,719,136	2,881,777	Natural gas, clays, petroleum, sand and gravel.
Noxubee	27,000	45,900	Stone.
Panola	(2)	(2)	Clays, sand and gravel.
Pearl River	3,451,244	3,800,219	Natural gas, petroleum, sand and gravel, clays.
Perry	62,112	(2)	Sand and gravel, petroleum.
Pike		1,241,013	Petroleum, natural gas.
Pontotoc	3,500	(2)	Clays.
Prentiss	6,200	(2)	Do.
Rankin	(2)	(2)	Cement.
Sharkey	1,033	8,171	Petroleum.
Simpson	544,232	1,635,333	Petroleum, natural gas.
Smith	3,678,789	4,578,766	Petroleum, clays, natural gas.
Sunflower	22,400	(2)	Clays.
Tippah	(2)	(2)	Do.
Walthall		61,773	Petroleum.
Washington	(2)	875,066	Sand and gravel.
Wayne	7,476,572	9,086,422	Petroleum, natural gas.
Webster	720	(2)	Sand and gravel, iron ore.
Wilkinson	3,725,174	2,820,556	Petroleum, natural gas.
Yalobusha	(2)	(2)	Sand and gravel.
Yazoo	12,144,041	10,964,276	Petroleum, sand and gravel, natural gas.
Undistributed	4,743,359	7,273,775	
Total	144,950,000	148,663,000	

[1] The following counties are not listed because no production was reported: Benton, Calhoun, Choctaw, Claiborne, Covington, Humphreys, Jackson, Kemper, Lafayette, Lawrence, Leake, Leflore, Montgomery, Neshoba, Newton, Oktibbeha, Quitman, Scott, Stone, Tallahatchie, Tate, Tishomingo, Tunica, Union, Warren, and Winston.
[2] Value included with "Undistributed."

De Soto.—The two stationary plants of Memphis Stone & Gravel Co. produced sand, gravel, and clay base for road structures. The Weymouth Construction Co. produced paving and building sand and gravel.

Forrest.—The Pittman Concrete & Gravel Co. produced structural and paving sand and gravel. Production of sand and gravel for paving and structural uses, and for railroad ballast was reported by the

American Sand & Gravel Co. Hattiesburg Brick Works manufactured face brick and structural tile from miscellaneous clay. Development well drilling in the Maxie field was exceptionally successful during the year. The county ranked first in the production of natural gas.

Franklin.—Two new oilfields, the North Flat Rock and the Dry Bayou, were discovered in April and July, respectively, and, by the end of 1958 a producing development well had been completed in each of the fields.

Hancock.—Molding sand was dredged from the East Pearl River and processed by the Jahncke Service, Inc. The Ansley field continued as an important producer of petroleum and natural gas.

Harrison.—Bell Gravel Co. reported the production of sand and gravel for building purposes and for county road construction.

Hinds.—The Miss-Lite Aggregate Division of Jackson Ready-Mix Concrete Co. started producing lightweight aggregate on July 1 at a plant near Jackson. The Traxler Gravel Co., Inc., reported production of paving sand and gravel. The Johnson-Cone Brick Co. and the Tri-State Brick & Tile Co. used miscellaneous clay for the manufacture of building bricks and other heavy clay products. Development drilling in the Bolton field was markedly productive. The Mississippi Power & Light Co. started the construction of a 230,000-kilowatt steam-electric generator at Jackson.

Holmes.—The Hammett Gravel Co. reported production of paving sand and gravel from an open pit near Lexington.

Itawamba.—The county ranked second in the value of clays produced. Two companies, the American Colloid Co. and the Filtrol Corp. produced bentonite for use in refractories, insecticides, filtering processes, and as animal feed.

Jackson.—No mineral production was reported from the county. The Bayou Casotte Industrial District east of Pascagoula showed increasing activity with the completion of the H. K. Porter Co., Inc. basic refractory plant and the Coastal Chemical Corp. fertilizer plant.

Jasper.—The deepest petroleum-producing sand in Mississippi to date was discovered by Gulf Oil Corp. in the Jasper County area of the Soso field. After drilling to 19,040 feet in dry Smackover lime, crews backed up and successfully tested Cotton Valley perforations from 15,247–56 feet. Oil production from the Heidelberg field was sufficient to retain the county's rank as the State's second largest petroleum producer.

Jefferson.—Jefferson County was one of the State's leading producers of oil. Exploration and development drilling was active during the year.

Jefferson Davis.—Production from the Gwinville field was sufficient to attain second place among the natural-gas producers.

Jones.—The Laurel Brick & Tile Co., Inc., reported the production of miscellaneous clay for use in manufacturing common and face bricks at their plant near Laurel. Two new oilfields were discovered in Jones County during the year.

Kemper.—Iron ore, sand and gravel, clay, bauxite, lignite, and phosphate in Kemper County are discussed.[5]

Lamar.—The Baxterville oil and gas-condensate field in the southwest corner of the county continued as a major producer, ranking fifth in the production of natural gas and sixth in petroleum production.

Lee.—Tupelo Brick & Tile Co. reported mining miscellaneous clays and manufacturing building bricks.

Lincoln.—Brookhaven Pressed Brick & Manufacturing Co. reported the manufacture of building brick and heavy clay products from miscellaneous clay. An important new oilfield, the Little Creek field, was discovered in Lincoln and Pike Counties early in the year and, by the end of 1958, contained 46 producing oil wells. The county ranked third in petroleum production.

Lowndes.—Lowndes County ranked third in value of sand and gravel produced during the year. Producers were: C & P Gravel Co., Columbus Gravel Co., Fleming Gravel Co., and Smith Gravel Co. The Columbus Brick Co. manufactured heavy clay products from miscellaneous clays.

Marion.—Pit-run gravel was mined by the county road department for maintenance and construction of county roads. The Hub oil and gas-condensate field and the Sandy Hook gas-condensate field were important producers.

Marshall.—The Holly Springs Brick & Tile Co. produced fire clay for heavy clay products. The company announced expansion plans, which include a new brick manufacturing unit designed to produce a special type of low-cost brick. Clays from Marshall County were to be used as raw material for the new plant.

Monroe.—The county continued to lead in the value of clay produced; the entire output was bentonite. American Colloid Co. produced bentonite for refractories, foundries and steel works, insecticides, fungicides, drilling mud, etc. Eastern Clay Products Department of the International Mining & Chemical Co. produced bentonite for bonding clay and manufacturing refractories. Hamilton Sand & Gravel Co. and Nash Contracting Co. produced sand and gravel for paving and structural work. The county was an important producer of natural gas.

Noxubee.—The State of Mississippi Lime Plant Board produced limestone for use as a soil conditioner.

Panola.—The county ranked fourth in the value of clay produced. Kentucky & Tennessee Clay Co. mined ball clay for use in ceramics. The Weymouth Construction Co. produced paving gravel.

Pearl River.—Pearl River Clay Co. quarried montmorillonite for use in drilling mud, insecticides, and fungicides. Williams Gravel Co. dredged and processed sand and gravel for structural uses. A new gas reserve, the Stewart field, discovered in May, was steadily increasing the value of natural gas produced in the county.

Perry.—The Underwood Sand & Gravel Co. dredge and stationary plant produced building and paving sand and gravel. A rela-

[5] Hughes, Richard John, Kemper County Geology: Mississippi Geol. Survey Bull. 84, 274 pp.

tively small amount of petroleum was produced from the Glazier oilfield.

Pontotoc.—Pontotoc Brick Co. mined miscellaneous clay for building brick.

Prentiss.—Baldwyn Brick & Tile Co. manufactured building brick from locally mined miscellaneous clay.

Rankin.—Marquette Cement Manufacturing Co. continued processing calcareous marl to produce portland and masonry cement.

Simpson.—The Martinville field produced petroleum and natural gas during the year.

Smith.—Filtrol Corp. operated the Burns mine to produce bentonite for use in filtering and decolorizing mineral oils, vegetable oils, and animal fats. Petroleum and natural gas were produced.

Sunflower.—Delta Brick & Tile Co., Inc., mined clay for heavy clay products.

Tippah.—The county ranked third in the value of clays produced. Howell Southern Products, Inc., mined fuller's earth for use as absorbents. Wyandotte Chemical Corp. mined montmorillonite for absorbent uses.

Walthall.—New oil and gas pay zones were discovered for the Dexter pool. Skelly Oil Co. and Kin-Ark Oil Co. successfully tested the Good Friday sand of Lower Tuscaloosa and the Paluxy sand. Both were new formations for the Dexter field.

Warren.—The new cement plant of Mississippi Valley Portland Cement Co. began operations late in the year.

Washington.—The county ranked first in value of sand and gravel produced during the year. The U.S. Army Corps of Engineers used large amounts of the locally produced sand and gravel for river stabilization near Vicksburg. Suppliers were: Brent Contracting Co., Inc., Greenville Dredging Co., and Greenville Gravel Co. Pesticides were manufactured by Olin Mathieson Chemical Corp. at its plant near Leland.

Wayne.—Wayne County ranked fifth as a producer of petroleum. Major fields contributing to the production were the Eucutta and the Yellow Creek. Exploration and development drilling was reported.

Webster.—The National Park Service was a non-commercial producer of gravel for road work. The Kilmichael Ore Corp. mined and concentrated a small tonnage of brown iron ore.

Wilkinson.—Many small fields accounted for a moderate amount of oil and gas production in Wilkinson County. Wildcat drilling was unsuccessful.

Yalobusha.—Grenada Gravel Co. operated a fixed plant to produce building and paving sand and gravel, and filter sand.

Yazoo.—Mississippi Chemical Corp. expanded its nitric acid and ammonia capacity and commenced construction of a 100-ton-a-day prilled urea plant. Anderson Sand & Gravel Co. produced pit-run paving gravel for highway construction. Yazoo County ranked fourth in the value of petroleum produced.

The Mineral Industry of Missouri

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Division of Geological Survey and Water Resources, Department of Business Administration of Missouri.

By W. G. Diamond [1] and William C. Hayes [2]

MISSOURI led the Nation in 1958 in output of lead for the 51st consecutive year and was also first in output of barite. Mineral production was reported from 109 of the 114 counties. The leading counties in order of production value were St. Louis, St. Francois, Ste. Genevieve, Cape Girardeau, and Jackson. Eighteen mineral commodities were produced in the State—eight metals, eight nonmetals, and two mineral fuels. The five principal minerals in order of value were cement, stone, lead, lime, and coal. This was the first year that lead was not the chief mineral produced.

TABLE 1.—Mineral production in Missouri [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite	317,350	$3,938	199,268	$2,666
Cement thousand 376-pound barrels	[2] 10,794	[2] 34,307	[2] 11,813	[2] 39,376
Clays thousand short tons	2,648	7,648	2,060	5,986
Coal do	2,976	12,691	2,592	11,111
Copper (recoverable content of ores, etc.)	1,604	966	1,429	752
Iron ore (usable) thousand long tons, gross weight	530	4,625	387	3,820
Lead (recoverable content of ores, etc.)	126,345	36,135	113,123	26,471
Lime thousand short tons	1,393	16,475	1,173	14,136
Natural gas million cubic feet	12	2	----------	----------
Sand and gravel thousand short tons	8,480	8,942	8,972	9,728
Silver (recoverable content of ores, etc.) thousand troy ounces	184	166	251	227
Stone thousand short tons	22,098	29,836	24,276	32,878
Zinc (recoverable content of ores, etc.)	2,951	685	362	74
Value of items that cannot be disclosed: Native asphalt, masonry cement, cobalt, gem stones, manganese ore, nickel (content of ore) and petroleum	----------	[3] 2,793	----------	3,202
Total Missouri [4]	----------	[3] 152,913	----------	144,005

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes masonry cement, value for which is included with "Value of items that cannot be disclosed."
[3] Revised figure.
[4] The total has been adjusted to eliminate duplicating value of clays and stone.

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[2] Assistant State geologist, Geological Survey and Water Resources, Rolla, Mo.

Employment and Injuries.—*Employment.*—Average annual employment declined 6 percent in the metal and 2 percent in nonmetal-mining and 26 percent in the coal-mining industries.

Injuries.—Six mine fatalities occurred, according to the Division of Mine Inspection, Department of Labor and Industrial Relations of Missouri. The cause of each of the three iron-mining-industry fatal accidents is listed: (1) The bank caved on the shovel operator at a surface mine, (2) improper movement of the cage in a shaft, and (3) failure of a steel platform in the shaft, causing the shaftman to fall to the bottom. One fatality in coal mining resulted when a shovel and ground man at a strip mine was covered by mud and clay. Two fatal accidents were reported in the lead and zinc mining industry: One accident was caused by falling material and the other, by running a tractor off a bluff.

Legislation and Government Programs.—The Defense Minerals Exploration Administration (DMEA) expired June 30 and was replaced later in the year by the Office of Minerals Exploration (OME). Active DMEA projects included the following exploration: Lead and copper sources in Madison, Bollinger, and Perry Counties by National Lead Co.; lead, zinc, and copper sources in Crawford, Washington, and Iron Counties by St. Joseph Lead Co.; and copper and lead sources in Dent and Iron Counties by American Zinc, Lead & Smelting Co.

TABLE 2.—Average annual employment of mining industries [1]

Industry	1954	1955	1956	1957	1958
Metal mining	3,527	3,371	[2] 3,524	[2] 3,767	3,540
Nonmetal mining	3,909	3,999	[2] 3,991	[2] 4,030	3,941
Coal mining	962	970	921	[2] 970	720
Total	8,398	8,340	[2] 8,436	[2] 8,767	8,201

[1] Division of Employment Security, Department of Labor and Industrial Relations, State of Missouri.
[2] Revised figure.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Nonmetals supplied 69 percent of the total value of mineral production.

Barite.—Barite was produced in Washington and Jefferson Counties. The leading producers included Milwhite Mud Sales Co., Magnet Cove Barium Corp., Midwest Mining Co., Hornsey Brothers, and De Soto Mining Co. The grinding plants were in Washington and St. Louis Counties. Missouri barite was used in oil-well drilling and by chemical industries.

Cement.—Cement plants in St. Louis, Cape Girardeau, Jackson, and Ralls produced 12.1 million barrels of portland cement and averaged 79 percent of total capacity. About 58 percent was produced by wet-process and 42 percent, by dry-process. Of the total 11.8 million barrels, over 81 percent was shipped in bulk and 19 percent, in bags; more than 97 percent was transported by railroad and the remainder,

by boat. At its Prospect Hill plant in St. Louis and at its Sugar Creek plant near Independence, Missouri Portland Cement Co. completed constructing new facilities for storing and shipping bulk cement.

TABLE 3.—Barite sold or used by producers

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	263,273	$2,475,579	1956	381,642	$4,461,955
1954	312,791	3,047,436	1957	317,350	3,938,486
1955	363,692	4,003,842	1958	199,268	2,666,496

TABLE 4.—Production and shipments of portland cement

Year	Production (thousand barrels)	Shipments		Year	Production (thousand barrels)	Shipments	
		Barrels (thousands)	Value (thousands)			Barrels (thousands)	Value (thousands)
1949–53 (average)	9,818	9,693	$23,924	1956	12,441	12,014	$36,888
1954	11,202	11,379	31,425	1957	10,866	10,794	34,307
1955	12,001	12,255	34,912	1958	12,143	11,813	39,376

All of the cement plants also produced masonry cement.

Clays.—Missouri ranked high in refractory manufacturing because of its many deposits of fire clay and high-alumina clay. Refractories were produced by A. P. Green Fire Brick Co., Mexico Refractories Co., Harbison-Walker Refractories Co., Walsh Refractories Corp., General Refractories Co., North American Refractories Co., and Laclede-Christy Co. Contractors mined most of the clay. Gilliam Mining Co., Bethlehem Co., and Fluetsch Bros. mined fire clay

TABLE 5.—Clays sold or used by producers, by kinds

Year	Fire clay		Diaspore		Burley	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1949–53 (average)	1,368	$6,450	43	$652	57	$502
1954	1,170	4,460	3	17	9	51
1955	1,486	5,693	12	134	31	208
1956	1,699	6,499	25	293	42	325
1957	1,672	6,206	10	123	50	398
1958	1,176	4,806	9	143	27	190

Year	Miscellaneous clay		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1949–53 (average)	801	$938	2,269	$8,542
1954	745	1,331	1,927	5,859
1955	873	867	2,402	6,902
1956	892	899	2,658	8,016
1957	916	921	2,648	7,648
1958	848	847	2,060	5,986

for use in horizontal zinc retorts in Oklahoma and Texas. Lightweight aggregate was produced from miscellaneous clay in Platte County by Carter Waters Corp. Heavy clay products and cement also were produced from miscellaneous clay. Clays were produced in 21 counties. Leading clay-producing counties were Gasconade, Audrain, Callaway, Maries, and Montgomery.

Lime.—Lime was produced at six lime plants in 1958—two in Greene County and one each in Marion, Newton, St. Francois, and Ste. Genevieve Counties. Approximately 84 percent of the lime was used for chemical and industrial purposes, 9 percent for refractory material, and 7 percent for building purposes.

TABLE 6.—Lime (quick and hydrated) sold and used by producers

Year	Quicklime (thousand short tons)	Hydrated lime (thousand short tons)	Total lime	
			Thousand short tons	Value (thousands)
1949–53 (average)	893	183	1,076	$10,436
1954	918	208	1,126	11,165
1955	1,241	224	1,465	14,408
1956	1,254	227	1,482	15,814
1957	1,172	221	1,393	16,475
1958	953	220	1,173	14,136

TABLE 7.—Sand and gravel sold or used by producers

Year	Commercial		Government-and-contractor		Total	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
1949–53 (average)	5,286	$4,865	878	$523	6,164	$5,388
1954	8,822	9,555	1,069	648	9,891	10,203
1955	8,353	8,790	1,631	1,191	9,984	9,981
1956	8,161	8,873	1,424	1,244	9,585	10,117
1957	7,198	8,000	1,282	942	8,480	8,942
1958	8,281	9,285	691	443	8,972	9,728

Sand and Gravel.—Sand and gravel was produced, chiefly from stream deposits, in 73 counties. St. Louis, Jefferson, Franklin, St. Charles, and Jasper Counties led in value of production. Nearly 78 percent of total production was used for building and highway construction. Commercial production furnished 92 percent of the total tonnage and 95 percent of the total value; the remainder was Government-and-contractor output. Quality silica sand was obtained in St. Louis County for abrasive, foundry, enamel, pottery, porcelain, tile, and other uses.

Stone.—Missouri produced limestone, granite, marble, sandstone, and miscellaneous stone. Limestone production was reported in 86 counties and supplied 96 percent of the total tonnage and 94 percent of the total value. Crushed and dimension granite was produced in Iron County. Dimension marble was quarried in Jasper, Greene, and Ste. Genevieve Counties. Sandstone was quarried in Shannon, Reynolds, Wayne, and Camden Counties. Miscellaneous stone (chats)

was produced in St. Francois, Jasper, Washington, Newton, St. Clair, and Audrain Counties. The principal uses for crushed stone were for concrete aggregate, roadstone, riprap, and agricultural stone. Dimension stone was used as monumental and building stone. Commercial producers supplied 98 percent of total tonnage.

Asphaltic sandstone was produced in Barton County by Bar-Co Roc, Inc., for use on roads.

TABLE 8.—Stone sold or used by producers, by kinds

Year	Granite		Marble		Limestone	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1954	3,827	$170	22,893	$1,068	17,770,749	$22,914
1955	2,821	180	[2] 8,500	[2] 102	21,283,587	28,850
1956	3,456	302	[2] 5,000	[2] 25	23,152,644	31,051
1957	5,369	232	(1)	(1)	20,936,499	27,269
1958	3,648	260	(1)	(1)	23,387,507	30,774

Year	Sandstone		Miscellaneous stone [3]		Total stone	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1954	633	$11	874,137	$589	18,672,239	$24,752
1955	3,036	59	1,070,824	389	[2] 22,368,768	[2] 29,580
1956	(1)	(1)	1,395,776	820	24,578,243	33,577
1957	(1)	(1)	1,117,339	751	22,097,639	29,836
1958	(1)	(1)	870,879	465	24,275,550	32,878

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Excludes dimension marble.
[3] Chats; also include small quantity of stone.

Tripoli.—Tripoli was processed from ore quarried in Oklahoma at the American Tripoli Division of The Carborundum Co. Seneca plant in Newton County. Production was slightly less than in 1957. The processed tripoli was used for abrasive polishing and buffing compounds in the metal-finishing trades, as a chemically inert filler, and for foundry facings.

METALS

Mine Mills and Smelters.—At the beginning of 1958 seven mine-mills were operating in Southeastern Missouri—the Mine La Motte mill of Mine La Motte Corp. and the Madison mill of National Lead Co., Madison County; the Indian Creek mill, Washington County; and the Federal, Bonne Terre, Desloge, and Leadwood mills, operated by St. Joseph Lead Co., St. Francois County. The Desloge mill was shut down June 16 and the Mine La Motte mill on July 11. National Lead Co. refined cobalt-nickel at Fredericktown. At Herculaneum, St. Joseph Lead Co. smelted and refined lead. According to the Company Annual Report to Stockholders, production was reduced from two furnaces to one furnace from March 1 to May 1. The zinc-slag furnace at the plant was not operated.

Cadmium, Gallium, Germanium, and Indium.—These metals occur in Missouri lead-zinc ores and were recovered from flue dusts from zinc

smelting. Since no source was designated for any of the concentrate smelted in Missouri, no State of origin was assigned for these by-product metals.

Cobalt and Nickel.—Cobalt and nickel were recovered from the complex lead-copper-cobalt-nickel ores in Madison County by National Lead Co. at Fredericktown. The refinery was leased from the U.S. Government.

Columbium-Tantalum, and Uranium.—Domestic euxenite concentrate, mostly from Idaho, was processed by Mallinckrodt Chemical Co. at St. Louis to separate columbium-tantalum and uranium products.

Copper.—Copper was recovered from lead-copper ore in Madison County and lead ore in St. Francois County. Significant quantities of copper were found in deposits being explored principally for iron ore.

Iron Ore.—Iron ore exploration and development continued. Good progress was made on the Pea Ridge iron-ore project by Meramec Mining Co., owned jointly by Bethlehem Steel Corp. and St. Joseph Lead Co. At the end of the year, the service shaft of the mine reached 1,200 feet in depth; the main ore-hoisting shaft was collared; and the foundations were poured for the headframe. At the plant site and service area much of the grading was completed. Construction (grading and bridge building) of the first 12-mile section of the Missouri Pacific Railroad Co. new Pea Ridge line was started late in the year.

Joint exploration by American Zinc, Lead and Smelting Co. and Granite City Steel Co. was continued. According to the American Zinc, Lead and Smelting Co. 1958 Annual Report, approximately 50,000 feet of combined churn and diamond drilling was completed at the Bourbon and Boss-Bixby areas. Out of 12 holes completed, 3 gave promise of a Commercial-grade copper ore up to 100 feet in thickness. All holes completed have contained iron.

Brown-ore (limonite) and hematite-ore output declined 27 percent in tonnage and 17 percent in value from 1957. Production was reported from 26 mines in 9 counties.

Lead.—Missouri mine production of recoverable lead totaled 113,000 tons—42 percent of total lead production in the Nation. No lead production was reported in Southwestern Missouri. Value of lead production declined as the price of lead dropped from 13 cents per pound, New York, on January 1 to a low of 10¾ cents on August 13, and returned to 13 cents on October 14, where the price remained. Because of price reductions, St. Joseph Lead Co. shut down southeast Missouri mining entirely from March 8 to March 31. The workweek was reduced from 5 to 4 days on August 25 but the 5-day week was resumed early in the fourth quarter. About midyear, the Hayden Creek mine was closed indefinitely and equipment removed. The Mine La Motte Corp did not begin mining the new ore body but did complete sinking the new shaft.

At St. Joseph Lead Co. Viburnum lead project, the Kilmer shaft was completed at a depth of 804 feet, and lateral development started. Grading of the plant site at the Conway shaft and foundations for the crushing plant also were underway. Completion of the first 3,000-ton unit of the 6,000-ton mill was expected early in 1960. The

town of Viburnum began taking shape as streets, sewer, and water-supply systems neared completion.

Mining and milling methods and costs of the Indian Creek Mine of St. Joseph Lead Co. were described in a Bureau of Mines report.[3] The Indian Creek mine was the first important producer of lead ore at depth in Washington County. Trackless equipment that was powered by diesel or electric motors was used exclusively. The hoisting shaft was the first circular, concretelined shaft to be sunk in the lead district.

TABLE 9.—Mine production of silver, copper, lead, and zinc in 1958, by months, in terms of recoverable metals

Month	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	19,850	151	11,686	98
February	18,250	115	10,601	93
March	6,270	113	3,939	----
April	20,300	148	11,799	----
May	26,100	140	11,046	141
June	24,300	143	10,124	30
July	24,900	121	10,019	----
August	22,780	117	8,859	----
September	19,600	105	7,734	----
October	23,270	97	9,290	----
November	21,790	77	8,626	----
December	23,507	102	9,400	----
Total:				
1958	250,917	1,429	113,123	362
1957	183,427	1,604	126,345	2,951

TABLE 10.—Mine production of silver, copper, lead and zinc, in terms of recoverable metals

Year	Mines producing	Material sold or treated		Silver		Copper	
		Crude ore (short tons)	Old tailing (short tons)	Fine ounces	Value (thousands)	Short tons	Value (thousands)
1949–53 (average)	----	6,533,484	1,452,291	284,265	$257	2,805	$1,294
1954	16	6,598,647	1,579,068	352,971	319	1,925	1,136
1955	18	6,734,346	1,546,126	268,620	243	1,722	1,285
1956	19	6,996,696	1,223,575	295,111	267	1,890	1,607
1957	16	6,874,008	1,271,684	183,427	166	1,604	966
1958	9	5,945,836	479,916	250,917	227	1,429	752

Year	Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	
1949–53 (average)	128,198	$38,809	9,898	$2,979	$43,339
1954	125,250	34,319	5,210	1,125	36,899
1955	125,412	37,373	4,476	1,101	40,002
1956	123,783	38,868	4,380	1,200	41,942
1957	126,345	36,135	2,951	684	37,951
1958	113,123	26,471	362	74	27,524

[3] Christiansen, Carl R., Calhoun, Willis A., and Brown, Walter F., Mining and Milling Methods and Costs at the Indian Creek Mine, St. Joseph Lead Co., Washington County, Mo.: Bureau of Mines Inf. Circ. 7875, 1959, 47 pp.

TABLE 11.—Mine production of silver, copper, lead, and zinc in 1958, by classes of ore or other sources of material, in terms of recoverable metals

Source	Mines, number	Material sold or treated (short tons)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lead ore [1]	9	6,425,752	250,917	1,429	113,123	362

[1] Includes lead-copper ore from 1 mine concentrate that was 479,916 tons of remilled old tailing mixed with that from crude ore.

TABLE 12.—Mine production of lead and zinc in Southeastern and Central Missouri, in terms of concentrate and recoverable metals [1]

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite) [2]		Recoverable metal content [3]			
					Lead		Zinc	
	Short tons	Value (thousands) [4]	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1949–53 (average)	181,818	$30,724	3,873	$367	126,096	$38,145	2,325	$694
1954	181,790	29,681	6,069	480	125,173	34,297	[5] 3,169	685
1955	180,262	32,428	7,507	700	125,357	37,356	3,934	968
1956	174,131	33,266	6,484	542	123,395	38,746	3,345	917
1957	179,312	31,507	5,903	448	126,323	36,128	2,866	665
1958	159,068	23,015	770	41	113,123	26,471	362	74

[1] Based upon Southeastern and Central Missouri ore "dirt" and old tailing treated at mills during calendar year indicated.
[2] Includes zinc-lead carbonate concentrate.
[3] The calculation of the metal content of the assayed ores made allowance for losses in smelting both lead and zinc. The values of concentrate "ore" and metal are actually those received by the producer; whereas, the value of the lead and zinc is calculated from the average price for all grades.
[4] Values given are somewhat arbitrary because part of the lead concentrate is smelted by the producer.
[5] Includes 427 tons of zinc recovered from byproduct matte from lead smelting.

TABLE 13.—Mine production of lead and zinc in Southwestern Missouri, in terms of concentrate and recoverable metals [1]

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content [2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	[3] 2,698	[3] $559,017	[4] 14,041	[4] $1,386,859	2,101	$664,444	7,573	$2,284,507
1954	103	16,826	3,713	378,782	77	21,098	2,041	440,856
1955	75	12,750	1,048	74,528	55	16,390	542	133,332
1956	496	102,096	1,862	161,502	388	121,832	1,035	283,590
1957	29	5,576	161	[5] 12,742	22	6,292	85	19,720
1958								

[1] Based upon southwestern Missouri ore "dirt" and old tailing treated at mills during the calendar year indicated.
[2] The calculation of metal content of the ores from assays made allowance for losses in smelting both lead and zinc. The values of concentrate "ore" and metal are those actually received by the producer; whereas, the values of lead and zinc are calculated from the average price of all grades.
[3] Includes lead carbonate.
[4] Includes zinc silicate.
[5] Revised figure.

TABLE 14.—Tenor of lead and zinc ore, old tailing, and slimes milled and concentrate produced, by districts

	Southeastern Missouri		Southwestern Missouri	
	1957	1958	1957	1958
Concentrate production:				
Lead, short tons	179,312	159,068	29	
Zinc, do	5,903	770	161	
Concentrate obtained from:				
Lead, percent	2.20	2.48	.85	
Zinc, do	.07	.01	4.74	
Metal content of ore[1]:				
Lead, do	1.55	1.76	.65	
Zinc, do	.04	.01	2.50	
Average lead content of galena concentrate, do	71.90	72.57	75.86	
Average zinc content of sphalerite concentrate, do	54.11	52.21	59.00	
Average value per ton:				
Galena concentrate	$175.71	$144.69	$192.28	
Sphalerite concentrate	$75.84	$53.79	$79.14	
Total material milled, short tons	[2] 8,142,292	[2] 6,425,752	3,400	

[1] Figures represent only the metal content of crude ore recovered in the concentrate; data on tailing losses not available.
[2] Includes lead-copper ore and old tailing remilled: 1957, 1,271,684 tons; 1958, 479,916 tons.

TABLE 15.—Quoted prices of 60-percent zinc concentrate and 80-percent lead concentrate at Joplin, Mo., in 1958

[E&MJ Metal and Mineral Markets]

Zinc concentrate		Lead concentrate	
Period	Price per short ton	Period	Price per short ton
Jan. 1–Oct. 7	$56.00	Jan. 1–Mar. 31	$156.12
Oct. 8–Nov. 6	64.00	Apr. 1–May 13	141.72
Nov. 7–Dec. 31	68.00	May 14–June 2	134.52
		June 3–June 17	127.32
		June 18–June 30	134.52
		July 1–Aug. 12	127.32
		Aug. 13–Sept. 17	123.72
		Sept. 18–Sept. 29	127.32
		Sept. 30–Oct. 7	134.52
		Oct. 8–Oct. 13	148.92
		Oct. 14–Dec. 31	156.12

Flotation tailing from the St. Joseph Lead Co. mill at Bonne Terre, Mo., was the object of mineral-dressing research to recover a significant part of the residual, finely divided galena.[4] This research showed that, from a feed material averaging 0.20 percent lead, a recovery of up to 45 percent could be effected by flotation in rougher concentrate analyzing up to 6.5 percent lead.

Silver.—Silver recovery from Missouri lead and lead-copper ores was greater than in 1957. Silver was recovered from refining pig lead, which was obtained from smelting ores mined in St. Francois and Madison Counties.

Zinc.—Production of recoverable zinc declined for the sixth consecutive year. No zinc production was reported in southwestern Missouri. Production was reported from St. Francois and Washington Coun-

[4] Frommer, D. W., and Fine, M. M., Experiments in Concentrating Lead Sulfide Slime: Bureau of Mines Rept. of Investigations 5444, 1959, 13 pp.

ties. The price of Prime Western slab zinc was 10 cents per pound, East St. Louis, on January 1 and rose to 11.5 cents on November 7; this latter price held through December.

No production was reported in the southwestern Missouri part of the Tri-State district. (Details of Tri-State activity may be found in the Oklahoma chapter.)

Iron and Steel.—The Kansas City steel plant of the Sheffield Division, Armco Steel Corp. (annual ingot capacity of 708,000 net tons) operated its open-hearth and electric furnaces and its rolling mills.

Many iron and steel foundries, principally in the St. Louis and Kansas City areas, consumed iron and steel scrap and pig iron and produced iron and steel castings.

MINERAL FUELS

Coal.—Bituminous coal was produced in 16 counties; more than 1,000 tons was reported from 37 mines. Thirteen underground mines in six counties supplied 4 percent of the State total coal tonnage and 5 percent of total value. By far the greater part of underground production was cut by machines; 82 percent was power-drilled. Strip-mine production reported from 24 mines in 12 counties supplied 96 percent of total tonnage and 95 percent of total value. Total overburden reported excavated in 1958, nearly 40 million cubic yards, averaged 16 cubic yards for each ton of coal strip-mined. At 10 mines, almost 73 percent of total coal tonnage was mechanically cleaned, and at 13 mines over 51 percent of the mined coal was crushed. Four percent of the coal at eight mines was oil-treated. Nearly 81 percent of coal mined was shipped by rail and 19 percent, by truck.

TABLE 16.—Consumption of ferrous scrap and pig iron, in short tons

Year	Total scrap	Pig iron	Total scrap and pig iron	Year	Total scrap	Pig iron	Total scrap and pig iron
1955	1,017,473	51,864	1,069,337	1957	976,266	51,932	1,028,198
1956	1,039,866	45,722	1,085,588	1958	896,231	36,257	932,488

TABLE 17.—Coal production

Year	Short tons (thousands)	Value (thousands)	Year	Short tons (thousands)	Value (thousands)
1949–53 (average)	3,046	$12,518	1956	3,283	$13,223
1954	2,514	10,028	1957	2,976	12,691
1955	3,232	12,772	1958	2,592	11,111

Petroleum.—Crude petroleum was recovered near St. Louis and near Tarkio in Atchison County. Output and value continued to decline. Construction of a $1,250,000 marine service bulk plant for Gulf Oil Co. was started at St. Louis late in the year. The new installation will permit loading 12 tank cars on 2 railway sidings simultaneously, as well as 4 tank trucks. Construction was expected to be completed in 1959.

REVIEW BY COUNTIES

Mineral production was reported in 109 of the 114 counties in Missouri; 19 counties (1 less than in 1957) reported production valued at $1 million or more. Five counties—St. Louis, St. Francois, Ste. Genevieve, Cape Girardeau, and Jackson—contributed 60 percent of the total mineral-production value; no output was reported in Chariton, Mississippi, New Madrid, Schuyler, and Scotland Counties.

Adair.—Coal was mined underground by Billy Creek Coal Co., Inc., and Blacksmith Coal Co., Inc. Bailey Limestone Quarry crushed limestone for concrete aggregate, roadstone, and agricultural stone.

Andrew.—George W. Kerford Quarry and the U.S. Army Corps of Engineers quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone, and riprap (for the banks of the Missouri River).

TABLE 18.—Value of mineral production in Missouri, by counties[1]

County	1957	1958	Minerals produced in 1958 in order of value
Adair	$303,988	$343,227	Coal, stone.
Andrew	202,288	66,393	Stone.
Atchison	(2)	(2)	Petroleum.
Audrain	1,618,698	1,248,737	Clays, stone.
Barry	(2)	(2)	Sand and gravel, stone.
Barton	(2)	(2)	Coal, asphaltic sandstone.
Bates	1,615,787	134,652	Stone, coal, sand and gravel.
Benton	(2)	16,222	Sand and gravel.
Bollinger	(2)	(2)	Sand and gravel, gem stones.
Boone	735,526	1,126,120	Stone, sand and gravel, clays.
Buchanan	254,059	339,880	Do.
Butler	(2)	20,661	Sand and gravel.
Caldwell	122,319	208,532	Stone.
Callaway	2,220,142	1,508,862	Coal, clays, stone, sand and gravel.
Camden	(2)	(2)	Sand and gravel, stone.
Cape Girardeau	9,078,817	9,992,819	Cement, stone, sand and gravel, clays, gem stones.
Carroll	15,495	(2)	Stone.
Carter	(2)	(2)	Sand and gravel.
Cass	356,626	246,339	Stone, clays.
Cedar	(2)	(2)	Stone, sand and gravel.
Christian	(2)	19,496	Do.
Clark	(2)	305,418	Stone, coal.
Clay	780,991	980,343	Stone.
Clinton	106,059	183,009	Do.
Cole	96,853	212,744	Sand and gravel.
Cooper	74,500	243,227	Stone, sand and gravel.
Crawford	56,774	26,408	Clays, stone, sand and gravel.
Dade	(2)	193,328	Stone, coal.
Dallas	(2)	(2)	Sand and gravel.
Daviess	(2)	(2)	Stone, sand and gravel.
De Kalb	81,688	172,499	Stone.
Dent	39,600	(2)	Sand and gravel.
Douglas	177,285	(2)	Sand and gravel, stone.
Dunklin	(2)	(2)	Sand and gravel.
Franklin	880,687	742,139	Sand and gravel, stone, clays.
Gasconade	2,280,342	1,952,783	Clays, stone.
Gentry	115,150	(2)	Stone, sand and gravel.
Greene	2,495,902	3,185,094	Lime, stone, iron ore, sand and gravel.
Grundy	(2)	(2)	Stone.
Harrison	243,155	190,177	Stone, sand and gravel, coal.
Henry	4,900,365	5,166,469	Coal, stone.
Hickory	(2)	20,226	Stone, sand and gravel.
Holt	73,601	547,570	Stone.
Howard	180,686	187,571	Stone, sand and gravel.
Howell	771,177	504,604	Iron ore, stone.
Iron	284,575	301,513	Stone.
Jackson	7,860,749	9,772,126	Cement, stone, sand and gravel, clays.
Jasper	2,246,226	2,104,162	Stone, sand and gravel.
Jefferson	1,491,587	1,257,016	Sand and gravel, stone, barite.
Johnson	138,537	170,450	Stone.
Knox	(2)	(2)	Do.
Laclede	53,775	37,453	Stone, sand and gravel.

See footnotes at end of table.

TABLE 18.—Value of mineral production in Missouri, by counties[1]—Continued

County	1957	1958	Minerals produced in 1958 in order of value
Lafayette	$253,165	$327,905	Stone, sand and gravel, coal.
Lawrence	49,079	4,449	Stone, sand and gravel.
Lewis	(2)	(2)	Sand and gravel, stone.
Lincoln	241,791	141,443	Stone, clays, sand and gravel.
Linn	(2)	(2)	Stone.
Livingston	230,941	406,048	Stone, clays, sand and gravel.
Macon	(2)	(2)	Coal, stone.
Madison	6,180,716	4,158,310	Lead, cobalt, nickel, copper, stone, sand and gravel, silver.
Maries	388,221	464,227	Clays, stone, sand and gravel.
Marion	705,308	(2)	Lime, stone.
McDonald	(2)	(2)	Sand and gravel.
Mercer	(2)	(2)	Stone.
Miller	55,534	51,591	Sand and gravel, stone.
Moniteau	32,900	51,600	Stone, sand and gravel.
Monroe	293,035	280,497	Clays, stone, sand and gravel.
Montgomery	599,755	758,417	Do.
Morgan	14,900	31,456	Sand and gravel, stone.
Newton	550,656	438,477	Lime, stone.
Nodaway	280,581	170,500	Stone, sand and gravel.
Oregon	627,381	149,370	Iron ore, stone, sand and gravel.
Osage	382,295	325,640	Clays, sand and gravel.
Ozark	41,650	14,327	Sand and gravel, iron ore, gem stones.
Pemiscot	(2)	267,450	Sand and gravel.
Perry	(2)	(2)	Stone, sand and gravel.
Pettis	(2)	(2)	Stone.
Phelps	150,681	129,814	Stone, clays, sand and gravel.
Pike	209,022	196,507	Stone, sand and gravel.
Platte	244,348	157,316	Clays, stone.
Polk	36,700	17,800	Sand and gravel.
Pulaski	84,200	(2)	Do.
Putnam	338,542	761,796	Coal, stone.
Ralls	5,797,201	5,875,221	Cement, stone, coal, sand and gravel.
Randolph	346,665	1,605,234	Coal, stone.
Ray	249,437	483,920	Stone, coal.
Reynolds	(2)	95,703	Iron ore, stone, sand and gravel, manganese.
Ripley	41,143	(2)	Sand and gravel.
St. Charles	1,256,844	956,350	Stone, sand and gravel.
St. Clair	1,089,511	1,030,776	Coal, stone, sand and gravel.
St. Francois	35,918,538	26,968,208	Lead, iron ore, lime, stone, copper, silver, zinc.
Ste. Genevieve	13,390,014	11,737,588	Lime, stone, sand and gravel.
St. Louis	23,223,090	27,879,472	Cement, sand and gravel, stone, clays, petroleum, gem stones.
Saline	292,187	540,878	Stone.
Scott	(2)	3,100	Sand and gravel.
Shannon	42,450	349,300	Iron ore, stone, sand and gravel.
Shelby	(2)	(2)	Stone.
Stoddard	(2)	164,715	Sand and gravel.
Stone	(2)	(2)	Stone, sand and gravel.
Sullivan	150,463	94,113	Stone.
Taney	713,200	(2)	Stone, sand and gravel.
Texas	43,321	31,518	Do.
Vernon	362,774	413,305	Coal, stone, sand and gravel.
Warren	269,932	197,052	Clays, stone, sand and gravel.
Washington	7,610,672	5,833,299	Lead, barite, sand and gravel, stone, zinc, iron ore.
Wayne	316,961	233,242	Iron ore, stone, sand and gravel.
Webster	(2)	(2)	Sand and gravel.
Worth	(2)	(2)	Stone.
Wright	(2)	24,547	Stone, sand and gravel.
Undistributed	7,853,187	6,458,626	
Total	[3] 152,913,000	144,009,000	

[1] The following counties are not listed because no production was reported in 1957 or 1958: Chariton, Mississippi, New Madrid, Schuyler, and Scotland.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Revised figure.

Audrain.—Audrain County, second in State clay production for the fourth consecutive year, reported output of fire clay for refractories. Fire clay was mined by Mexico Refractories Co., A. P. Green Fire Brick Co., North American Refractories Co., Wellsville Fire Brick Co., Harbison-Walker Refractories Co., Laclede-Christy Co., and Walsh Refractories Corp. A. P. Green Fire Brick Co. announced

plans to construct a new research center in 1959 at Mexico. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by Molino Lime Co.

Barry.—Crushed and dimension limestone was produced by Douthitt Lime Co. Missouri State Highway Department contracted for paving gravel.

Barton.—Clemens Coal Co. strip-mined coal in Barton County. Bar-Co Roc, Inc., produced asphaltic sandstone for use on roads.

Bates.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Alvis Limestone & Concrete Co. and Frank Underwood. Coal was strip-mined by Mullies Coal Co. Building gravel was produced by Clyde S. Miller.

Benton.—J. C. Orender obtained gravel for paving from deposits in the county.

Bollinger.—Mayfield Sand & Gravel Co. and the Missouri State Highway Department produced building and paving gravel. Gem varieties of agate were produced by Lee Roy Friday.

Boone.—Boone County ranked seventh in the State in value of stone production. Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by W. J. Menefee Construction Co., Adrian Materials Co., N. R. Garrett, Boone Quarries, Inc., Central Stone Co., and the U.S. Army Corps of Engineers. Building and paving sand and gravel were produced by N. R. Garrett, Columbia Sand & Towing Co., T. W. S. Sand Co., Columbia Special Road District, and the Missouri State Highway Department. Columbia Brick & Tile Co. mined shale and fire clay for heavy clay products.

Buchanan.—Everett Quarries, Inc., George W. Kerford Quarry Co., L. S. Stafford, and the U.S. Army Corps of Engineers quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone, and riprap. Pioneer Sand Co. prepared sands for building paving, and engine use. Shale for common building brick and tile was quarried by Moorhead Brick & Tile Co.

Butler.—Building and paving sand and gravel were produced by Kittredge Gravel Co. and Grobe & Sons.

Caldwell.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Farmers Rock & Lime Co., Kingston Stone Co., Trager Quarries, Inc., and Caldwell County Highway Department.

Callaway.—The county ranked third in State clay production. The leading producers of fire clay mined for use in refractories, included Harbison-Walker Refractories Co., Walsh Refractories Corp., Laclede-Christy Co., Mexico Refractories Co., Clayton & Crawson, and North American Refractories Co. Marriott-Reed Coal Co. strip-mined coal. Limestone was quarried and crushed by Auxvasse Stone & Gravel Co. and Sulgrove Mining & Quarry Co. for concrete aggregate, roadstone, and agricultural stone.

Camden.—The Missouri State Highway Department contracted for paving gravel. Trio Stone Co. produced rough dimension sandstone for architectural uses and dressed stone.

Cape Girardeau.—The county ranked fourth in the value of mineral production. The Federal Materials Co., Inc., Farmers Limestone Co., and Marquette Cement Manufacturing Co., quarried and crushed

limestone for concrete aggregate, roadstone, agricultural stone, and riprap. Marquette Cement Manufacturing Co. also produced clay, which was used with limestone to manufacture portland and masonry cement. Sand for paving and other uses was produced by Cape Girardeau Sand Co., Inc. Kasten Bros. Brick Co. and Ceramo Co., Inc., mined common red clay for brick, pottery, and stoneware. Lee Roy Friday produced gem varieties of agate and jasper.

Carroll.—Limestone was quarried and crushed for concrete aggregate and roadstone by M. M. Green Quarry Co.

Cass.—S. & W. Quarries, Emmet Brosnahan Rock Co., and Deitz Hill Development Co. quarried and crushed limestone for concrete aggregate, roadstone, and agricultural stone. Miscellaneous clay for brick and tile was mined by United Brick & Tile Co.

Cedar.—The Missouri State Highway Department contracted for paving gravel. Alvis Limestone & Concrete Co. crushed limestone for concrete aggregate, roadstone, and agricultural stone.

Christian.—Joe Howard quarried and crushed limestone near Billings for soil conditioner. The Missouri State Highway Department contracted for paving gravel.

Clark.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes. Producers included Baker Quarry Co. and Brooks Quarry Co. near Kahoka. Coal was strip-mined by Hamlin Bros. Coal Co.

Clay.—Clay County ranked sixth in the State in value of stone production. Limestone was crushed mainly for use in concrete aggregate, roadstone, and riprap. Producers included Midwest PreCote Co., J. H. Oldham Stone Co., Kansas City Quarries Co., Tobin Quarries, Inc., Clay County Quarries, Everett Quarries, Inc., and the Clay County Highway Engineer.

Clinton.—Limestone was quarried and crushed for concrete aggregate, roadstone, agricultural stone, and riprap by Everett Quarries, Inc.

Cole.—Sand and gravel, obtained along the Osage and Missouri Rivers, was used mainly for building and paving. Producers included Leonard Barnhart, Jefferson City Sand Co., Thompson Sand Co., and the Cole County Highway Department.

Cooper.—Hall & Riley Quarries & Construction Co., Castle Bros. Quarry Co., and the U.S. Army Corps of Engineers crushed limestone for concrete aggregate, roadstone, agricultural stone, and riprap. Sand and gravel for building and paving were obtained by Missouri River Sand & Gravel Co.

Crawford.—A. P. Green Fire Brick Co. mined fire clay for use in refractories. Domenic Ramori and Francis J. Strothkamp quarried and crushed agricultural limestone. The Missouri State Highway Department contracted for paving gravel.

Dade.—Lockwood Rock Products quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone, and riprap. Tyler & Claypool Coal Co. strip-mined coal in the county.

Daviess.—Snyder Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, and agricultural stone. Building and paving sand and gravel were produced by Bethany Falls Transit-Mix Concrete Co. and Snyder Quarries, Inc.

De Kalb.—Limestone was quarried and crushed by Everett Quarries, Inc., for concrete aggregate, roadstone, agricultural stone, and riprap.

Douglas.—Paving gravel was obtained from local deposits by Welton & Gray Gravel Co. S. P. Johnson crushed limestone for soil conditioner.

Dunklin.—Wilkey & Lankford, Inc., and the Missouri State Highway Department produced paving gravel.

Franklin.—Franklin County ranked third in the State in value of sand and gravel produced. Sand and gravel used mainly for building and paving was produced by Pacific Pebbles, Inc., Meramec Sand & Gravel Co., St. Louis Material & Supply Co., Washington Sand Co., and the Missouri State Highway Department. A small quantity was used for grinding and polishing. Limestone and dolomite was crushed for concrete aggregate, roadstone, riprap, and agricultural purposes. Leading producers included Oliver L. Taetz Co., Inc., Edwin Bebermeyer, Bramel Limestone Quarry Co., and George Dawson. Fire clay for use in refractories was mined by Hugo Meyer and by A. P. Green Fire Brick Co.

Gasconade.—Gasconade County continued to lead the State in clay production. Six refractory-manufacturing companies mined burley, flint, and diaspore fire clays valued at nearly $1.3 million for use in refractories. General Chemical Division of Allied Chemical Corp. mined fire clay for chemical uses. Limestone was quarried and crushed for concrete aggregate and roadstone by Oliver L. Taetz Co., Inc.

Gentry.—Albany Gravel Co., Inc., and Gentry County Quarry crushed limestone for concrete aggregate, roadstone, and agricultural stone. Albany Gravel Co., Inc., also produced paving gravel.

Greene.—Greene County ranked second and fourth in the State in value of lime and stone production, respectively. Ash Grove Lime & Portland Cement Co. quarried limestone at its Galloway and Springfield quarries for use in lime and for concrete aggregate, roadstone, and soil conditioner. Other limestone producers included Joseph J. Griesemer, Concrete Co. of Springfield, Greystone Quarry Co., and Floyd Rose & Son. Jay Wilcox Limestone Quarry Co. and E. E. Trenary quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone, railroad ballast, and riprap. Brown iron ore was mined by Craig & Seigrist Mining Co. in Greene County. The Missouri State Highway Department contracted for paving gravel.

Harrison.—L. W. Hayes, Inc., Mathes Quarries, and Davis-Snyder Quarries, Inc., crushed limestone for concrete aggregate, roadstone, and agricultural stone. Mathes Quarries also produced paving gravel. Harrison County Highway Department contracted for paving gravel. Coal was mined underground in Harrison County by New Black Diamond Coal Co.

Henry.—Henry County continued to lead in coal production; eight strip mines each produced more than 1,000 tons. Producers included Peabody Coal Co., Windsor Coal Co., A. G. Pence Coal Co., W & W Coal Co., Inc., Bud Jones, and Clary Coal Co. Williams Rock Co., Davis Rock Co., and O. A. Knisely quarried and crushed limestone for concrete aggregate, roadstone, and soil conditioner.

Hickory.—Roy Worthington crushed limestone for soil conditioning. The Missouri State Highway Department contracted for paving gravel.

Holt.—Gordon Bros. Quarries, Inc., and George W. Kerford Quarry Co. crushed limestone for concrete aggregate, roadstone, riprap, and agricultural stone.

Howard.—Glasgow Quarries crushed limestone for concrete aggregate, roadstone, and agricultural stone; it also produced sand for building, paving, and other uses. The U.S. Army Corps of Engineers produced limestone for riprap.

Howell.—The county ranked second in the State in iron ore production. A total of 12 mines was operated during the year. Leading iron-ore producers included Shook & Fletcher Supply Co., Four Mining Co., Stephens Mining Co., McClain & Allen Mining Corp., and Burleson & Stewart. The first iron-ore jig processing mill was installed in West Plains by the McClain & Allen Mining Corp. The jig was claimed to improve the quality of the ore prepared for shipment by 75 percent.[5] H. V. Windsor quarried and crushed limestone for concrete aggregate, roadstone, and soil conditioner.

Iron.—Crushed granite for riprap and dimension granite for building and monumental purposes was produced by Heyward Granite Co., which added jet channel equipment and a new polishing mill in 1958. Dolomite was quarried for agstone by Duncan Bros.

Jackson.—In value of production in the State, Jackson County ranked second in stone, third in cement, fifth in total minerals, and seventh in sand and gravel. Limestone was crushed by 10 producers for use in concrete aggregate, roadstone, riprap, and agriculture. Leading producers were Byer Crushed Rock Co., Stewart Sand & Material Co., Union Construction Co., McKee Quarries, and Centropolis Crusher Co. Dimension limestone was produced by George & Clark Stone Contractors, Gerald Hodgins Quarry, and Charles Rove Rock Quarry. Limestone and shale for manufacturing portland and masonry cement were quarried near Independence by Missouri Portland Cement Co. Kansas City Quarries Co. and Stewart Sand & Material Co. produced sand mainly for building and paving purposes. A small quantity of sand was prepared for use as engine sand. United Brick & Tile Co. mined miscellaneous clay for heavy clay products. Standard Oil Co. (Indiana) produced heptene and sodium cresylate at its petrochemical plant at Sugar Creek, using petroleum fractions as raw material. The Zonolite Co. plant in Jackson County exfoliated vermiculite from Montana.

Jasper.—Jasper County ranked third in value of stone and fifth in value of sand and gravel production for the second consecutive year. Carthage Marble Corp. quarried dimension marble for sale as rough building stone, dressed building stone, and dressed monumental stone. Crushed limestone was produced by Carthage Marble Corp., Independent Gravel Co., and Carthage Crushed Limestone Co., and it was used for building, paving, agricultural, and other purposes. Miscellaneous stone (chats) was produced by American Zinc, Lead, & Smelting Co., Highway Stone Co., Independent Gravel Co., and the Missouri State Highway Department. Independent Gravel Co. pro-

[5] Mining World, vol. 20, No. 7, June 1958, p. 75.

duced grinding and polishing sand, blast sand, paving gravel, and railroad-ballast gravel.

Jefferson.—Jefferson County continued to rank second in the State in the value of sand and gravel produced. High-purity surface sand, used in plate glass and for molding, grinding, and polishing, was quarried by Pittsburgh Plate Glass Co., Aubuchon Silica Mining Division of Portage-Manley Sand Co., and Masters Bros. Silica Sand Co. Building and paving sand and gravel, railroad ballast, and other gravel were produced by Monarch Building Materials Corp., Ficken Material Co., Jefferson County Highway Department, Missouri State Highway Department, and Holzer Sand & Gravel Co. Paul H. Guidicy produced crushed and dimension limestone. Producers of crushed limestone included Kitson Bros. Quarry, Henry Trautman, Guidicy Marble Terrazzo & Tile Co., Bussen Quarries, Inc., and Hess Quarry. Crude barite was mined near Valles Mines by Ronald E. Wood, Sr. The Mississippi River Chemical Co., Division of Mississippi River Fuel Corp., plant near Crystal City produced ammonia, nitric acid, ammonium nitrate, and solutions of ammonia from natural gas. Dow Chemical Co. produced polystyrene from the raw material, styrene, at its petrochemical plant near Pevely.

Johnson.—Limestone was quarried and crushed by Deitz Hill Development Co. and Marr Bros., and it was used for concrete aggregate, roadstone, and as soil conditioner.

Knox.—Knox County Stone Co., Inc., and McSorley Lime Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Laclede.—Wissbaum Quarry and Gaddy & Mason Lime Co. crushed limestone for concrete aggregate, roadstone, and agricultural stone. The Missouri State Highway Department contracted for paving gravel.

Lafayette.—Limestone was quarried for riprap by the U.S. Army Corps of Engineers and for concrete aggregate and roadstone by Deitz Hill Development Co. and Red Stone Co. Coal was mined underground by Earl Ashford Coal Co., Hughes Coal Mining Co., and H. S. Peek Coal Co.; the entire output was shipped to consumers by truck. Lexington Sand & Gravel Co. and Glasgow Sand Co. dredged sand for building and paving purposes.

Lawrence.—D. L. Britain produced dressed dimension limestone. The Missouri State Highway Department contracted for paving gravel.

Lewis.—Lewis County ranked sixth in the State in value of sand and gravel production. Sand and gravel for building and paving was obtained near LaGrange by Missouri Gravel Co. Hamill & Wheeler Lime Co. and Missouri Gravel Co. quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone, and riprap.

Lincoln.—Fire clay for refractories was mined by Harbison-Walker Refractories Co. Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural uses by Columbia Quarry Co., Gessman Quarry, and Watson Quarry. The Missouri State Highway Department contracted for paving gravel.

Linn.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by Bailey Limestone Co.

Livingston.—M. M. Green Quarry Co., Cooper Contracting Co., and Fred McVey quarried and crushed limestone for concrete aggregate, roadstone, agstone, and riprap. Cooley Gravel Co. obtained sands for paving, railroad-ballast, and other uses from local deposits. Midland Brick & Tile Co. mined miscellaneous clay for use in brick and tile.

Macon.—Macon County ranked third in coal production. Coal was strip-mined by Peabody Coal Co. Limestone was quarried and crushed for concrete aggregate and roadstone by Trager Quarries, Inc.

Madison.—Ores containing lead, copper, silver, cobalt, nickel, and iron were mined at the Madison mine of National Lead Co. near Fredericktown. At the refinery near Fredericktown, cobalt and nickel were recovered from iron rejects of the lead-copper circuit of the Madison mill. Ores containing lead, copper, and silver were mined near Mine La Motte by Mine La Motte Corp. Guidicy Marble Terrazzo & Tile Co. crushed limestone for use as terrazzo. The Missouri State Highway Department produced and contracted for paving gravel.

Maries.—Maries County ranked fourth in the State in value of clay production. A. P. Green Fire Brick Co., Harbison-Walker Refractories, Co., Laclede-Christy Co., and Wallace Bros. mined diaspore, burley, and fire clays for refractories. Crushed limestone for concrete aggregate, roadstone, and agricultural purposes was produced by Virgil Smith.

Marion.—Marblehead Lime Co. quarried limestone near Hannibal for quick and hydrated lime; limestone was also used for asphalt filler, mineral food, concrete aggregate, roadstone, and agricultural stone. S. B. Fessenden & Sons crushed limestone for concrete aggregate, roadstone, and agricultural stone.

Mercer.—Wilcox Quarries quarried and crushed limestone for concrete aggregate, roadstone, riprap, and agricultural stone.

Miller.—Gravel for paving purposes was obtained by C. W. Roweth Co. and the Missouri State Highway Department. Franklin Groose and Eldon Quarry Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Moniteau.—Moniteau County Agricultural Association, Inc., quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes. The Missouri State Highway Department contracted for paving gravel.

Monroe.—Gilliam Mining Co., Bethlehem Co., and Fluetsch Bros. mined fire clay for use in horizontal zinc retorts and condensers. Fire clay for refractories was mined by Walsh Refractories Corp. Limestone for concrete aggregate, roadstone, and agstone was crushed by Hamilton Lime Co. and Central Stone Co. Wilkerson Bros. produced building gravel. Monroe County Highway Department and Missouri State Highway Department contracted for paving gravel.

Montgomery.—The county ranked fifth in the State in value of clay production—entirely fire clay used for refractories. McClain Lime Quarry crushed limestone for concrete aggregate, roadstone, and agstone. Two Rivers Sand & Gravel Co. produced building and paving sand. Montgomery County Highway Department and Missouri State Highway Department contracted for paving gravel.

Morgan.—Missouri State Highway Department contracted for paving gravel. Morgan County Lime Crusher crushed limestone for soil conditioning.

Newton.—Southwest Lime Co. produced quicklime from limestone quarried in Newton County; a small quantity of limestone was sold for building, paving, and agricultural purposes.

Nodaway.—Gendler Stone Products Co. quarried and crushed limestone for building, paving, and agricultural purposes. Earl Wilson Sand Co. dredged sand and gravel for building, paving, railroad ballast, and other purposes.

Oregon.—Plateau Mining Co., Oresco, Inc., and Midwest Mining Co. mined brown iron ore from open pits. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by O. O. Mainprize. The Missouri State Highway Department produced paving gravel in Oregon County.

Osage.—The county ranked sixth in the State in value of clays produced. Fire, diaspore, and burley clays were mined for use in manufacturing refractories. Producers included A. P. Green Fire Brick Co., Laclede-Christy Co., Mexico Refractories Co., and Walsh Refractories Corp. Paving gravel was produced by Osage County Highway Department and Missouri State Highway Department.

Ozark.—Building and paving gravel was produced by Ozark County Highway Department and the Missouri State Highway Department. Brown iron ore was mined by E. E. & E. H. Carroll.

Pemiscot.—Sand and gravel for building and paving were obtained from local deposits by Taylor Sand & Gravel Co.

Perry.—Gibbar Bros. crushed limestone for concrete aggregate, roadstone, and agstone, and produced gravel for paving.

Pettis.—W. J. Menefee Construction Co., Howard Construction Co., and T & O Lime & Rock Co. quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes.

Phelps.—Bray Construction Co., Jessie Nivens, and St. James Limestone Quarry crushed limestone for concrete aggregate, roadstone, and agstone. A. P. Green Fire Brick Co., Dillon Bros., Laclede-Christy Co., and Mexico Refractories Co. mined fire clay for refractories. Sand and gravel for building and paving was produced by Grisham Sand & Gravel Co. and the Missouri State Highway Department.

Pike.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Magnesium Mining Co. and Galloway Limestone Co. Paving gravel was produced by Goodman Sand & Gravel Co. and the Missouri State Highway Department. The Hercules Powder Co. petrochemical plant manufactured ammonia, methanol, formaldehyde, and entaerythritol from natural gas.

Platte.—Carter-Waters Corp. mined miscellaneous clay for use in manufacturing lightweight aggregates. The U. S. Army Corps of Engineers used broken and crushed limestone for stabilizing the banks of the Missouri River. Midwest PreCote Co. and Everett Quarries, Inc., produced limestone for concrete aggregate, roadstone, and riprap.

Polk.—H. F. Butcher produced gravel for building, paving, and other uses from deposits near Humansville. Missouri State Highway Department contracted for paving gravel.

Putnam.—Coal was strip-mined by Kirksville Coal Co. and Albrecht Coal Co. and mined underground by Clark Coal Co. and Glen Vestal. Twin State Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Ralls.—Ralls County ranked fourth in value of cement production in the State. The Universal Atlas Cement Co. plant near Ilasco produced portland and masonry cement; limestone and shale were obtained near the plant. Central Stone Co. quarried and crushed limestone for concrete aggregate and roadstone. Edward B. Cooper mined paving gravel. Coal was strip-mined by Couch Coal Co.

Randolph.—Randolph County ranked second in the State in value of coal production. Coal was mined underground by Moberly Coal Co., Inc., D. L. Bradley Coal Co., Inc., Fately Coal Co., and Nejedly Coal Co.; it was strip-mined by Peabody Coal Co. and Lewis Mabry Coal Co. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural purposes by N. J. Cooksey Co., Ralph Potter Quarry Co., and Alfred Vanskike Lime Quarry.

Ray.—Limestone was quarried and crushed by Steva Stone Co. near Richmond, Orrick Stone Co. near Orrick, and M. M. Green Quarry Co. Coal was mined underground by Eastside Coal Co.

Reynolds.—Brown iron ore was mined by General Mining Co. Dimension sandstone was produced by Salem Stone Co. The Missouri State Highway Department produced and contracted for paving gravel. A small quantity of manganese ore was mined by the New Era Mining Co.

St. Charles.—The county ranked fourth in the State in value of sand and gravel production. Tavern Rock Sand Co. obtained sand for glass, molding, and other uses. The Missouri State Highway Department contracted for paving gravel. Limestone was quarried and crushed for concrete aggregate, roadstone, riprap, and agricultural purposes by St. Charles Quarry Co., O'Fallon Quarry & Supply Co., Joerling Bros. Quarry, Schiermeier Limestone Co., and the U.S. Army Corps of Engineers.

St. Clair.—St. Clair County ranked fourth in the State in coal production. Coal was strip-mined by Pioneer Mining Corp. and Osage Coal Co. Alvis Limestone & Concrete Co. crushed limestone and miscellaneous stone. Hunt Limestone Co. crushed limestone.

St. Francois.—St. Francois County led Missouri in value of lead, zinc, and iron ore and ranked second and third in value of total minerals and lime, respectively. At Iron Mountain, Ozark Ore Co. mined hematite iron ore, which was shipped to steel furnaces. St. Joseph Lead Co. mined and milled lead ore that yielded zinc, copper, and silver as byproducts. Chats from lead and iron milling was used for concrete aggregate, roadstone, and railroad ballast. Valley Dolomite Corp. produced dead-burned dolomite for refractory uses; crushed dolomite was used as fertilizer filler, refractory material, concrete aggregate, and agstone. St. Joseph Lead Co. quarried and crushed dolomite for agricultural and fluxing purposes.

Ste. Genevieve.—The county led the State in lime production, ranked third in total value of minerals, and fifth in value of stone output. Limestone, quarried and crushed by Mississippi Lime Co., was used to produce quick and hydrated lime at the plant near Ste. Genevieve. Lime was used for chemical, industrial, and building purposes. The company sold limestone for glass, whiting, asphalt filler, coal-mine

rock dust, poultry grit, chemicals, concrete aggregate, and various other purposes. DeLore Division of National Lead Co. crushed limestone for paint whiting. Limestone was quarried and crushed for riprap, concrete aggregate, and roadstone by Cliffdale Quarry & Manufacturing Co. Dimension limestone was produced by Ste. Genevieve Building Stone. Dimension marble was produced by Weiler Marble Co., Inc., and Tennessee Marble Co. The Missouri State Highway Department and Bauman Bros. produced building and paving sand and gravel.

St. Louis.—St. Louis County led the State in cement, sand and gravel, and stone production and in value of total mineral production. Portland and masonry cements were manufactured near Lemay by Alpha Portland Cement Co. and near Prospect Hill by Missouri Portland Cement Co. Westlake Quarry & Material Co. produced crushed and dimension limestone. Producers of crushed limestone included Vigus Quarries, Inc., Rock Hill Quarries Co., Riverview Stone & Material Co., and Bussen Quarries, Inc. Stone was crushed for cement, roadstone, riprap, and agricultural purposes; dimension stone was used for curbing, flagging, and rough architecture. Sands for glass, molding, grinding, and polishing and also sand and gravel for building and paving were obtained from local deposits. Sand and gravel producers included Winter Bros. Material Co., Inc., Missouri Aggregates, Inc., Dennis Materials Co., Meramec Sand & Gravel Co., and St. Charles Sand Co. Shale and plastic fire clay were mined for heavy clay products and refractory brick. Production of fire brick at the Laclede plant was halted and transferred to the Christy plant and a refractory plant in Illinois. W. S. Dickey Clay Manufacturing Co. purchased the Evens & Howard Sewer Pipe Co. plant and operated it until September 15, when the plant and office were destroyed by fire. Crude vermiculite shipped from Western States was exfoliated by Zonolite Co. The DeLore Division of National Lead Co. plant ground barite. Gem varieties of agate and jasper were recovered near Ellisville by Robert Kissick. The Titanium Division of National Lead Co. completed expanding the facilities at St. Louis to increase titanium pigment capacity. Titanium Division shipments in 1958 were greater than in 1957, according to the National Lead Co. 1958 Annual Report. Perlite, expanded at a plant in St. Louis from crude perlite mined in Western States, was used mainly in building plaster and as lightweight aggregate.

Saline.—Howard Construction Co., Hall & Riley Quarries & Construction Co., Gilliam Rock, Inc., Everett Quarries, Inc., George W. Kerford Quarry Co., Scott Quarries, and the U.S. Army Corps of Engineers crushed limestone for concrete aggregate, roadstone, riprap, and in agriculture.

Scott.—Building sand was obtained locally by Sikeston Concrete Products Co., Inc.

Shannon.—Shannon County ranked third in the State in iron ore production. Brown iron ore was mined by Ozark Mining Co. and Shook & Fletcher Supply Co. Shook & Fletcher Supply Co. began separating iron ore by heavy-medium at its plant—the first in the area. Ozark Stone Products, Inc., quarried dimension sandstone for rubble. Limestone was quarried and crushed by Crider Bros. for use as a soil conditioner.

Shelby.—Central Stone Co. and Turner Lime & Rock Quarry quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes.

Stoddard.—Sand and gravel for building and paving were produced by Hill & Stuart, Inc., Brown Sand & Gravel Co., and Lee R. Warren.

Stone.—Gillioz Co., Inc., quarried and crushed limestone for concrete aggregate and roadstone. The Missouri State Highway Department contracted for paving gravel.

Sullivan.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Partin Lime & Rock Co.

Taney.—Concrete aggregate and roadstone were produced by the U.S. Army Corps of Engineers. The Missouri State Highway Department contracted for paving gravel.

Texas.—Limestone was quarried and crushed for soil conditioner by Long Bros. and Earl Duke. The Missouri State Highway Department produced and contracted for paving gravel.

Vernon.—Coal was strip-mined in Vernon County in 1958 by M. L. Schooley Coal & Construction Co., Ellis Coal Co., Thornhill Coal Co., and K & M Coal Co. Trager Quarries, Inc., Alvis Limestone & Concrete Co., and R. E. Jones quarried and crushed limestone for concrete aggregate and roadstone. Paving gravel for road maintenance was produced by Blue Mound Township.

Warren.—Harbison-Walker Refractories Co. and Walsh Refractories Corp. mined fire clay for refractories. Limestone was quarried and crushed by Sprick Quarry and the U.S. Army Corps of Engineers for concrete aggregate, roadstone, agstone, and riprap.

Washington.—The county was the leading barite producer in the State; twelve companies reported from 17 operations. Leading producers included Magnet Cove Barium Corp., Milwhite Mud Sales Co., De Soto Mining Co., Midwest Mining Co., and Baroid Division of National Lead Co. Lead ore that contained small quantities of zinc was mined and milled at the St. Joseph Lead Co. Indian Creek plant. Lead also was recovered in mining and washing barite. Building and paving sand and gravel and railroad ballast gravel were produced by A. M. Mount, Midwest Mining Co. and the Missouri State Highway Department. The Missouri State Highway Department also produced miscellaneous stone or tiff chat for use on roads. A small quantity of brown iron ore was mined in the county.

Wayne.—Wayne County ranked fifth in the State in iron ore production. Wayne County Mining Co., Central Mining Co., and Sam Budrovich mined brown iron ore. Williamsville Stone Co. quarried dimension sandstone for use as rubble and flagging. Limestone was quarried and crushed by Wm. Harris & Son Lime Co. and used as agstone. Building and paving sand and gravel and railroad ballast gravel were produced by Keener Gravel Co., Inc., and the Missouri State Highway Department.

Worth.—Grand River Limestone Co. quarried and crushed limestone for concrete aggregate, roadstone, and agricultural uses.

Wright.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agriculture by W. H. Bennett Quarries, Inc.

The Mineral Industry of Montana

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Montana Bureau of Mines and Geology.

By Frank B. Fulkerson,[1] Gary A. Kingston,[1] and A. J. Kauffman, Jr.[2]

UNFAVORABLE economic conditions in metal mining continued through 1958 and resulted in another large drop in the annual value of minerals produced in Montana. The State total ($177.2 million) was $14.5 million less than 1957 ($191.8 million) and $36.6 million less than the record year 1956 ($213.8 million).

As the result of a high rate of production in the last quarter of the year, the copper tonnage was almost as much as in 1957, but because of lower average prices the annual value of this major metal was $7.4 million less. Zinc declined $4.9 million (17,300 tons) and lead, $1.8 million (4,900 tons).

Total decrease in value of metals was $18.3 million; of this amount, $15.4 million was due to lower values of copper, zinc, and byproduct lead, gold, and silver from mines in Butte. Nonmetal output in Montana gained $2.9 million owing to greater activity in sand and gravel, phosphate rock, and talc industries. Mineral fuels recovery advanced $1.1 million resulting from a record petroleum production which more than offset declining values for natural gas and coal.

Markets.—In contrast to reduced metal activity in Montana because of low demand nationally, nonmetal production for local, State, and regional distribution was maintained at a fairly high rate. This was attributed to good demand for raw materials and products by construction and agricultural industries. Large engineering projects in Montana supporting mineral-industry production of construction materials included the $85 million Noxon Rapids Dam near Thompson Falls, the Federal interstate highway-building program, and air-base expansion at Great Falls and Glasgow. In the last 6 months, commercial and residential construction exhibited strength also. For the year, building permits issued by cities and towns were up 11 percent in value.

Copper oversupply in the Nation was resolved partly by the end of the year. No substantial relief was in sight for lead-zinc producers, although a moderate increase in consumption coupled with import quotas established October 1 resulted in slightly more favorable conditions at yearend. Montana production of ferromanganese and iron ore was interrupted by lagging demand in the steel industry. Primary aluminum was another product influenced by the 1957–58 business

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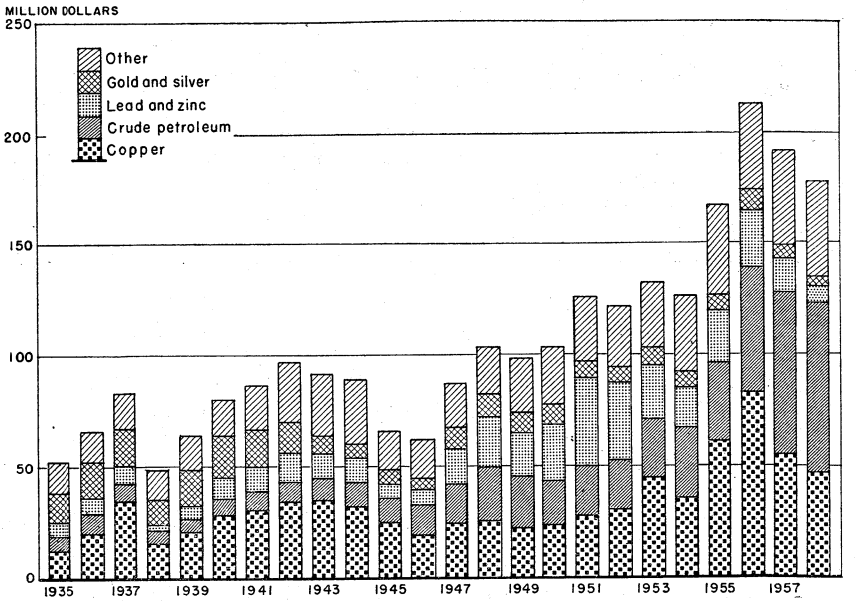

FIGURE 1.—Value of copper, crude petroleum, lead and zinc, gold and silver, and total value of mineral production in Montana, 1935–58.

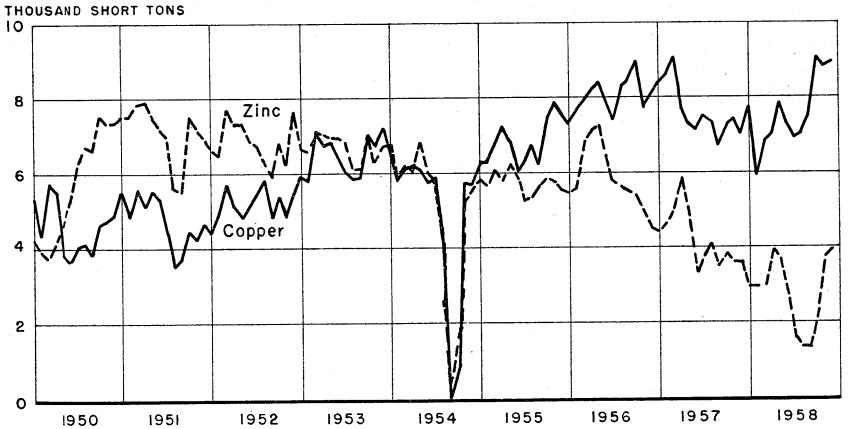

FIGURE 2.—Mine production of copper and zinc in Montana, 1950–58, by months, in terms of recoverable metals.

recession in the Nation; however, a recovery in Montana production of this metal was in prospect by the end of the year.

The metal-mining industry was affected also by completion of Government stockpile programs for tungsten concentrate and manganiferous ore; the probable ending in 1959 of the domestic small-producer (carlot) program for manganese ore; and the 1961 completion date for a Government purchase contract for chromite concentrate, produced by one company. The chromite-mining company was in-

TABLE 1.—Mineral production in Montana [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Chromium ore and concentrate—gross weight	119,149	$3,921	119,057	(2)
Clays—thousand short tons	[3] 32	[3] 24	[3] 23	[3] $19
Coal (bituminous and lignite)—do	413	2,161	305	1,475
Copper (recoverable content of ores, etc.)	91,512	55,090	90,683	47,699
Fluorspar	64,339	(2)	53,654	(2)
Gold (recoverable content of ores, etc.)—troy ounces	32,766	1,147	26,003	910
Iron ore (usable)—thousand long tons, gross weight	36	(2)	14	(2)
Lead (recoverable content of ores, etc.)	13,300	3,804	8,434	1,974
Manganese ore and concentrate (35 percent or more Mn)—gross weight	68,298	(2)	53,123	4,036
Manganiferous ore and concentrate (5 to 35 percent Mn)[4]—gross weight	4,547	(2)	(2)	(2)
Natural gas—million cubic feet	28,638	2,062	27,989	1,903
Petroleum (crude)—thousand 42-gallon barrels	27,172	73,364	[5] 28,291	[5] 74,971
Phosphate rock—thousand long tons	534	3,825	(2)	(2)
Sand and gravel—thousand short tons	[6] 11,403	[6] 8,732	13,432	12,593
Silver (recoverable content of ores, etc.) thousand troy ounces	5,558	5,030	3,631	3,286
Stone—thousand short tons	2,567	3,654	1,545	2,214
Tungsten ore and concentrate (60 percent WO_3 basis)	661	(2)		
Uranium ore and concentrate (oxide content)—pounds	(2)	(2)	4,652	20
Zinc (recoverable content of ores, etc.)	50,520	11,721	33,238	6,781
Value of items that cannot be disclosed: Barite, cement, clays (fire clay and bentonite), gem stones, gypsum, lime, mica, natural-gas liquids, pyrites, talc, vanadium (1957), vermiculite, and values indicated by footnote 2		[6] 17,951		20,200
Total [7]		[6] 191,750		177,240

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Excludes fire clay and bentonite.
[4] Production figures on manganiferous ores (less than 35 percent) mined and shipped to Government depots not included in State total (see text—Manganese).
[5] Preliminary figure.
[6] Revised figure.
[7] Total has been adjusted to eliminate duplicating the value of stone.

vestigating possibilities of producing ferrochrome at the mine site after the contract was fulfilled.

Trends.—A comparison of 1950 and 1958 totals showed strong upward trends in State production of copper, petroleum, phosphate rock, and sand and gravel in the 9-year period, and declining output of coal, gold, manganese, natural gas, silver, and zinc. Chromite, fluorspar, and talc were commodities of 1958 that were not produced or produced only in small quantities in 1950. Tungsten mining was established and terminated within the period, and uranium production became a reality. The tonnage of copper ore increased from 1 million in 1950 to 10 million in 1958, and the average yield of copper per ton of ore mined declined from 4 percent to less than 1 percent because of new projects based on low-grade ore. Manufacturing expansion was centered in copper, aluminum, petroleum, and phosphate rock industries.

Employment.—Lower employment in metal mining and related primary-metals industries was responsible directly for one-third of the total decrease in nonagricultural employment. The average number of workers in metal mining was only 5,300, compared with 7,500 in 1957 and 8,700 in 1956, according to the Montana Employment Service.

Mine closures at Butte and emphasis on lower cost open-pit production caused most of the decline in metal-mining employment. In August, 28 percent of the State unemployment claim load was at Butte.

Average weekly earnings of production workers in metal mining increased from $92.78 in 1957 to $93.56 in 1958 because of a slightly longer work week (38.5 hours). Average hourly earnings ($2.43) were the same as in 1957.

TABLE 2.—Employment in mining, primary metals, and petroleum refining [1]

	Total mining	Metal mining	Nonmetallic, including coal	Petroleum and natural gas	Processing	
					Primary metals	Petroleum refining
1949–53 (average)	10,700	7,900	1,200	1,700	3,800	[2]
1954	10,700	7,400	900	2,400	3,300	1,200
1955	12,000	8,400	900	2,700	4,300	1,200
1956	12,400	8,700	900	2,800	4,600	1,200
1957	11,300	7,500	900	2,900	4,900	1,200
1958	8,700	5,300	700	2,700	4,200	1,000

[1] Montana State Employment Service, Montana Labor Market. Excludes proprietors and self-employed. Comparability between 1958 and earlier totals reduced by changes in industrial coding. Industry groups may vary from those in Bureau of Mines canvass.
[2] Figures not published before 1953.

TABLE 3.—Average weekly earnings, weekly hours, and hourly earnings of workers in mining, metal mining, and primary metals [1]

	1954	1955	1956	1957	1958
Mining:					
Average weekly earnings	$81.93	$91.63	$102.77	$96.79	$97.42
Average weekly hours	38.1	40.3	41.7	38.9	39.6
Average hourly earnings	$2.15	$2.28	$2.47	$2.49	$2.46
Metal mining:					
Average weekly earnings	$77.43	$90.77	$103.41	$92.78	$93.56
Average weekly hours	37.1	40.3	42.2	38.2	38.5
Average hourly earnings	$2.09	$2.25	$2.45	$2.43	$2.43
Primary metals processing:					
Average weekly earnings	$75.69	$84.95	$98.89	$90.55	$91.57
Average weekly hours	39.4	41.5	44.1	39.9	39.3
Average hourly earnings	$1.92	$2.05	$2.24	$2.27	$2.33

[1] Montana State Employment Service, Montana Labor Market. Hours and earnings data exclude administrative and salaried personnel. Average weekly and hourly earnings include overtime and other premium pay.

TABLE 4.—Employers, wage earners, and wages in mining [1]

Fiscal year	Average number of employers	Average number of wage earners	Wages (thousands)	Average wage level
1950	463	9,483	$31,502	$3,322
1951	458	10,561	41,470	3,927
1952	474	10,562	46,941	4,444
1953	517	11,406	53,308	4,674
1954	528	11,635	54,105	4,650
1955	524	10,710	49,036	4,578
1956	528	12,193	65,154	5,344
1957	526	12,021	65,017	5,409
1958	448	9,019	48,503	5,378

[1] Unemployment Compensation Commission of Montana, Montana Labor Market. Industries and employment covered under unemployment insurance laws of Montana.

Government Programs.—Defense Minerals Exploration Administration (DMEA) contracts active included one for uranium (Carbon County), three for manganese (Granite County), one for copper (Jefferson County), and one for lead-zinc (Judith Basin County). The lead-zinc contract, at the Doctor Kalloch property, was the only new project. The DMEA program ended on June 30; however, contracts active on that date were continued by the new Office of Minerals Exploration (OME) in the Department of the Interior, which administered a similar type of program providing exploration assistance for strategic and critical minerals.

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—The national industrial and consumer demand for aluminum, as in 1957, was below previous years. Overproduction and declining prices pervaded the industry as the result of a national economic recession coupled with lower Government purchases.

Anaconda Aluminum Co. at Columbia Falls was the only aluminum producer in the State; the company annual report to shareholders showed production of 49,800 tons compared with 52,100 tons in 1957. Production for the first half of the year was 26,500 tons, approximately 88 percent of plant capacity. Output was reduced to 75 percent of capacity on July 1 and remained at that level for the rest of the year. Economies were made in maintenance and operations, and production-per-pot-day attained a new high.

Alumina (aluminum oxide) processed from Caribbean bauxite was received by rail at the Columbia Falls plant to be reduced by electrolysis to aluminum. Anaconda Aluminum Co. held an alumina-

TABLE 5.—Defense Minerals Exploration Administration contracts active during 1958

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
CARBON					
Midland Mining Co	Sandra group	Uranium	June 3, 1957	$27,008	75
GRANITE					
Echols and Collier	Whitehorse	Manganese	Feb. 20, 1957	23,560	75
Jennie M. Moore	Mystery Manganese	do	Apr. 12, 1955	83,240	75
Taylor-Knapp Co	True Fissure and Durango.	do	Feb. 1, 1954	648,727	75
JEFFERSON					
Uranium Corp. of America	Dailey Copper	Copper	Oct. 18, 1957	85,172	50
JUDITH BASIN					
John Zupan	Doctor Kalloch	Lead, zinc	May 9, 1958	11,768	50

purchase agreement with Kaiser Aluminum & Chemical Corp. Final quittance on an advance payment under the contract was made; the advance totaled $17 million and represented a credit, at the rate of $20 a ton, against future alumina requirements of Anaconda Aluminum Co.

Construction at Anaconda of a 50-ton-a-day alumina-from-clay pilot plant was completed, and preliminary operations were begun in the summer on 7,500 tons of stockpiled clay from Idaho. The first phase of the program was to determine, by testing, the most suitable construction materials and equipment for the process. Company-held clay deposits near Moscow, Idaho, would be utilized should the pilot research program prove the process economical.

Utilization of regional mineral deposits as a source of alumina would make it unnecessary to ship alumina from the Gulf coast area; however, in 1958 the Pacific Northwest aluminum industry received some relief from transportation costs in the form of lowered freight charges from Gulf coast shipping points. Also, freight charges were reduced on aluminum metal shipped to the major eastern markets.

American Aluminum Co. and Cochran Foil Corp. were merged with Anaconda Aluminum Co., bringing about consolidation of production and marketing facilities.

Chromium.—At the end of 1958 only one domestic chromite mine, the Mouat mine (Stillwater County) operated by American Chrome Co., was active. The company produced 119,000 tons of 38-percent Cr_2O_3 concentrate, which was delivered to a nearby Government stockpile under a contract negotiated with the Defense Materials Procurement Agency in 1952 for a total of 900,000 tons of chromite concentrate by December 31, 1961. At the end of 1958, 605,600 tons had been delivered. The Mouat chromite deposit (largest in the United States) was believed to be saucer-shaped, with ore in nine separate horizons. Two horizons were being mined by shrinkage-stoping methods. Because of the structure and shape of the deposit, a halo-type stress was expected to be exerted on the lower levels as the upper ore was removed. Pillars and empty-stope caving were being utilized in an attempt to reduce the expected stress condition.

Of significance to the future of the company was completion of a pilot plant constructed near the mill site for smelting ferrochrome. Successful production (technically and economically) of this alloy used by the steel industry would mean that the mining operation likely could be continued after the stockpiling contract was fulfilled. A high-carbon ferrochrome containing 53-percent chromium was to be produced initially in the pilot smelter. Expenditures at the mine and smelter in excess of $1 million were made by American Chrome Co.

Research also was being conducted by the company to upgrade chromite concentrate from a 1.5 : 1 Cr : Fe ratio to 3 : 1.

Copper.—Copper mining during the year was affected adversely by lower domestic demand and prices; copper prices, declining since mid-1956, reached a low in February of 23 cents a pound. Excess stocks were reduced in the last half of the year, bringing about an advance in the metal price to 29 cents a pound before the close of 1958.

Output of copper in the State declined slightly (1 percent) from 1957 to 90,683 tons. The relatively high production rate was main-

tained, despite adverse markets and prices, through continued emphasis on large-scale mechanized mining methods at several mines. Nearly 100 percent of the State production was derived from mines (primarily those of The Anaconda Co.) in Silver Bow County. Leading producers were the Berkeley pit, and the Kelley, Mountain, Con and Leonard underground mines, all operated by The Anaconda Co.

A reduced level of operation at Butte in effect during the last half of 1957 was continued through most of 1958. In October, mining operations were stepped up from 5 to 6 days a week.

Gold.—Output was at the lowest point since 1954 and was 21 percent below the preceding year, owing to lower recoveries from lode-mine operations.

Nearly two-thirds of the total lode-mine output came from copper and zinc ores of The Anaconda Co. mines in Silver Bow County. Gold yielded by placer mining was mostly from a floating-dredge operation on Prickly Pear Creek, Jefferson County.

Iron Ore.—Mine production was reported in Beaverhead, Broadwater, and Judith Basin Counties; output was 62 percent below 1957, principally because there were no shipments from the Young Montana Corp. Willow Creek open-pit mine, Judith Basin County. The only marketed production was approximately 10,000 tons of magnetite ore sold for use in making cement.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1949–53 (average)	206	24	4,179	36,784	$1,287	6,428	$5,818
1954	113	11	5,104	23,660	828	5,178	4,686
1955	100	12	7,260	28.123	984	6,080	5,503
1956	152	7	9,536	38,121	1,334	7,386	6,685
1957	125	13	10,790	32,766	1,147	5,558	5,030
1958	125	11	10,861	26,003	910	3,631	3,286
1862–1958	--------	--------	(3)	17,548,000	398,631	822,379	613,352

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1949–53 (average)	61,612	$29,457	20,029	$6,086	73,976	$21,910	$64,559
1954	59,349	35,016	14,820	4,061	60,952	13,166	57,757
1955	81,542	60,830	17,028	5,074	68,588	16,873	89,265
1956	96,426	81,962	18,642	5,854	70,520	19,322	115,157
1957	91,512	55,090	13,300	3,804	50,520	11,721	76,792
1958	90,683	47,699	8,434	1,974	33,238	6,781	60,649
1862–1958	7,422,000	2,379,285	902,000	139,693	2,621,000	493,608	4,024,568

[1] Includes recoverable metal content of gravel washed (placer mines), ore milled, old tailings retreated, and ore, old slag, and copper precipitates shipped to smelters during the calendar year indicated. Owing to rounding, figures may not add to totals.
[2] Does not include gravel washed.
[3] Figure not available.

TABLE 7.—Gold produced at placer mines

Year	Mechanical and hydraulic methods			Small-scale hand methods			Total		
	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)
1949–53 (average)	7	995	3,039	[1] 17	5	87	24	1,000	3,126
1954	4	86	1,473	[1] 7	2	56	11	88	1,529
1955	8	581	3,295	4	([2])	57	12	581	3,352
1956	5	267	1,483	2	([2])	13	7	267	1,496
1957	8	170	724	5	1	78	13	171	802
1958	[3] 7	209	1,069	4	1	19	11	210	1,088

[1] Includes surface and underground (drift) placers.
[2] Less than 500.
[3] Includes 1 bucketline dredge, 1 dragline dredge, 3 hydraulic operations, and 2 nonfloating washing plants; Bureau of Mines not at liberty to publish separately.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1958, by counties, in terms of recoverable metals [1]

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
Beaverhead	11	----	327	$11	48,302	$44
Fergus	1	----	----	----	124	([2])
Granite	7	1	189	7	175,627	159
Jefferson	22	1	1,821	64	32,293	29
Lewis and Clark	6	1	11	([2])	929	1
Mineral	----	4	65	2	1	([2])
Silver Bow	22	----	17,374	608	3,307,748	2,994
Undistributed [3]	56	4	6,216	218	65,506	59
Total	125	11	26,003	910	3,630,530	3,286

County	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
Beaverhead	12	$6	283	$66	59	$12	$140
Fergus	----	----	8	2	1	([2])	2
Granite	14	7	173	40	801	163	377
Jefferson	11	6	241	56	92	19	174
Lewis and Clark	----	----	536	125	5,551	1,132	1,259
Mineral	----	----	----	----	----	----	2
Silver Bow	90,557	47,633	5,492	1,285	26,580	5,422	57,942
Undistributed [3]	89	47	1,701	398	154	31	753
Total	90,683	47,699	8,434	1,974	33,238	6,781	60,649

[1] Owing to rounding, figures may not add to totals.
[2] Less than $500.
[3] Includes values and quantities that cannot be shown separately for Broadwater, Deer Lodge, Gallatin, Judith Basin, Lincoln, Madison, Meagher, Missoula, Park, Phillips, Powell, Ravalli, and Sanders Counties.

Minerals Engineering Co. produced 3,700 tons of magnetite from the Carter Creek mine (Beaverhead County) to be used in large-scale testing of methods for producing a concentrate suitable to the steel industry.

Lead.—Production of lead declined 37 percent. Zinc mines operated by The Anaconda Co. in Silver Bow County furnished 65 percent of the State output. Other principal producers were the Jack Waite mine (Sanders County), Cumberland mine (Meagher County), Algonquin mine (Granite County), Maulden mine (Beaverhead County), and East Helena slag dump (Lewis and Clark County).

Despite sharp curtailments in production of lead in the United States, supplies exceeded demand, resulting in lower prices. The price of lead declined from 13 cents a pound at the beginning of the year to a low of 10.75 cents. Import quotas were imposed in October at a time when business conditions were improving and when consumer inventories were low; these factors influenced a price return to 13 cents a pound.

Poor markets and an import quota on lead adversely affected the American Smelting and Refining Co. East Helena smelter, since this facility was dependent largely on processing ores from South America.

Manganese.—Manganese production declined sharply as the result of closure of many mines when the Federal program for low-grade ore stockpiling at Butte and Philipsburg was completed in June. In 1958 shipments to the depots totaled 38,189 short tons of ore valued at $1.3 million, compared with 108,029 short tons valued at $2.9 million in 1957. Shipments to these low-grade stockpiles were to be

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1958, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	35	7,912	6,091	28,432	2,700	1,000	4,300
Dry gold-silver	14	3,502	783	34,735	7,600	92,500	56,300
Dry silver	31	20,294	571	105,134	23,659	253,100	140,500
Total	80	31,708	7,445	168,301	33,959	346,600	201,100
Copper	10	10,096,767	14,251	2,167,491	173,516,906		
Lead	20	13,571	198	31,676	104,700	4,015,600	425,600
Lead-zinc	6	666	118	17,340	3,000	236,400	87,900
Zinc	5	[2] 648,767	2,594	1,206,450	1,911,541	11,265,500	54,667,800
Total	41	10,759,771	17,161	3,422,957	175,536,147	15,517,500	55,181,300
Other lode material:							
Dry gold: Old tailings	2	6,348	260	226	900		
Dry gold-silver: Old tailings	1	5	1	33		200	200
Dry silver: Old tailings	4	8,601	48	37,951	12,989		
Copper: Precipitates					5,781,205		
Lead: Old slag	1	27		634	800	3,800	2,400
Zinc: Old slag	1	54,085				999,900	11,091,000
Total	9	69,066	309	38,844	5,795,894	1,003,900	11,093,600
Total "lode" material	125	10,860,545	24,915	3,630,102	181,366,000	16,868,000	66,476,000
Gravel (placer operations)	11	[3]	1,088	428			
Total, lode and placer	136	10,860,545	26,003	3,630,530	181,366,000	16,868,000	66,476,000

[1] Figures do not necessarily add to total, because some mines produce more than 1 class of material.
[2] Includes 338,858 tons of manganese ore containing lead and zinc.
[3] 209,682 cubic yards.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1958, by types of material processed and methods of recovery, in terms of recoverable metals

Types of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation	10	2			
Cyanidation	58	955			
Concentration and smelting of concentrates	17,480	3,414,994	175,469,347	13,837,000	54,999,900
Total	17,548	3,415,951	175,469,347	13,837,000	54,999,900
Direct smelting:					
Ore	7,058	175,307	100,759	2,027,100	382,500
Old tailings	309	38,210	13,889	200	200
Old slag		634	800	1,003,700	11,093,400
Copper precipitates			5,781,205		
Total	7,367	214,151	5,896,653	3,031,000	11,476,100
Placer	1,088	428			
Grand total	26,003	3,630,530	181,366,000	16,868,000	66,476,000

included in State mineral-production totals after the material was removed from the stockpiles for commercial use.

The Government "carlot" program (minimum 40-percent manganese) continued with a scheduled ending date of January 1, 1961, or earlier if the tonnage limitation was reached. Of the allotted 28 million long ton units of recoverable manganese, over 22 million had been delivered by December 31, 1958. The quantity of manganese ore and concentrate going to consumers and high-grade stockpiles decreased for the third consecutive year. Shipments declined 22 percent in 1958.

Major tonnages were mined at the Moorlight group (Taylor-Knapp Co.), Granite County; the Algonquin group (Trout Mining Division), Granite County; and the Emma mine (The Anaconda Co.), Silver Bow County.

General market specifications during 1958 required at least 65 percent manganese oxide for battery-grade ore, and 40 percent manganese and not more than 15 percent insoluble matter for metallurgical-grade ores.

Silver.—Production of silver was the lowest since 1946, totaling 3.6 million ounces compared with 5.6 million ounces in 1957. The Anaconda Co. mines (Silver Bow County) produced 90 percent of the State total. The only other large silver producer was the Algonquin mine (Trout Mining Division), Granite County.

Thorium.—A thorite deposit in Beaverhead County was acquired by Sawyer Petroleum Co., Los Angeles, Calif. The company intended to produce thorium concentrate from the property, west of Armstead near the Idaho-Montana border.

Uranium.—Seven operations in Carbon County yielded 690 tons of ore valued at nearly $20,000. No production was reported from other counties.

Zinc.—Zinc output dropped 34 percent below the preceding year. Eighty percent of the State output came from The Anaconda Co. zinc mines (Anselmo, Badger State-Niagara, and Emma) in Silver Bow County. The Anaconda Co. slag-fuming operation adjoining the

American Smelting and Refining Co. East Helena smelter slag dump, furnished 17 percent of the total. The Algonquin mine (Trout Mining Division), Granite County, was a sizable producer of zinc.

The Anaconda Co. Alice mine, Silver Bow County, which formerly produced siliceous silver ore for converter flux, was also a source of zinc ore.

Closure of the electrolytic zinc plant at Anaconda because of a labor dispute was averted when union workers agreed to strip 18 instead of 12 tanks of cathodes per shift; the increase was made possible by installation of air- in place of hand-operated hoists.

NONMETALS

Barite.—The quantity of barite sold or used by producers declined to about half of the 1957 total as a direct result of curtailed oil-well drilling activity. Baroid Sales Division, National Lead Co., continued as the major producer. Lewis F. Miller mined barite at a property near Stevensville, Ravalli County; production was shipped to a sugar refinery.

Barite deposits in Montana were the subject of a published report.[3]

Cement.—Cement shipments increased over 1957. Ideal Cement Co., Montana Division, at Trident, Gallatin County, was the only producer in the State. About 88 percent of the cement sold was shipped to destinations in the State; principal out-of-State destinations were South Dakota and Wyoming.

Clays.—A 13-percent decrease in output of all clays was accompanied by a decline of about 4 percent in value. This situation was due to smaller quantities of miscellaneous clay used for making heavy clay products during 1958. Fire-clay production was more than double the past year total, and bentonite was mined at about the 1957 rate. Carter County was the site of bentonite mining; reported fire-clay production came from Fergus, Cascade, and Deer Lodge Counties.

Bentonite found use mainly in rotary-drilling mud and in refractories. Firebrick, blocks, and other types of refractories were made from the fire clay mined.

Clay deposits in Montana were described in a report.[4]

Fluorspar.—Mine production of fluorspar increased substantially but shipments dropped from 64,000 tons in 1957 to 54,000 tons in 1958. Smaller shipments to the steel industry and cessation of one mining operation which shipped its output to the GSA stockpile caused the decline. Cummings-Roberts (Darby, Ravalli County) was the only producer.

Of the total State production, 65 percent was sent to the stockpile, 34 percent was consumed by the steel industry, and the remainder was used at metallurgical and cement plants.

An article concerning fluorspar deposits in Western United States was published.[5]

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[3] DeMunck, V. C., and Ackerman, W. C., Barite Deposits in Montana: Montana Bureau of Mines and Geol. Inf. Circ. 22, 1958, 30 pp.

[4] Sahinen, U. M., Smith, R. I., and Lawson, D. C., Progress Report on Clays of Montana: Montana Bureau of Mines and Geol. Inf. Circ. 23, 1958, 41 pp.

[5] Economic Geology, Geologic Characteristics of Fluorspar Deposits in Western United States: Vol. 53, No. 6, September–October 1958, pp. 663–688.

Gypsum.—Mine output of crude gypsum was 22 percent higher than in 1957. Fergus County was the site of activity—Shoemaker mine (United States Gypsum Co.) and Hanover mine (Ideal Cement Co.). Ground gypsum, wallboard, and lath were the principal products marketed. Twenty-one percent of the production was used uncalcined, mainly as cement retarder; only a small quantity went for agricultural purposes.

Lime.—Tonnage and value of lime output increased 38 percent and 21 percent, respectively, over the preceding high reached in 1957. Limestone was calcined to quicklime in Deer Lodge County (The Anaconda Co.) and Powell County (Elliston Lime Co.); hydrated lime also was produced by the latter company. Most of the production was for use at metallurgical plants and ore concentrators. A small quantity of quicklime and hydrated lime was used for building, chemical, and other industrial purposes.

Mica.—Two operations contributed to a small production of hand-cobbed mica. Activity was limited to the Thumper Lode near Gallatin Gateway, Gallatin County, and the Merlin lease 15 miles south of Ennis, Madison County. Output was shipped to the Government purchase depot at Custer, S. Dak.

Phosphate Rock.—Output of marketable phosphate rock recovered from a slight decline in 1957 to reach a new high in both quantity and value. Mines in Powell, Beaverhead and Silver Bow Counties furnished this output, part of which was exported to British Columbia. Phosphate rock mined in the State was converted to elemental phosphorus, phosphoric acid, and phosphate fertilizers.

Pelletized ammonium phosphate was made from rock mined at Conda, Idaho, at the new $1.5 million facility of The Anaconda Co. at Anaconda, Deer Lodge County. Construction of the plant, which began operating in the fall, had been started in 1956 to meet the increased demand for this type of fertilizer.

An article on defluorination of phosphate rock was published.[6]

Pyrite.—There was about a 5-percent decrease in the quantity of pyrite converted to sulfuric acid by The Anaconda Co. (Deer Lodge County). This raw material was recovered from Silver Bow County base-metal ores. The acid was used at the company chemical-fertilizer plant and metallurgical works.

Sand and Gravel.—Production of sand and gravel was 13.4 million tons ($12.6 million) compared with 11.4 million tons ($8.7 million) in 1957. The extensive road program of the State highway department supplied most of this 2-million-ton increase. Sand and gravel was produced in 33 counties.

Sand and gravel was distributed by use as follows: Road material, 90 percent; building purposes, 7 percent; and railroad ballast and miscellaneous, 3 percent. In 1957 the percentages were 83, 14, and 3, respectively.

Late in the year progress on the Noxon Rapids Dam (Washington Water Power Co., Clark Fork River, Sanders County) reached the three-quarter mark. About 500,000 cubic yards of concrete had been poured.

[6] Hall, Milton B., and Banning, Lloyd A., Removing and Recovering Fluorine From Western Phosphate Rock and Utilizing the Defluorinated Product: Bureau of Mines Rept. of Investigations 5381, 1958, 49 pp.

TABLE 11.—Sand and gravel sold or used by producers, by classes of operations and uses

	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand and gravel:				
Building	1,393	$1,426	868	$1,262
Road material	968	1,233	836	893
Railroad ballast	244	201	323	144
Other [1]	119	88	110	102
Total	2,724	2,948	2,136	2,400
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand and gravel:				
Building	[2] 212	[2] 272	100	184
Road material	[2] 8,467	[2] 5,512	11,195	10,008
Total	[2] 8,679	[2] 5,784	11,296	10,193
ALL OPERATIONS				
Sand and gravel:				
Building	[2] 1,605	[2] 1,698	968	1,446
Road material	[2] 9,436	[2] 6,745	12,031	10,901
Railroad ballast	244	201	323	144
Other [1]	119	88	110	102
Grand total [3]	[2] 11,403	[2] 8,732	13,432	12,593

[1] Includes engine and ballast sands and sand and gravel used for miscellaneous unspecified purposes.
[2] Revised figure.
[3] Owing to rounding, individual items may not add to totals.

Stone.—Production of 1.5 million tons of stone valued at $2.2 million did not reach the level attained in 1957, when an unprecedented quantity of the commodity was prepared for road construction and maintenance, but was substantially higher than at any time before that record-breaking year. Much of the output was used for heavy construction and for the Bureau of Public Roads and county highway-building and maintenance programs. All categories of stone, except limestone, decreased in output; basalt and sandstone registered the largest drops.

Stone was quarried in 19 of the 56 counties in the State. The bulk of the limestone production came from Gallatin and Deer Lodge Counties, and the Trident plant (Gallatin County) of Ideal Cement Co. continued to be the principal consumer of this commodity. Major county sources of other rock types were: Park, basalt; Deer Lodge and Missoula, sandstone; and Missoula, granite.

Sulfur.—Recovery of high-purity elemental sulfur from refinery gases by Montana Sulphur & Chemical Co. was at about the 1957 rate. Two oil refineries near Billings, Yellowstone County, furnished the source of sulfur to this plant.

Talc.—There was a substantial increase in the quantity and value of talc mined compared with 1957. Tri-State Minerals Co. (Beaverhead and Madison Counties) and Sierra Talc & Clay Co. (Madison County) continued to be the leading producers. American Chemet Corp. mined deposits near Dillon and Alder. The preparation scheme remained unchanged: Tri-State ground talc at its Barratts mill (Beaverhead County) and also shipped some of the crude output to its

Ogden (Utah) plant; Sierra Talc & Clay shipped to company plants at Grand Island, Nebr., and Los Angeles, Calif., for grinding; and American Chemet Corp. operated a pulverizing plant at East Helena (Lewis and Clark County).

Compared with 1957, there was only a slight change in the use (1957 tonnages in parentheses): Paint, 48 percent (49 percent); ceramics, 33 percent (30 percent); and miscellaneous, including paper, rice polishing, and textiles, 19 percent (13 percent). Eight percent of the talc ground in 1957 was used as asphalt filler; no such use was reported for 1958.

Vermiculite.—Zonolite Co. continued to be the only producer of vermiculite in Montana and the major national source of the mineral. The company operated an open pit at Libby, Lincoln County. Most of the production was shipped out of the State for expanding; however, a small quantity was exfoliated at Great Falls, Cascade County.

MINERAL FUELS

Coal.—Output and value of bituminous coal and lignite were 26 and 32 percent lower, respectively, than in 1957. This marked the 14th year of consecutive decline. Production was reported from 25 mines in 10 counties. Musselshell County furnished 80 percent of the bituminous coal total; Rosebud County also was an important source of this commodity. Bituminous coal also was mined in Blaine, Carbon, and Cascade Counties, and lignite was produced in Custer, Dawson, Powder River, Richland, and Sheridan Counties.

Despite the decline in State output, the coal-mining industry received a boost as the result of production from a lignite operation at Savage, about 20 miles southwest of Sidney, Richland County. The surface mine was worked by Knife River Coal Mining Co. of Bismarck, N. Dak.

The char plant at Red Lodge, Carbon County, formerly operated by Koal Krudes, Inc., was leased for 1 year, with an option to buy, to Husky Oil Co., Cody, Wyo. The plant was designed to make char, creosote, and other byproducts from coal.

Petroleum and Natural Gas.[7]—Recovery of crude oil set another record; output was 28.3 million barrels ($75 million) compared with 27.2 million barrels ($73.4 million) in 1957. Petroleum value led the State and represented 42 percent of the total mineral output for the year. The major producing fields were Pine, Poplar East, Cabin Creek, Elk Basin, Cut Bank, and Sumatra. Combined production from these fields represented 72 percent of the total compared with 73 percent in 1957. The number of producing wells increased to 3,963 (67 fields), 171 more than in the preceding year. The average daily production also was higher—76,593 barrels in 1958 and 74,308 in 1957. Seven new oilfields came into production with a daily flow of 5 to 450 barrels.

Eleven refineries processed 23.3 million barrels of crude oil during 1958; Montana wells supplied 39 percent of the total, and Wyoming

[7] Production figures for crude oil and natural gas, by fields, were obtained from the Montana Oil and Gas Statistical Bulletin, a monthly publication of the State Oil and Gas Conservation Commission.

furnished 60 percent. Canadian wells contributed less than 1 percent. During the year 335 wells were drilled, 97 less than in 1957. Total footage drilled was 1.7 million. Of the wells drilled, 212 were development wells and 123 exploratory ventures; neither oil nor gas was found in 155 of the wells.

Gross withdrawals of natural gas (marketed production plus quantities used in repressuring, vented, and wasted) were 31 billion cubic feet compared with 32.8 billion in 1957. Cut Bank (including Reagan) again was the principal gasfield with production of 11.8 billion cubic feet. Other fields that had withdrawals of more than 1 billion cubic feet, in order of output, were Cedar Creek, Bowdoin, Dry Creek, Keith Block, Whitlash, and Kevin-Sunburst.

Oil and gas leasing activity in Montana began to extend westward across the Rocky Mountains. Drilling in western Teton County by Northern Natural Gas Producing Co. resulted in discovery of the Blackleaf Canyon field. This well was drilled in the so-called "disturbed belt," which extends northward into Alberta where the largest Canadian gas reserves were located. Sunshine Mining Co. contracted exploratory drilling in Park County near Cooke City.

Increased jet-fuel requirements and stronger demand for asphalt to meet needs of State and Federal highway construction caused Carter Oil Co. to expand its refinery facilities at Billings. The Texas Co. changed its plans for closing the small refinery at Sunburst, Toole County; however, operations were curtailed and about two-thirds of the employees were transferred to the company Anacortes (Wash.) refinery.

As a result of greater crude oil production capacity and reserves in eastern Montana the capacity of the Butte pipeline was raised to 65,000 barrels a day. This was the second change in capacity since its completion in 1955.

A study to determine the feasibility of installing a crude-oil pipeline from the Williston Basin to St. Paul, Minn., was completed for the Great Northern Railway Co.

REVIEW BY COUNTIES

Indicating the growing importance of the State petroleum industry, all leading counties in value of mineral production except Silver Bow were in eastern Montana and produced petroleum as the principal product. The essential commodities, sand and gravel and stone, were produced in 33 and 19 counties, respectively. Coal was extracted in 10 counties. Only three counties had no mineral production.

Copper and zinc mines in Silver Bow County and old-slag processing in Lewis and Clark County produced metals valued at $59 million or 98 percent of the State total for gold, silver, copper, lead, and zinc. Small production of these metals was reported in 19 other counties, all in western and central parts of the State, resulting in a value of $1.5 million. Chromite mining in Stillwater County and manganese mining in Silver Bow and Granite Counties produced substantial values.

Important nonmetal industries were in Beaverhead (phosphate rock and talc), Fergus (gypsum), Gallatin (cement), Lincoln (vermicu-

lite), Powell (phosphate rock), Ravalli (fluorspar), and Silver Bow Counties (phosphate rock).

Beaverhead.—Minerals Engineering Co. continued development at the Carter Creek iron-ore deposit, approximately 11 miles east of Dillon. Diamond- and rotary-drilling programs were instituted to outline the deposit further.

TABLE 12.—Value of mineral production in Montana, by counties [1]

(Thousand dollars)

County	1957	1958	Minerals produced in 1958 in order of value
Beaverhead	$2,138	(2)	Phosphate rock, talc, lead, silver, iron ore, stone, zinc, gold, copper.
Big Horn	377	$247	Petroleum, sand and gravel.
Blaine	601	471	Petroleum, coal, sand and gravel.
Broadwater	129	130	Iron ore, gold, sand and gravel, lead, silver, zinc, copper, stone.
Carbon	7,541	9,217	Petroleum, stone, coal, uranium, sand and gravel.
Carter	336	(2)	Clays, petroleum.
Cascade	3,062	605	Sand and gravel, stone, coal, clays.
Chouteau	----------	33	Sand and gravel.
Custer	160	117	Sand and gravel, coal.
Daniels, Roosevelt [3]	13,320	11,836	Petroleum, sand and gravel.
Dawson, McCone [3]	3,395	3,309	Petroleum, sand and gravel, coal.
Deer Lodge	(2)	862	Lime, stone, sand and gravel, clays.
Fallon, Prairie, Wibaux [3]	26,532	28,682	Petroleum, sand and gravel.
Fergus	(2)	(2)	Gypsum, sand and gravel, clays, lead, zinc, silver.
Flathead	368	161	Sand and gravel, stone.
Gallatin	(2)	(2)	Cement, stone, sand and gravel, mica, lead, silver.
Garfield, Petroleum [3]	444	461	Petroleum.
Glacier, Pondera, Teton, Toole [3]	13,109	12,054	Petroleum, sand and gravel, stone.
Golden Valley	(2)	----------	
Granite	1,286	1,064	Manganese ore, zinc, silver, stone, manganiferous ore, lead, copper, gold, sand and gravel.
Hill	68	(2)	Sand and gravel.
Jefferson	293	254	Stone, gold, lead, silver, zinc, copper.
Judith Basin	(2)	(2)	Sand and gravel, lead, zinc, silver.
Lake	(2)	(2)	Sand and gravel.
Lewis and Clark	(2)	1,517	Zinc, sand and gravel, lead, silver, gold.
Liberty	(2)	255	Petroleum.
Lincoln	(2)	(2)	Vermiculite, sand and gravel, gold, lead, silver.
Madison	(2)	620	Talc, gold, silver, copper, lead, zinc, mica.
Meagher	9	(2)	Lead, silver, zinc, gold, copper.
Mineral	(2)	45	Sand and gravel, gold, stone, silver.
Missoula	(2)	230	Sand and gravel, barite, stone, copper, silver, gold, lead.
Musselshell	3,122	2,812	Petroleum, coal, stone.
Park	249	142	Stone, sand and gravel, lead, silver, gold, zinc.
Phillips	115	(2)	Sand and gravel, gold, silver.
Powder River	(2)	(2)	Coal.
Powell	2,517	(2)	Phosphate rock, lime, stone, sand and gravel, clays, gold, silver.
Ravalli	(2)	(2)	Fluorspar, sand and gravel, barite, stone, lead, silver, gold.
Richland	70	(2)	Coal, petroleum.
Rosebud	(2)	4,140	Petroleum, coal.
Sanders	1,599	755	Lead, sand and gravel, stone, zinc, copper, silver, gold.
Sheridan	413	1,048	Petroleum, coal.
Silver Bow	79,428	62,547	Copper, zinc, manganese, silver, lead, gold, phosphate rock, pyrites, sand and gravel.
Stillwater	3,925	(2)	Chromite, stone, petroleum.
Treasure	19	(2)	Sand and gravel.
Valley	(2)	1,151	Sand and gravel, stone.
Yellowstone	1,853	1,713	Petroleum, sand and gravel, clays.
Undistributed [4]	26,007	31,602	
Total [5]	191,750	177,240	

[1] Sweet Grass and Wheatland Counties are not listed, because no production was reported.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Daniels and Roosevelt; Dawson and McCone; Fallon, Prairie, and Wibaux; Garfield and Petroleum; and Glacier, Pondera, Teton, and Toole Counties have been combined because of joint oilfield production.
[4] Includes value of gem stones, natural gas, natural gas liquids, petroleum, sand and gravel, and stone that cannot be assigned to specific counties and values indicated by footnote 2.
[5] Total has been adjusted to eliminate duplicating the value of stone—1957 total revised.

The Ida B. Hand Maulden mine in the Argenta district produced over 2,200 tons of crude lead ore. Lively Mining Co. produced silver ore from the Hecla property. A sizable tonnage of old tailings (silver ore) was treated from the Quartz Hill property in the Vipond district. Production was reported from the following mines: Gladstone (gold ore), Goldsmith (copper ore), Shafer group (gold-silver ore), Yellow Band (gold ore), Keystone (silver ore), Silver King (silver ore); and the Glendale smelter site (lead slag).

Sodak Uranium & Mining Co. shipped a small tonnage of manganese ore from the Gob mine to the GSA depot at Butte.

Phosphate rock mined in larger quantities than in 1957 at the Victor Chemical Works Canyon Creek property near Melrose was shipped to the company elemental-phosphorus plant at Silver Bow. J. R. Simplot Co. operated its Centennial open pit in the Centennial Mountains at a reduced rate compared with 1957. Talc was mined by Tri-State Minerals Co. at its Smith-Dillon and Regal properties.

Big Horn.—Recovery of crude oil from the Soap Creek, Ash Creek, and Snyder (Hardin) fields was about 90,000 barrels less than in 1957. Withdrawals of natural gas from the Hardin field totaled 50.5 million cubic feet compared with 52.2 million cubic feet the year before.

Blaine.—Crude oil production from the Bowes field was 277,000 barrels, about 29,000 less than in 1957; the field also yielded 886 million cubic feet of natural gas (51 million cubic feet more than the preceding year). A small quantity of bituminous coal was mined at one operation.

Broadwater.—Iron ore was produced from the Iron Cross mine (Ralls & Harris Bros.) near Radersburg. Nearly 10,000 tons of magnetite (45 percent Fe) was shipped to a plant at Trident for use in making cement.

Northern Milling Co. (formerly Marietta Mines) extracted a sizable tonnage of gold ore from the Marietta mine, Park (Indian Creek) district. The Acme gold mine, Beaver district, was operated. Of 12 mines, 7 produced gold ore; 4, lead ore; and 1, lead-zinc ore in the Backer, Beaver, Cedar Plains, Park (Indian Creek), and Townsend districts.

A small tonnage of oxide manganese ore was shipped to the low-grade manganese stockpile at Butte from the Josephine and Baby claims.

A bulletin was published concerning the geology of a portion of the county.[8]

Carbon.—Uranium ore totaling 690 tons with an average uranium oxide content of 0.34 percent was mined by the following companies: Lisbon Uranium Corp., Planet Exploration Co., Pryor Mining Co., Midland Mining Co., and Balboa Mining & Development Co.

Carbon County was fourth in output value of nonmetals and fuels ($9.2 million), the same ranking it held in the State in 1957. Most of the 3.5 million barrels of petroleum produced came from the Elk Basin field; county output was 700,000 barrels higher than in 1957. Initial production was recorded from the Belfry field. Four fields contributed to a total natural gas withdrawal of 2.6 billion cubic feet.

[8] Freeman, V. L., Ruppel, E. T., and Klepper, M. R., Geology of Part of the Townsend Valley, Broadwater and Jefferson Counties, Mont.: Geol. Survey Bull. 1042–N, 1958, 75 pp.

The Dry Creek field ranked fourth in the State as a natural gas source. Limestone was quarried at Warren by The Bighorn Limestone Co., and two companies mined bituminous coal.

Carter.—Bentonite was mined at about the 1957 rate by Baroid Sales Division, National Lead Co. Recovery of crude oil from the Repeat Field was more than double that of the preceding year.

Cascade.—Modernization of The Anaconda Co. electrolytic copper refinery at Great Falls was continued. At the zinc plant, conversion in the preceding year from hand-casting zinc slabs to a new mechanical zinc-casting conveyor proved successful in operation. Work on zinc-concentrate handling facilities was completed. Anaconda Wire & Cable Co. operated copper and aluminum rod and wire mills adjacent to the Great Falls plant of The Anaconda Co.

Cascade County maintained first place in producing sand and gravel. Small quantities of stone, coal, and clay also were mined. Refractories for use at the Anaconda metallurgical works (Deer Lodge County) were made from fire clay produced at the Armington mine.

Daniels and Roosevelt.—These counties were considered as a unit because the Bredette-North oilfield extends over the Roosevelt County line into Daniels County. Output that totaled 4.2 million barrels compared with 4.8 million barrels in 1957 placed the area in second position as a petroleum source. Poplar East in Roosevelt County furnished most of the production. This field relinquished its position as the leading source of crude oil to become third in the State. Recovery from Bredette-North was 151,000 barrels compared with 145,000 in 1957.

Dawson and McCone.—These counties were combined because the Richey field extends from McCone County into Dawson County. Output from fields in these counties was a little less than in the preceding year. Recovery from Richey Southwest field in McCone County was 47,000 barrels (42,000 in 1957). There was a small decrease from the other five fields in Dawson County.

Deer Lodge.—At The Anaconda Co. reduction works, six ore-storage bins (3,500 tons capacity each) under construction at the East Anaconda crushing plant were completed, and feeding and conveying equipment to and from the bins was installed. Advantages accruing from this installation were: Flexibility in dumping, crushing, and storing ores from Butte; increased ore-treatment capacity; and minimized interruptions in ore transportation and concentration. Also, a blending of copper ores to provide a more uniform feed to all sections of the copper concentrator was made possible by the new installation. Smelter slag was disposed of more efficiently through an improved system employing a "slinger." Preliminary operations were started at a 50-ton pilot plant designed to extract alumina from clays. Water recovery was the subject of a long-range program adopted by the company. In accordance with this program, work was to begin in 1959 on a new system of handling concentrator tailings. Manganese ore was concentrated, sintered, and consumed primarily for making ferromanganese by the company.

Three silver mines (Alturas, Log Cabin No. 1, and Silver Reef) operated in the Georgetown district.

Limestone mined at Brown's quarry by The Ananconda Co. was burned to quicklime for use at the company ore-processing and metallurgical operations. By virtue of this output, the county ranked second in stone production. Deer Lodge County also had production of sandstone and sand and gravel. Pyrite (Silver Bow County), phosphate rock (Conda, Idaho), and clay (Cascade County) were processed by The Anaconda Co.

Fallon, Prairie, and Wibaux Counties.—This area, considered as a unit for reporting petroleum production, was the major source of crude oil in the State. Recovery totaled 10.8 million barrels ($28.7 million) compared with 10.1 million barrels ($26.5 million) in 1957. Pine field, the leading producer in the State (5.3 million barrels), underlies parts of Fallon, Prairie, and Wibaux Counties. Eight fields in Fallon County yielded 5.4 million barrels; Cabin Creek field, second largest producer in the State, furnished 4.3 million barrels of the total. Initial production was reported from the Monarch field.

Natural gas withdrawals totaled 7.4 billion cubic feet for the area. Cedar Creek field (Fallon and Wibaux Counties) accounted for 5.4 billion cubic feet of gas to continue in second place in the State. Production from the Pine field was 993 million cubic feet.

Fergus.—A small tonnage (38 tons) of lead ore was mined at the Cave property, Warm Springs district.

Gypsum was mined near Heath by United States Gypsum Co. and near Hanover by Ideal Cement Co. Sand and gravel and clay also were mined.

Flathead.—The Anaconda Aluminum Co. plant at Columbia Falls continued to supply aluminum pig and ingot to customers, and the company anticipated that combined requirements of fabricators and other customers would allow an increase in production.

Gallatin.—Reser Mines, Inc., mined lead ore at the Nellie H mine, Deer Park district.

Ideal Cement Co., Montana Division, was the principal mineral industry in the county and the only cement producer in the State. Output was at about the 1957 rate. Gallatin County continued to lead the State in value of nonmetals and to rank fifth when compared with counties producing petroleum (first for stone). Limestone for use at the cement plant was mined at the Trident quarry. Granite for riprap and sand and gravel for structural and paving purposes were produced.

Garfield and Petroleum.—Production of crude oil from the Cat Creek field (underlying Garfield and Petroleum Counties) rose 6,000 barrels to a total of 171,000 barrels. A small quantity was recovered from the Rattlesnake Butte field in Petroleum County.

Glacier, Pondera, Teton, and Toole.—These counties were combined for reporting purposes because Cut Bank, the fifth ranking oilfield and principal gasfield (including Reagan), underlies parts of Glacier, Pondera, and Toole Counties. Recovery of crude oil from the four-county area totaled 4 million barrels ($11.8 million), a moderate decline from the 4.3 million barrels valued at $13 million produced in 1957. As a result of this output, the area moved into third position as a petroleum source. Kevin-Sunburst field (902,000 barrels) in Toole

County and Pondera field (559,000 barrels) in Pondera and Teton Counties followed Cut Bank in importance; these fields supplied 92 percent of the area production. Toole County had the largest production of any single county in the group. One new field, Red Creek in Glacier County, was opened.

Natural gas withdrawals totaled 13 billion cubic feet to lead the State. Cut Bank (including Reagan), the principal source, contributed 11.8 billion cubic feet followed by Kevin-Sunburst with 1 billion cubic feet. A new gasfield—Blackleaf Canyon—was discovered in Teton County.

Granite.—Major shippers to the Butte low-grade manganese stockpile were Peter Antonioli (Scratch All mine), Taylor-Knapp Co. (Moorlight group), and Trout Mining Division (Algonquin group). Taylor-Knapp Co. and Trout Mining Division shipped Metallurgical- and Battery-grade ore. Taylor-Knapp Co. concentrated and sintered manganese ore to Metallurgical-grade for delivery to Denver, Colo., under the GSA small producers "carlot" program. Trout Mining Division recovered a sizable tonnage of zinc ore at the Algonquin mine. Lead-zinc and zinc ores were recovered at the Scratch All mine. Silver Butte Mines, Ltd., operated the Brooklyn silver mine in the Boulder district near Maxville. This underground mine, owned by Black & White Mining Co., was operated by a new process of hydraulic monitors washing the ore from a soft porphyry dike.

Surface buildings at the old Bi-metallic mine, which was being explored by Trout Mining Division, burned in September. The mine, owned by Peter Antonioli, had produced approximately $50 million in silver during the period 1882–1905.

A small placer was operated by Master Mining Co. in the Gold Creek district.

Jefferson.—Metal production declined 14 percent from the preceding year. The Silver Crescent (gold-silver ore), Nellie Grant (lead-zinc ore), Alta (silver ore), and Hope (silver from old tailings) mines were the major producers in the county. A floating dredge was operated in Prickly Pear Creek near Jefferson City.

A report published during the year dealt with the geology of part of the county.[9]

Judith Basin.—Iron ore (hematite with disseminated magnetite) was mined by Montana Iron Mining Co. from an open pit near Stanford. No shipments were made.

A lead-zinc deposit at the Doctor Kalloch claim in Barker district received an exploration contract from DMEA. Faith Mining Co. operated the Liberty silver mine.

Lewis and Clark.—At its East Helena lead smelter, American Smelting and Refining Co. treated ore and concentrate from Montana, Idaho, and foreign sources, and zinc-plant residue from Great Falls and Anaconda. Old slag from a dump and molten slag from the smelter were processed at the adjacent slag-fuming plant of The Anaconda Co. Lead and zinc recovered from the old dump slag supplied most of the metal output of the county.

Largely through cost cutting, the East Helena smelter operated despite adverse metal prices; a significant expense reduction was made

[9] Work cited in footnote 8.

by a labor-saving device patented by J. T. Roy, former plant manager, that continuously tapped the smelting furnace. The company was experimenting with an ore-nodulizing method, which would eliminate one pass through the sintering machines.

Liberty.—Production of crude oil decreased to 98,000 barrels from 120,000 barrels in 1957. Natural gas recovery totaled 3.5 billion cubic feet (4.8 billion cubic feet in 1957). Keith-Block (1.5 billion cubic feet) and Whitlash (1.1 billion cubic feet) fields ranked fifth and sixth, respectively, in the State as sources of natural gas and contributed 75 percent of the total production in the county.

Lincoln.—Zonolite Company, which produced vermiculite from an open pit near Libby, was the largest mining enterprise in the county. The company spent considerable time and money in research to improve milling facilities for treatment of lower grade ores. Work was carried out by St. Paul Lead Co. and Merger Mines Corp. on a mill at the St. Paul mine near Libby. Stopes in the mine were being prepared, and 2,500 tons of ore was stockpiled.

There was activity at a barite deposit 6 miles south of Troy. Exploration showed a mineralized zone about 2,000 feet long and 1,000 feet wide, and assessment work (trenching and open cuts) exposed four barite veins.

Madison.—A sizable tonnage of gold ore was mined at the West Mayflower mine, Cedar Hollow district. Copper ore was recovered at three properties in the Stone Creek district.

The Strawberry-Keystone gold-tungsten property in the Pony district was the subject of a report.[10]

Another report was published concerning the Potosi tungsten district.[11]

Production of talc in the county rose sharply. Principal mines were the Yellowstone (Sierra Talc & Clay Co.) and Treasure State (Tri-State Minerals Co.). American Chemet Corp. operated the Sweetwater and Ruby mines and a screening plant at Alder. This company ground the output at its East Helena plant.

Meagher.—Crude manganiferous ore was shipped by Feusner Mining Co. (Little Belt mine) and by P. R. K. Mining Co. (Rachele pit) to the Butte stockpile. The H. O. Mining Co. shipped lead ore from the Cumberland mine.

Missoula.—Copper ore was produced at the Hidden Treasure mine near Clinton by Hera Exploration Co. The company also was developing the adjacent Cape Nome mine.

Barite mining by Baroid Sales Division, National Lead Co., continued to be the principal mineral industry in the county. Small quantities of sand and gravel and stone also were produced.

Musselshell.—Petroleum and bituminous coal furnished almost all of the mineral production in the county. Eight fields yielded 832,000 barrels of crude oil compared with a total of 907,000 barrels in 1957; initial production was reported from the Hawk Creek field. Musselshell County was the leading coal-producing county in the State. The

[10] Reid, Rolland R., The Strawberry-Keystone Gold-Tungsten Property Pony Mining District, Madison County, Mont.: Montana Bureau of Mines and Geol. Inf. Circ. 24, 1958, 19 pp.

[11] Eyde, Theodore H., The Potosi Tungsten District, Madison County, Mont.: Montana Bureau of Mines and Geol. Inf. Circ. 21, 1958, 51 pp.

Roundup mine of Roundup Mining Co. was the largest of nine mines, contributing to the county coal output.

Phillips.—Northern Mining & Milling Co. mined gold ore from the Hawkeye mine in the Little Rockies district. Ore from the open pit was milled in a 50-ton mill on the property.

The principal mineral industry in the county was recovery of natural gas. Total withdrawals from the Bowdoin field, third-ranking in the State, were 2.1 billion cubic feet; in 1957 the field produced 1.8 billion cubic feet and ranked fifth.

Powell.—Hydraulic placer mining of 10,000 cubic yards of bench gravel was carried out at the Ophir property.

Powell County was the leading source of phosphate rock in the State. Montana Phosphate Products Co. mined a substantially larger quantity of phosphate rock from the Anderson and Luke operations. The output was exported to Trail and Kimberley, British Columbia. George Relyea produced phosphate rock in the Garrison area. Limestone was calcined by Elliston Lime Co., 18 miles west of Helena, at about the 1957 rate; both quick and hydrated lime were marketed.

Ravalli.—Mining fluorspar at the Crystal Mountain open pit by Cummings-Roberts continued to be the major mineral industry in the county. Because of the elevation (7,000 feet) of the deposit 15 miles east of Darby, mining has been limited to the period May to December. Barite was produced from a deposit near Stevensville.

Richland.—The county gained in rank as a source of coal (lignite) by virtue of a new operation west of Sidney. In August, Knife River Coal Mining Co. began surface-mining a lignite deposit to supply fuel for the Montana-Dakota Utilities Co. powerplant at Sidney. Crude oil production from the Brorson field was 29,000 barrels, a little more than 1957.

Rosebud.—The county maintained sixth position in production of fuels and nonmetals, owing to the output of petroleum and coal. Recovery of crude oil from the Sumatra field, the sixth most important in the State, was 1.6 million barrels, some 300,000 barrels more than in 1957. A new field—Stensvad—was brought into production. Output of bituminous coal declined sharply; the Northern Pacific Railway Co. Rosebud mine was the major producer.

Sanders.—The Jack Waite lead-zinc mine, Eagle district, was the only producing metal mine in the county. American Smelting and Refining Co. operated the mine under a new 99-year lease. An extensive development program was conducted at the property, involving expenditures exceeding $100,000.

Sanders County ranked fourth in the quantity of sand and gravel produced. One concern furnished the output, which was used in completing heavy construction at the Noxon Rapids Dam (Washington Water Power Co.) on the Clark Fork River. By yearend over 500,000 cubic yards of concrete had been poured at the site.

Sheridan.—A threefold increase in crude oil production was reported for the Outlook field; recovery, which began in 1956 (2,800 barrels), rose to 499,000 barrels. This field is in the northwest flank of the Williston basin, the area that furnished 59 percent of the 1958 crude-

oil output in the State. Initial production was reported from the Red Stone field. Lignite was mined at two locations.

Silver Bow.—County production, mostly from The Anaconda Co. mines in Summit Valley (Butte) district, represented 96 percent of the State value of gold, silver, copper, lead, and zinc output, and 35 percent of the total value of State mineral production, compared with 41 percent in 1957.

Silver Bow County supplied most of the State manganese production (90 percent); county output (349,269 tons) declined 7 percent below 1957 (377,113 tons).

Phosphate rock was mined by Victor Chemical Works at its Maiden Rock operation at a slightly reduced rate compared with 1957. Output from this mine and from the Canyon Creek property (Beaverhead County) was processed to elemental phosphorus at the company Silver Bow plant. Pyrite recovered as a byproduct from base-metal ores mined in the county was converted to sulfuric acid at Anaconda (Deer Lodge County).

Summit Valley (Butte) District.—Major gold, silver, copper, lead, and zinc mines operated by The Anaconda Co. were the Alice (silver ore), Berkeley pit (copper ore), Leonard (copper ore), Mountain Con (copper ore), Kelley (copper ore), Anselmo (zinc ore), Badger State-Niagara (zinc ore), and Emma (zinc ore).

A substantial reserve of zinc ore was being developed at the Alice open-pit operation. The mine formerly produced siliceous ore for converter flux from the oxidized surface portion of the Alice vein.

Copper ore extracted from the Berkeley pit totaled 6.6 million tons compared with 4.7 million tons in 1957, an increase of 40 percent. This highly mechanized open-pit operation was the principal single source of copper in Montana, supplying 47 percent of the total. Ore production at the beginning of the year was at the rate of approximately 17,500 tons a day, increasing to about 28,500 tons a day by October. Waste was stripped at the rate of 1.9 tons per ton of ore mined. In March, a new crushing plant, conveyor system, ore-stockpiling facilities, bins, and railroad yard were completed and placed in operation.

The Leonard mine was shut down in May; its production was replaced by resumption of operations at the Mountain Con.

TABLE 13.—Mine production of gold, silver, copper, lead, and zinc in Silver Bow County, in terms of recoverable metals

Year	Mines producing	Material sold or treated (thousand short tons)	Gold, lode and placer (troy ounces)	Silver, lode and placer (thousand troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value (thousands)
1949–53 (average)	18	3,978	18,279	5,904	61,149	15,346	68,626	$60,227
1954	22	4,988	17,395	4,663	59,240	11,516	53,527	54,498
1955	22	7,160	22,262	5,578	81,428	14,331	62,588	86,240
1956	21	9,395	31,132	6,772	96,292	14,989	63,375	111,138
1957	19	10,673	27,312	5,069	91,393	9,617	43,169	73,328
1958	22	10,745	17,374	3,308	90,557	5,492	26,580	57,942
1882–1958	--------	(1)	2,272,000	612,046	7,383,000	391,000	2,256,000	3,376,046

[1] Data not available.

The Kelley mine produced 2.9 million tons of copper ore, which was 31 percent below the 4.2 million tons extracted in 1957. Production from this underground block-caving operation averaged approximately 12,500 tons a day except for a 7-month period (April to December) when output was cut to approximately 9,000 tons a day. A new exhaust ventilation system, designed to handle 600,000 cubic feet of air a minute, was installed between the 1,300 level and the surface.

The Anselmo mine was closed for approximately 3 months (July 21 to October 19) because of major repairs necessary at the Anaconda zinc concentrator.

The Butte, Anaconda & Pacific Railway Co. handled an average of more than 60,000 tons of ore a day near the end of the year owing to increased ore production from the Berkeley pit. Handling was facilitated by an arrangement to operate over Northern Pacific Railway trackage between Butte and Durant.

Manganese ore production (349,000 tons) came almost entirely from The Anaconda Co. Emma mine. The ore was converted to nodules at the company concentrating and sintering plant in Deer Lodge County, and the nodules were shipped direct to metallurgical consumers or processed to ferromanganese at the Anaconda ferromanganese plant. The Anaconda Co. annual report to shareholders disclosed output of 61,409 short tons of nodules and 25,825 short tons of ferromanganese, compared with 65,223 short tons and 22,407 short tons, respectively, in 1957.

Twenty-one operators in the Butte area consigned approximately 15,000 short tons of manganiferous ore valued at $356,000 to the Government stockpile at Butte. The West Mapleton mine (Peter Antonioli) was the leading shipper.

Stillwater.—At the close of the year, the American Chrome Co. Mouat mine, 45 miles southwest of Columbus at Nye, was the only domestic chromite mine in production. The company mined 250,165 tons of ore from which 119,057 tons of 38 percent chromic-oxide concentrates was produced and delivered to an adjacent GSA stockpile. Approximately 275 persons were employed at the mine and mill. A new development at the Nye operation was construction of a pilot smelter to produce ferrochrome. Raw materials for the smelting operation were to include coke from Illinois, coal from West Virginia and Montana, and limestone and silica from nearby company-owned properties.

Production of basalt and limestone for use by the county highway department ranked the county third in the State for stone output. Recovery of crude oil from the Lake Basin field dropped to 200 barrels. During 1958 one well produced in the field; at yearend this well was closed and abandoned, ending a production history for the Lake Basin field that began in 1925. A total of 474,000 barrels was produced from this field. Commercial quantities of natural gas were discovered at a well drilled at the North Lake Basin field early in 1958.

Valley.—Use of sand and gravel, mainly paving gravel, by the U.S. Army, Corps of Engineers, at the Glasgow Air Force Base put Valley County in second position in the State as a source of this commodity. Output value of $1.1 million was more than double the next highest

county valuation (Cascade County—first in production). Brazil Creek Bentonite Co. announced plans to develop an open-pit bentonite deposit 15 miles west of Glasgow.

Yellowstone.—Recovery of 590,000 barrels of crude oil from the Wolf Springs and Mosser fields about equaled the 1957 production. Sulfur was obtained from refinery gases by Montana Sulphur & Chemical Co. Clay mined near Billings was made into heavy clay products in the enlarged and modernized plant of Lovell Clay Products Co. The county was the third-ranking source of sand and gravel; output was used for structural and paving purposes.

The Mineral Industry of Nebraska

By D. H. Mullen [1]

NEBRASKA's mineral industry continued to expand in 1958, and the value of production increased for the 11th consecutive year. The value of all minerals produced was $90 million, an advance of $7.1 million (9 percent) over that in 1957. Gains in production and value were reported for all minerals except clays. The mineral fuels (petroleum, natural gas, and natural-gas liquids) represented 15 percent of the increase and 71 percent of the value of all mineral production. Petroleum output increased nearly 1 million barrels over 1957, and the discovery of 40 new fields in the western counties indicated continued expansion of the petroleum industry.

Employment.—Employment in the mineral industries averaged 2,300 workers compared with 2,100 in 1957. General contractors, except for building and special-trade contractors, employed an average of 4,800 people compared with an average of 3,700 in 1957. This category includes contractors engaged in heavy construction, such as highways, and affects the production of sand and gravel and crushed stones used on construction projects. Because of a labor dispute in the Omaha area in July that affected, to some extent,

TABLE 1.—Mineral production in Nebraska [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays—thousand short tons	134	$135	108	$110
Gem stones	(2)	2	(2)	2
Natural gas—million cubic feet	[3] 14,249	[3] 2,280	11,405	1,711
Natural-gas liquids:				
LP-gases—thousand gallons	(4)	(4)	31,178	1,565
Natural gasoline—do	(4)	(4)	10,870	727
Petroleum (crude)—thousand 42-gallon barrels	19,586	58,366	[5] 20,368	[5] 59,882
Sand and gravel—thousand short tons	7,944	5,889	10,441	7,945
Stone—do	3,065	3,749	3,555	4,747
Value of items that cannot be disclosed: Cement, pumice, and values indicated by footnote 4	----	13,670	----	14,603
Total Nebraska [6]	----	[3] 82,928	----	90,032

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Revised figure.
[4] Figure withheld to avoid disclosing company confidential data; value included with "Items that cannot be disclosed."
[5] Preliminary figure.
[6] Total has been adjusted to eliminate duplicating the value of raw material used in manufacturing cement.

[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

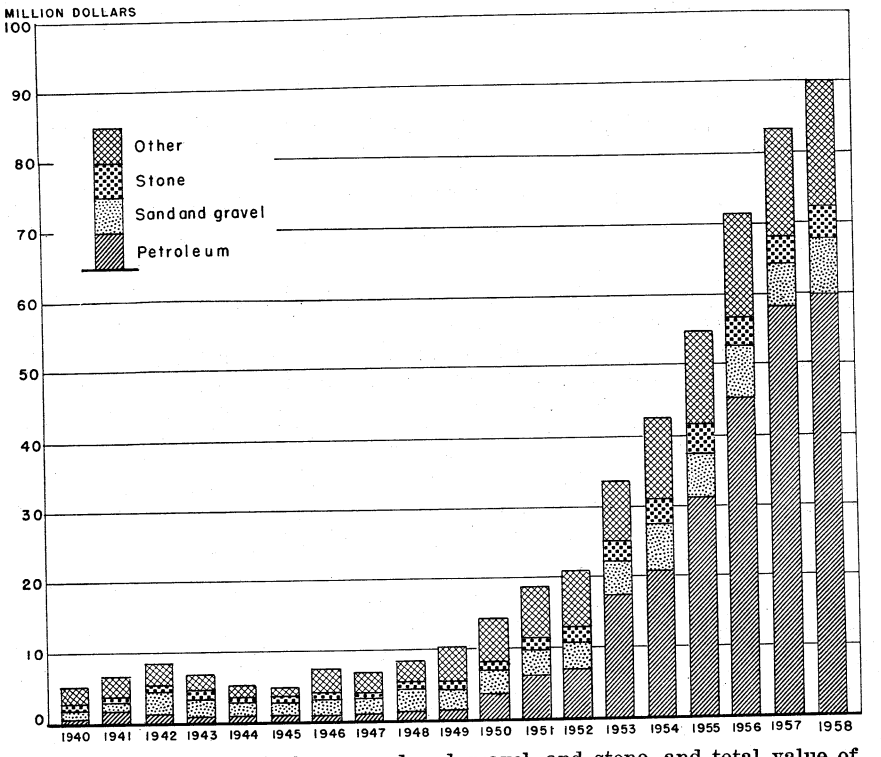

FIGURE 1.—Value of petroleum, sand and gravel, and stone, and total value of mineral production, in Nebraska, 1940–58.

heavy construction throughout the State, the 4,800 average was not as high as expected. Total employment in all nonagricultural occupations in the State averaged 350,600, or 1 percent below that in 1957.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Natural Gas.—Marketed natural gas production decreased 20 percent below 1957. Major production was from the Huntsman and SW. Sidney fields in Cheyenne County and the Big Springs field in Deuel County. All marketed gas was processed at natural gasoline plants before entering pipelines for distribution to consumers.

Natural-Gas Liquids.—Natural gasoline, butane, and propane recovered at four plants was 21 percent greater than in 1957. Plants at the Huntsman and SW. Sidney fields in Cheyenne County, at the Phillips field in Kimball County, and the Big Springs field in Deuel County processed 63.5 million cubic feet of gas a day; the rated capacity of the plants was 83.5 million cubic feet.

Petroleum.—Petroleum production from 219 fields in 10 counties increased 4 percent over 1957. At the end of the year 1,356 wells were operating. Substantial declines in production were recorded in some older fields such as the Sloss, Olsen, Maley, and Kimball.

TABLE 2.—Production of crude petroleum, by counties (thousand barrels)

County	1957	1958 (preliminary)	Principal fields in 1958 in order of production
Banner	2,774	3,881	Willson Ranch, Vedene, Fink, Edwards.
Cheyenne	4,637	4,679	Juelfs, Cook, Doran, Dorman.
Garden	11	9	Richards, McCord.
Harlan		5	Alma-S, Hausserman.
Hitchcock		1	Burr Oak, Hudson.
Kimball	11,123	10,689	Sloss, Allchin, Heidemann, Travis.
Morrill	894	934	Hascoll, Lane, Lindberg.
Red Willow	12	14	Barger, Poore.
Richardson	126	143	Dawson, Falls City.
Scotts Bluff	9	13	Vessels.
Total	19,586	20,368	

TABLE 3.—Wildcat- and development-well completions in 1958, by counties

[Oil and Gas Journal]

County	Crude	Dry	Total	Footage
WILDCAT				
Adams		2	2	8,200
Banner	8	82	90	550,200
Blaine		1	1	3,600
Chase		1	1	4,800
Cherry		1	1	4,500
Cheyenne	2	50	52	275,300
Dawes		1	1	5,200
Deuel		1	1	3,700
Dundy	1	2	3	13,400
Frontier		4	4	13,500
Gage		1	1	1,800
Garden		5	5	19,400
Grant		1	1	4,100
Harlan	1		1	3,700
Hayes		5	5	22,800
Hitchcock	1	3	4	18,600
Jefferson		1	1	3,200
Kimball	25	109	134	874,700
Morrill	2	17	19	89,800
Red Willow		4	4	15,000
Richardson		2	2	6,700
Saunders		1	1	1,400
Scotts Bluff		12	12	65,800
Sheridan		1	1	4,600
Sioux		1	1	4,900
Total	40	308	348	2,018,900
DEVELOPMENT				
Banner	57	51	108	669,700
Cheyenne	16	34	50	257,200
Dundy	1	1	2	8,600
Garden		1	1	3,200
Kimball	89	102	191	1,233,800
Morrill	9	11	20	96,400
Richardson	3	5	8	21,700
Total	175	205	380	2,290,600
Total all drilling	215	513	728	4,309,500

The Harrisburg, Baltensperger, Allely, Houtby, and Gurley fields also produced at a lower rate. These losses were more than offset by production from fields discovered in 1957 and 1958. Of these, the Allchin and Benziger fields (discovered in 1958) and the Edwards, Fink, and Gehrke fields (discovered in 1957) were the largest producers of the recent discoveries.

Exploratory drilling declined considerably. The success ratio, however, was higher, with 40 fields discovered from 348 exploratory wells compared with 45 discoveries from 474 exploratory wells in 1957. Development drilling also declined below 1957, while the

success ratio dropped to 46 percent compared with 60 in 1957. The most important discovery was the Allchin field in south central Kimball County. Two other discoveries, Petsch and Mintken fields in the same township, resulted in a 30-well development program that brought in 20 producers. Reasonably successful development programs in fields in Banner and Cheyenne Counties also were completed. Almost all of the successful completions were in the Cretaceous D and J sandstone members of the Dakota formation. Exploration outside the limits of the Denver-Julesburg basin resulted in discoveries in Dundy, Hitchcock, and Harlan Counties in the Pennsylvanian, Lansing-Kansas City formation. Widely scattered exploration was conducted in other counties beyond the producing areas of the Denver-Julesburg basin and along and east of the Chadron-Cambridge arch, without significant results. Almost without exception the level of activity in these areas was less than in 1957. Total drilling in 1958, both exploratory and development, was 4.3 million feet compared with 5.2 million feet in 1957. The Consumers Cooperative Refinery Association operated its 2,200-barrel-a-day skinning and cracking plant at Scottsbluff the entire year. Throughput was 9 percent greater than in 1957. The refinery at Salem in Richardson County remained idle.

NONMETALS

Cement.—Portland and masonry cements were produced at plants in Cass and Nuckolls Counties, which together operated at 94-percent capacity during the year. Shipments of portland and masonry cements increased 23 and 5 percent, respectively, compared with 1957. Limestone and shale used in manufacturing the cements were produced at quarries near the plants and from a limestone deposit in Kansas. Eight kilns at the two plants operated an average of 309 days during the year; the operations consumed 66.7 million kw.-hr. of electricity. Shipments were made to consumers within Nebraska (73 percent) and in Iowa (20 percent), and South Dakota (3 percent). Shipments also were made to Minnesota, North Dakota, Kansas, and Wyoming. The price of portland cement in Nebraska in 1958 was $3.26 a barrel and $3.15 in 1957.

Clays.—Miscellaneous clay was produced in six counties for manufacturing building brick, draintile, other heavy clay products, and portland cement. Stoneware clay from a deposit in Cass County was used in manufacturing art pottery and flowerpots. Production was 19 percent less than in 1957.

Gem Stones.—Gem stones and gem material, such as fossils, agate, jasper, and petrified wood, were collected by gem-stone societies and individuals.

Perlite.—Crude perlite was expanded at a plant in Omaha for use as an aggregate in building plaster and concrete, for soil conditioning, and as a filler.

Pumice.—Pumice produced in Custer County in 1958, slightly below that in 1957, was used in cleaning and scouring compounds and as an abrasive.

Sand and Gravel.—Sand and gravel output in 62 of the State's 93 counties was 31 percent greater than in 1957. Production by Government-and-contractor operators was reported in 21 counties at 27 locations and represented 6 percent of the total production. The

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Glass	1	$1		
Building	1,578	1,322	806	$556
Paving	1,627	1,123	907	645
Engine	46	32	(1)	(1)
Railroad ballast	23	15	(1)	(1)
Other	149	65	133	67
Total	3,424	2,558	1,846	1,268
Gravel:				
Building	565	424	2,971	2,520
Paving	2,979	2,219	4,883	3,621
Other	92	63	64	57
Total	3,636	2,706	7,918	6,198
Total sand and gravel	7,060	5,264	9,764	7,466
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving	235	106	52	35
Gravel:				
Building	47	45	625	444
Paving	602	474		
Total	649	519	625	444
Total sand and gravel	884	625	677	479
ALL OPERATIONS				
Sand	3,659	2,664	1,898	1,303
Gravel	4,285	3,225	8,543	6,642
Grand total	7,944	5,889	10,441	7,945

(1) Figure withheld to avoid disclosing individual company confidential data; included with "Other."

major portion of this was by contractors for county highway departments. Contracts by the Nebraska State Department of Roads represented 12 percent of the total noncommercial output. The greater portion of the sand and gravel used in road construction was produced by commercial operators. Commercial production, representing 94 percent of the total sand and gravel, was from 145 locations in 53 counties. Of this, 59 percent was used for paving and road construction, 39 percent for building purposes, and the remainder for engine sand, for bedding stock cars, and as fill material. Most of the sand and gravel was washed, screened, or otherwise prepared. Commercial operators prepared 91 percent and Government-and-contractor operations 66 percent. Dodge County led the State in the quantity produced, followed by Cass, Douglas, and Hall Counties. Twenty-four counties reported production over 100,000 tons. Progress of the National System of Interstate and Defense Highways in Nebraska, according to a report by the U.S. Department of Commerce, Bureau of Public Roads, showed that 10.6 miles of highways had been completed during the year and 12.4 miles was under construction at the end of the year.

Stone.—Production, consisting of limestone and sandstone, increased 16 percent over 1957. Crushed limestone for riprap, road construction, agriculture, the manufacture of cement, in fillers and mineral food, and as refractory stone was produced in 14 counties. Rubble

for rough construction was produced in two counties. Crushed sandstone for riprap and road construction was produced at Government-and-contractor operations in two counties. Of the total crushed limestone produced, 41 percent was used for road construction, 32 percent as riprap, and 2 percent for agricultural purposes. Leading counties in the production of stones were Cass, Nemaha, and Pawnee, all of which produced over 500,000 tons each.

TABLE 5.—Stone sold or used by producers, by kinds

Year	Limestone		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1954	2,639,625	$3,480,527	20,545	$30,967	2,660,170	$3,511,494
1955	3,077,414	4,166,969	3,833	10,392	3,081,247	4,177,361
1956	3,060,391	4,137,788	2,300	4,025	3,062,691	4,141,813
1957	3,063,184	3,746,621	1,900	1,900	3,065,084	3,748,521
1958	3,552,903	4,743,368	2,400	3,800	3,555,303	4,747,168

Talc.—Crude talc was ground at a plant at Grand Island for use in ceramics, paint, paper, textiles, and toilet preparations. The crude material was from mines in California, Montana, and Nevada.

Vermiculite.—Crude vermiculite from Montana was exfoliated at a plant at Omaha. The processed material was used as loose-fill insulation and for plaster and concrete aggregate.

METALS

There was no mine production of metals in Nebraska; however, the State used a substantial quantity of ferrous and nonferrous metals in numerous manufacturing plants. The nonferrous refinery of American Smelting and Refining Co. at Omaha refined lead bullion from smelters in other States and processed material from foreign countries. In addition to refined lead, the plant recovered substantial quantities of antimony, bismuth, and similar metals from the base bullion processed.

REVIEW BY COUNTIES

Banner.—Petroleum production from 37 fields was 40 percent above that in 1957. At the end of the year 274 wells were operating. Seven new fields were discovered (at two of the new fields production was from two horizons—the Cretaceous D and J sandstone

TABLE 6.—Value of mineral production in Nebraska, by counties [1]

County	1957	1958 [2]	Minerals produced in 1958 in order of value
Adams	$82,747	$48,392	Sand and gravel, clays.
Antelope	19,500	(3)	Sand and gravel.
Banner	8,270,740	11,433,940	Petroleum, sand and gravel.
Blaine	----------	(3)	Sand and gravel.
Boone	(3)	(3)	Do.
Boyd	19,000	21,500	Do.
Brown	40,200	60,500	Do.
Buffalo	131,700	268,600	Do.
Butler	50,700	30,900	Do.
Cass	10,589,425	13,100,191	Cement, stones, sand and gravel, clays, gem stones.

See footnotes at end of table.

TABLE 6.—Value of mineral production in Nebraska, by counties [1]—Continued

County	1957	1958 [2]	Minerals produced in 1958 in order of value
Cedar	$126,000	$65,100	Sand and gravel.
Chase	23,500		
Cheyenne [4]	13,818,760	13,756,260	Petroleum.
Clay	(3)	94,700	Sand and gravel.
Colfax	58,200	67,000	Do.
Cuming	87,900	(3)	Do.
Custer	(3)	(3)	Pumice.
Dawson	175,600	148,300	Sand and gravel.
Deuel [4]			
Dixon	32,500	37,000	Sand and gravel, stones.
Dodge	389,400	812,800	Sand and gravel.
Douglas	692,119	914,975	Sand and gravel, clays.
Dundy	7,400	(3)	Sand and gravel.
Fillmore	35,200	36,000	Do.
Franklin	(3)	65,200	Sand and gravel, stones.
Frontier	10,700	2,200	Stones.
Furnas	37,400	68,500	Sand and gravel.
Gage	178,100	223,730	Stones, sand and gravel, gem stones.
Garden	32,780	26,460	Petroleum.
Garfield	400		
Grant		3,500	Sand and gravel.
Greeley		3,700	Do.
Hall	226,800	352,800	Do.
Hamilton	59,500	5,500	Do.
Harlan	50,200	35,500	Sand and gravel. petroleum.
Hayes	24,900	(3)	Sand and gravel.
Hitchcock	67,200	80,340	Sand and gravel, petroleum.
Holt	75,000	87,500	Sand and gravel.
Howard	(3)		
Jefferson	175,218	307,577	Sand and gravel, clays.
Kearney	58,200	148,800	Sand and gravel, clays.
Keith	104,400	119,100	Do.
Kimball [4]	[5] 33,181,240	31,456,340	Petroleum, sand and gravel.
Knox	133,100	76,300	Sand and gravel.
Lancaster	225,761	244,209	Stones, clays.
Lincoln	59,900	32,325	Sand and gravel, gem stones.
Loup	27,200	(3)	Sand and gravel.
Madison	188,000	239,100	Do.
Merrick	61,200	92,500	Do.
Morrill	2,767,420	2,852,160	Petroleum, sand and gravel.
Nance	45,500	63,115	Sand and gravel, gem stones.
Nemaha	849,700	606,500	Stones.
Nuckolls	(3)	(3)	Cement, sand and gravel.
Otoe	(3)	(3)	Stones, clays.
Pawnee		889,700	Stones, sand and gravel.
Perkins	15,900	18,400	Sand and gravel.
Phelps	107,400		
Pierce	8,900	81,700	Do.
Platte	356,600	433,600	Do.
Red Willow	74,560	95,860	Sand and gravel, petroleum.
Richardson	654,380	731,020	Petroleum, stones, sand and gravel.
Rock		(3)	Sand and gravel.
Saline	40,400	40,600	Do.
Sarpy	1,021,100	956,000	Sand and gravel, stones.
Saunders	(3)	895,500	Stones, sand and gravel, gem stones.
Scotts Bluff	[5] 148,220	102,520	Sand and gravel, petroleum, stones.
Seward	(3)	(3)	Stones.
Sioux	[5] 20,700	20,615	Sand and gravel, gem stones.
Stanton	75,000	(3)	Sand and gravel.
Thayer	(3)	(3)	Do.
Thomas	2,700	46,200	Do.
Thurston		10,400	Stones.
Valley	19,000	39,600	Sand and gravel.
Washington	(3)	92,700	Stones.
Webster	68,800	117,000	Sand and gravel.
Wheeler	5,000	3,700	Do.
York	(3)	(3)	Do.
Undistributed [6]	[5] 8,182,000	8,627,300	
Total [7]	[5] 82,928,000	90,032,000	

[1] The following counties are not listed because no production was reported: Arthur, Box Butte, Burt, Cherry, Dakota, Dawes, Gosper, Hooker, Johnson, Keya Paha, Logan, McPherson, Polk, Sheridan, Sherman, and Wayne.

[2] Natural gas, natural-gas liquids, and petroleum values are preliminary.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Excludes natural gas and natural-gas liquids.

[5] Revised figure.

[6] Includes all natural gas, natural-gas liquids, some sand and gravel and gem stones that cannot be assigned to specific counties and values indicated by footnote 3.

[7] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacture of cement.

members of the Dakota formation) and 90 exploratory wells were completed. Development drilling was slightly higher than in 1957; of 108 completions, 57 were successful.

Cass.—Cass County led the State in the production of portland and masonry cements, clay, and stone, and was second in the production of sand and gravel. Ash Grove Lime & Portland Cement Co. produced portland and masonry cement at Louisville from limestone and shale mined nearby. Sand and gravel for building and road construction was produced by Lyman-Richey Sand & Gravel Corp. at its Nos. 5 and 6 plants and Western Sand and Gravel Co. at its Cedar Creek and South Bend plants.

Cheyenne.—Petroleum production from 54 fields was slightly above that in 1957. Two new fields were discovered (Chandler and Mather) from 52 completed exploratory wells. Fifty development wells were completed, 16 of which were successful, but total drilling was less than in 1957. A new process for secondary recovery of oil, started by Ohio Oil Co. at the Johnson field near Sidney, involved pumping 50,000 barrels of propane into the reservoir and then driving the oil to producing wells with natural gas. The propane, being miscible with the reservoir oil, reduced the viscosity of the oil, which then could be driven to the producing wells more easily. The cost of the operation was estimated to be $250,000. Ohio Oil Co. operated its Huntsman and West Sidney natural gas plants for recovering natural gasoline, propane, and butane. Gas for the plants came principally from the Huntsman and SW. Sidney fields. Residual gas was marketed through pipelines to consumers.

Deuel.—Natural gas from the Big Springs field was marketed. Kansas-Nebraska Gas Co., Inc., completed a natural gas plant at its Big Springs compressor station for recovering natural gasoline, propane, and butane. The plant had a designed capacity of 50 million cubic feet a day and at yearend was processing 30 million cubic feet a day. One unsuccessful exploratory well was drilled in 1958.

Dodge.—Sand and gravel was produced for use in building and road construction and as fill material. The 1958 production of 1.3 million tons was an increase of 85 percent over 1957. The principal producers were Lyman-Richey Sand & Gravel Corp. (at its Nos. 12 and 13 plants), Lincoln Sand & Gravel Co. and Christensen Sand & Gravel Co.

Douglas.—Lyman-Richey Sand & Gravel Corp., operating its Nos. 9 and 11 plants, and J. W. McCann Co. were the principal sand and gravel producers. The major uses were for building, road construction, and fill material, but a small quantity of engine sand also was produced. Omaha Brick Works produced miscellaneous clay for the manufacture of building brick and heavy clay products. Western Mineral Products Co., Omaha, produced expanded perlite and exfoliated vermiculite. The Omaha plant of American Smelting and Refining Co. refined base lead bullion.

Dundy.—An oilfield—the Rickard—discovered 1 mile southeast of the Jones field tested 70 barrels of oil a day on pump.

Garden.—Petroleum production from two fields was 18 percent below that in 1957. Six wells (five exploratory and one development) were completed, but all were unsuccessful.

Hall.—Sand and gravel produced was used principally for building and road construction. A substantial quantity also was produced

by contractors for the county highway department and the Nebraska State Department of Roads. The principal producers were Luther & Maddox and H & M Equipment Co. Sierra Talc & Clay Co. operated its grinding plant at Grand Island.

Harlan.—Petroleum was produced from three fields. One discovery, the Bottin, was made in the Pennsylvanian, Kansas City formation.

Hitchcock.—A small quantity of petroleum was produced from two fields, both 1958 discoveries. The Burr Oak field near the Kansas State line was of some significance because of other Pennsylvanian discoveries farther to the southwest in Kansas. The Burr Oak discovery well pumped 143 barrels of oil a day from the Lansing-Kansas City formation.

Jefferson.—Endicott Clay Products Co. produced miscellaneous clay for manufacturing building brick and heavy clay products. Western Brick and Supply Co., Fairbury pit, was idle. The county ranked third in the State in clay production.

Kimball.—Kimball County was again the major source of petroleum in the State and supplied 52 percent of the total. Production was from 104 fields, and at the close of the year 649 wells were operating. The major producing fields, with production over 500,000 barrels each, were the Sloss, Allchin, Heideman, Travis, and Griffith. Nine other fields produced over 200,000 barrels each. Unit opeation of the Sloss field, the second largest in the Denver-Julesburg basin, begin in June. Unitization reportedly will be followed by water-flooding operations that are expected to recover 40 percent of the estimated oil in place ultimately, as compared with 25 percent by primary operations.

Most of the exploratory and development drilling in Nebraska was in Kimball County. The most notable discovery was the Allchin field. Discovery of the Allchin, Mintken and Petsch fields in one township stimulated a 30-well development program that resulted in 20 producers, 12 in the Allchin and 4 each in the Mintken and Petsch fields. Initial daily production at the Allchin discovery was 940 barrels. Initial production at the Mintken and Petsch discovery wells was 226 barrels and 293 barrels a day, respectively. All three fields produced from the Cretaceous J sandstone member of the Dakota formation. The Allchin field was the second highest producer in the county in 1958. Other discoveries in the county were all in the Dakota D and J sandstone and initial production rates ranged from 40 to 240 barrels a day. Of these, the most significant were the Benziger and Simpson, which produced at daily rates of 240 and 235 barrels. Four other discovery wells produced at daily rates of 200 barrels or more.

Development drilling was extensive, especially in some of the older fields. The Sloss field, discovered in 1954, reached full development during the year, with seven new producers completed. In the Willson Ranch field, discovered in 1957, 10 new producers also were completed. At the Torgeson field, discovered in 1951, nine new producers were completed. Several producers also were added to the Fernquist and Kreizinger fields. Unitization and secondary recovery operations were planned at the Kimball and Ostgren fields. Kimball Gas Products Co. recovered natural gasoline, propane, and butane at its 9-million-cubic-feet-a-day plant

southeast of Kimball. Natural gas for processing was from wells in the southeastern part of the county.

Lancaster.—Yankee Hill Brick Manufacturing Co. produced miscellaneous clay for manufacturing building brick, draintile, and other heavy clay products. It was the leading producer of clay for brick manufacture in the State. Schwarck Quarries, Inc., produced limestone rubble for rough construction and crushed limestone for road construction and agricultural use. The county highway department produced crushed limestone for use as riprap. The Consumers Public Power district began constructing a 100,000-kw. steam powerplant at Hallam in June. Plans are to convert to a sodium-cooled, graphite-moderated nuclear plant in 1962, using slightly enriched uranium as fuel.

Morrill.—Petroleum production from 59 wells in 10 fields was 5 percent more than in 1957. Two new fields—the Baumgartner and Mar—discovered from 19 exploratory wells were completed in the J sandstone member of the Dakota formation and pumped 120 barrels of oil a day each. Twenty development wells were completed; nine were successful.

Nemaha.—Colaska Production Co. and Nelson Quarries, Inc., produced crushed limestone for riprap, road construction, and agricultural use. Crushed limestone for riprap was produced for the Omaha district, U.S. Army Corps of Engineers, by Eugene Luhr & Co., and by Mossman Construction Co. The county ranked third in the State in stone production. Production in 1958 was 9 percent below that in 1957.

Nuckolls.—Portland and masonry cements were produced by Ideal Cement Co. at its Nebraska Division plant at Superior which operated at near capacity for 350 days. Limestone used at the plant was mined at the company quarry in Jewell County, Kans. Portland-cement clinker was used as a base in the manufacture of masonry cement.

Pawnee.—The county ranked second in the State in crushed limestone production. Output of Hopper Bros. Quarries, used for riprap, road construction, and for agriculture, was 585,000 tons.

Red Willow.—Petroleum production from three wells in two fields was 17 percent more than in 1957. Davidson-Merritt Sand & Gravel Co., Gillen Sand & Gravel Co., and Midwest Sand & Gravel Co. produced sand and gravel for building, paving, and fill material, and for bedding in stock cars; production in 1958 increased 21 percent over 1957.

Richardson.—Petroleum production was from 40 wells in 4 fields. The Searls Petroleum Corp. refinery at Salem remained idle. Sand and gravel was produced by the county highway department for road repairs and maintenance. Crushed limestone for riprap and road construction was produced by Geo. W. Kerford Quarry Co. and Harmon Gravel Co. Pine Bluff Sand & Gravel Co. produced riprap for the Omaha District, U.S. Army Corps of Engineers. Stone production in 1958 was 36 percent greater than in 1957.

Scotts Bluff.—Production of petroleum continued from the Vessels field which had been discovered in 1957. Output was small, however, and all exploratory wells completed were unsuccessful. The Consumers Cooperative Refinery Association operated its skimming and cracking plant at Scottsbluff. Throughput was 8.5 percent

greater than in 1957. Crude oil was from fields in southeastern Wyoming and the Harrisburg field in Banner County. Sand and gravel production by American Marietta Co., Harry F. Berggren & Sons, Inc., and Trettenero Sand and Gravel Co. for use in building and paving and as fill material declined 39 percent compared with 1957. Crushed sandstone for use as riprap was produced for the Bureau of Reclamation, U.S. Department of the Interior.

The Mineral Industry of Nevada

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Nevada Bureau of Mines.

By L. E. Davis[1] and R. Y. Ashizawa[2]

THE TOTAL value of Nevada mineral production in 1958, 77 percent of which represented metals output, was less than the value of metals and metal ores alone produced in 1957. Lower prices for copper accounted for 68 percent of the total decline. Lower prices also led to the closing of the last of Nevada's major tungsten mines and of one lead-zinc mine. Loss of some export trade to Canada adversely affected iron-ore shipments, and a nationally curtailed iron and steel industry caused lower iron-ore output and substantially reduced the demand for magnesite and brucite for refractories. The availability of crude barite from sources closer to domestic markets appreciably decreased Nevada barite output and caused the only processing plant to close.

TABLE 1.—Mineral production in Nevada [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Antimony ore and concentrate—gross weight	29	$9	39	$8
Barite	109,663	721	59,407	405
Clays	12,428	20	(2)	(2)
Copper (recoverable content of ores, etc.)	77,750	46,806	66,137	34,788
Fluorspar	(2)	(2)	12,338	340
Gem stones	(3)	100	(3)	100
Gold (recoverable content of ores, etc.)—troy ounces	76,752	2,686	105,087	3,678
Gypsum	674,422	(2)	686,000	2,306
Iron ore (usable)—long tons, gross weight	904,455	5,341	594,000	3,149
Lead (recoverable content or ores, etc.)	5,979	1,710	4,150	971
Manganese ore (35 percent or more Mn.)gross weight [4]	129,046	(2)	127,322	7,566
Mercury—76-pound flasks	6,313	1,559	7,336	1,681
Petroleum (crude)—thousand 42-gallon barrels	44	76	40	69
Sand and gravel	5,233,000	5,190	5,503,000	5,311
Silver (recoverable content of ores, etc.)—troy ounces	958,477	868	932,728	844
Stone	925,000	1,585	813,000	1,335
Talc and soapstone	7,467	57	5,391	41
Tungsten concentrate—60-percent WO_3 basis	1,196	1,676	(2)	(2)
Zinc (recoverable content of ores, etc.)	5,292	1,228	91	19
Value of items that cannot be disclosed: Brucite, diatomite, lime, magnesite, molybdenum concentrate, perlite, pumice, salt, sulfur ore, uranium ore, and values indicated by footnote 2		16,756		6,020
Total Nevada [5]		86,023		68,293

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Weight not recorded.
[4] Shipments to Government low-grade depots and custom mills not included, but quantity and value of this material are as follows: 1957—manganese ore, 118 short tons, $6,306, and low-grade manganese ore, 4,444 short tons, $190,300; 1958—low-grade manganese ore, 1,774 short tons, $82,835.
[5] Total has been adjusted to eliminate duplicating the value of stone.

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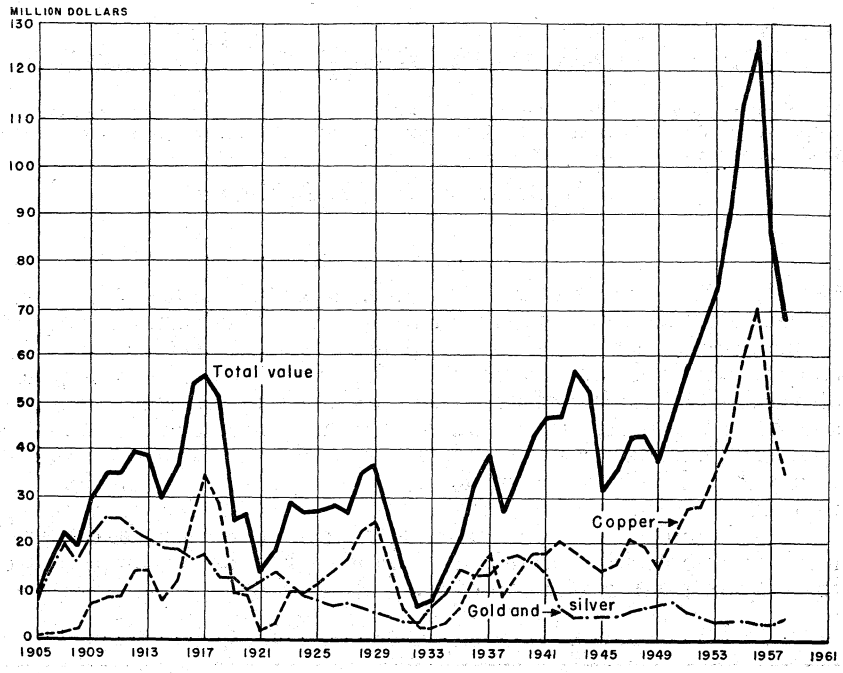

FIGURE 1.—Value of gold and silver, copper, and total value of mineral production in Nevada, 1905–58.

Significant new developments in 1958 included: Reactivation of a large placer-gold property; development of a diatomite deposit and construction of a plant to process the material; completion of a new lime kiln; and shipments of uranium ore by a new producer.

Employment and Injuries.—Employment statistics compiled by the Office of Nevada State Inspector of Mines revealed a 13-percent decline in the number of workers employed in the mineral industries.

Fatal injuries per thousand workers were slightly less than in 1957. Of the five fatalities in 1958, three occurred underground, one at a placer property, and one at an open-pit mining operation. Nonfatal lost-time injuries per thousand workers dropped 57 percent from 1957 figures. One of the most outstanding safety records to be achieved in the mineral industries was established by The Anaconda Co. at Weed Heights. The large copper mining-leaching operation worked the full year without a lost-time accident.

Average weekly earnings per employee, as reported by the Nevada Employment Security Department, rose from $95.74 in 1957 to $101.10 in 1958 for an average workweek that was 50 minutes longer.

Consumption, Trade, and Markets.—Production of 1 or more of Nevada's 30 mineral commodities was reported from each of the 17 counties. As Nevada mineral consumption was small producers had to seek out-of-State markets for more than 90 percent of their output. The minerals wholly consumed were clays, volcanic cinder, salt, sand and gravel, and stone, while those that were processed further and only partially consumed included gypsum, limestone, and perlite.

TABLE 2.—Employment and injuries in Nevada mines,[1] mills, and smelters

County	1957[2]				1958[2]			
	Employment		Injuries		Employment		Injuries	
	Operations	Employees	Fatal	Nonfatal	Operations	Employees	Fatal	Nonfatal
Churchill	3	30			2	23		
Clark[3]	15	1,215	1	32	15	1,213		20
Douglas	1	42		7	1	30		4
Elko	10	49	1	6	9	33		2
Esmeralda	8	84		4	8	116	1	3
Eureka	3	97		10	1	22	1	1
Humboldt	8	172	1	53	8	165		14
Lander	5	79		15	4	68		11
Lincoln	4	197		64	5	86		6
Lyon	3	504	1	25	3	462		4
Mineral	3	21			2	32		
Nye	9	366		26	7	344	3	26
Ormsby	1	3			1	3		
Pershing	8	298	1	31	7	117		9
Storey	3	49		7	3	47		4
Washoe	4	173		2	4	187		4
White Pine	7	1,713	1	36	8	1,491		11
Total	95	5,092	6	318	88	4,439	5	119

[1] Excludes sand, gravel, and stone facilities producing directly for the construction industry.
[2] Figures are as of December 31, compiled from information furnished by the Office of Nevada State Inspector of Mines.
[3] Includes specialty sand pits.

Although most metal ores received some processing before shipment, some were consigned in crude state to out-of-State mills and smelters or sold direct to the consumer. Export trade became an increasingly important factor in marketing the State's iron-ore output and to the producers of magnesite and magnesia products.

Legislation and Government Programs.—Early in 1958 the Nevada Tax Commission, at the request of Kennecott Copper Corp., voted to permit deduction of employer contributions to employment retirement funds as operating expense. The company had contended that the retirement fund contributions were necessary to maintain an adequate work force and should be deductible as part of operating expenses before tax on the net proceeds of mining was computed.

An order issued May 18 by the U.S. Department of the Interior excused owners of mining claims in certain areas of Washoe, Pershing, and Humboldt Counties from doing assessment work for the fiscal year ending June 30, 1958. The order affected that area released from the Naval Gunnery Range as a result of a cutback in original demands for land by the U.S. Department of the Navy.

In August, the Office of Minerals Exploration (OME) was established in the Department of the Interior to supersede the Defense Minerals Exploration Administration (DMEA), which was officially terminated at midnight, June 30, 1958. Exploration in Nevada under these programs consisted of 12 projects, in 7 counties, that were active during all or part of 1958. Two new contracts were executed under DMEA, one for copper-lead-zinc and one for uranium. The latter was terminated before yearend, at which time only four projects, one each for tungsten, manganese, copper-lead, and copper-lead-zinc, were active.

TABLE 3.—Defense Minerals Exploration Administration contracts active during 1958

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation (percent)
CHURCHILL					
Tungsten Mountain Mining Co	Hilltop	Tungsten	Dec. 3, 1957	$32,200	75
ELKO					
John H. Uhalde	Aladdin	Copper-lead	Apr. 29, 1957	62,610	50
LINCOLN					
Combined Metals Reduction Co	Black Prince	Lead-zinc	Mar. 2, 1955	98,200	50
Milbank & Jones	Bristol	Copper-lead-zinc.	Aug. 13, 1956	82,250	50
Southpaw Joint Venture	Southpaw	Manganese	Dec. 27, 1957	12,852	75
MINERAL					
Kennametal, Inc. (Nevada Scheelite Corp.).	Leonard	Tungsten	June 12, 1956	68,800	75
NYE					
Climax Tungsten Co	Climax	Tungsten	Oct. 30, 1956	66,320	75
Kohlmoos, Brandt & Corder	Rainbow & Cord.	Uranium	Mar. 3, 1958	4,740	75
PERSHING					
C. A. Coppin	Redbird	Mercury	July 5, 1955	23,483	75
Cordero Mining Co	Stormy Fraction.	Tungsten	July 23, 1956	57,254	75
Walter & Dorothy Low	Mount Tobin	Mercury	Sept. 11, 1957	10,544	75
WHITE PINE					
Hamilton Corp	Hamilton	Lead-zinc-copper.	June 18, 1958	37,520	50

The two 1952 Government purchase contracts for minerals produced at plants in Clark County continued in force. One was for 27.5 million long-ton units of manganese nodules from Manganese, Inc. The other was for 1,500 short tons of titanium sponge metal from Titanium Metals Corp. of America.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—In Lander County, concentrate produced from antimony ore previously mined at the Antimony King mine in the Big Creek district and antimony concentrate taken from stocks at an Austin mill were shipped to an eastern broker for export. The Austin concentrate was produced in 1957 from ore mined in earlier years at the Last Chance mine near Round Mountain, Nye County. Antimony ore mined at the White Caps mine at Manhattan, Nye County, was shipped to a Los Angeles, Calif., manufacturer of nonferrous alloys. Antimonial-lead ore mined in Mineral County was shipped to smelters in California and Utah.

Copper.—Curtailed copper output was attributed directly to lower prices throughout the year. Although ores from 32 active lode

mines in 11 counties contributed to the total copper produced, 4 mining companies in 3 counties accounted for 99 percent of the yield in recoverable copper credited to the State. In White Pine County, the Nevada Mines Division, Kennecott Copper Corp., the State's leading producer, purchased the Nevada holdings of Consolidated Coppermines Corp. on February 1, 1958. Kennecott mined out the Minnesota-Hi underground ore body in 1958, but no mining was done in the Deep Ruth deposit. Development continued north and west at the Liberty pit, which was in production throughout the year, as was the Veteran pit. Some direct smelting (fluxing) ore was mined at the latter, and at the Tripp pit. The skip-haulage system at the Liberty pit was scheduled for completion early in 1959, but no immediate plans were made to complete a similar system planned for the Tripp pit by Consolidated Coppermines. The Anaconda Co. open pit and leaching plant in Lyon County produced less copper precipitate than in 1957. The change in ownership, and new policy of the Garfield smelter in Utah to suspend acceptance of custom ores, scheduled for January 1, 1959, required Lincoln County's Bristol Silver Mines Co., Nevada's third largest copper producer, to seek another outlet for its ore produced after that date.

TABLE 4.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing [2]		Material sold or treated [3] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousand dollars)	Troy ounces	Value (thousand dollars)
1949–53 (average)	219	19	7,251	129,777	4,542	1,191,475	1,078
1954	119	17	9,843	79,067	2,767	560,182	507
1955	134	10	10,760	72,913	2,552	845,397	765
1956	132	5	12,300	[4] 68,040	[4] 2,381	[4] 993,716	[4] 899
1957	107	9	11,770	76,752	2,686	958,477	868
1958	102	14	9,792	105,087	3,678	932,728	844
1904–58 [5]			(6)	14,941,463	370,970	314,606,338	215,711

Year	Copper		Lead		Zinc		Total value (thousand dollars)
	Short tons	Value (thousand dollars)	Short tons	Value (thousand dollars)	Short tons	Value (thousand dollars)	
1949–53 (average)	53,298	25,509	7,669	2,341	16,132	4,798	38,268
1954	70,217	41,428	3,041	833	1,035	224	45,759
1955	78,925	58,878	3,291	981	2,670	657	63,833
1956	[4] 80,824	[4] 68,700	6,384	2,005	7,488	2,052	[4] 76,037
1957	77,750	46,806	5,979	1,710	5,292	1,228	53,298
1958	66,137	34,788	4,150	971	91	19	40,300
1904–58 [5]	2,515,928	923,672	387,515	61,376	481,983	93,161	1,664,890

[1] Includes recoverable metal content of gravel, washed (placer operations); or milled; old tailings or slimes retreated; and ore, old tailings, and slag shipped to smelter during calendar year indicated.
[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[3] Does not include gravel washed.
[4] Revised figure.
[5] From 1904 when first satisfactory annual canvass of mine production was made to 1958, inclusive.
[6] Data not available.

Gold.—Nevada gold output was affected adversely by curtailed copper mining in White Pine County and by the closing of major lead mining operations in Eureka County. A total of 33 lode mines in 15 counties contributed to the total gold recovered from ores mined in the State, most of which was a byproduct of ores treated chiefly for recovery of base metals. Four mining and milling operations were credited with 92 percent of the gold recovered from ore of lode mines; they were: The Kennecott open-pit copper mines, concentrator, and smelter, White Pine County; Goldacres open-pit gold mine and cyanide plant, Lander County; Richmond-Eureka lead mine, Eureka County; and Bootstrap underground gold mine and cyanide plant, Elko County.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc in 1958, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value	Troy ounces	Value
Churchill	4		11	$385	(2)	(2)
Clark	6		145	5,075	289	$262
Douglas	1		2	70	1	1
Elko	9	1	4,017	140,595	56,952	51,544
Esmeraldo	10		(2)	(2)	(2)	(2)
Eureka	6	3	6,780	237,300	210,912	190,887
Humboldt	8	1	518	18,130	883	799
Lander	8	1	(2)	(2)	39,137	35,421
Lincoln	4		(2)	(2)	(2)	(2)
Lyon	2				15	14
Mineral	6		477	16,695	20,803	18,828
Nye	10	6	(2)	(2)	(2)	(2)
Pershing	4	2	95	3,325	121	110
Storey	2		(2)	(2)	(2)	(2)
Washoe	4		29	1,015	322	291
White Pine	18		(2)	(2)	(2)	(2)
Undistributed			93,013	3,255,455	603,293	546,009
Total	102	14	105,087	3,678,045	932,728	844,166

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill			(2)	(2)	(2)	(2)	$385
Clark	1,800	$473	624,800	$73,102	700	$71	78,983
Douglas							71
Elko	6,900	1,815	(2)	(2)	(2)	(2)	193,954
Esmeraldo	100	26	1,600	187	2,900	296	509
Eureka	232,900	61,253	5,952,300	696,419	11,000	1,122	1,186,981
Humboldt	100	26	9,300	1,088	100	10	20,053
Lander	1,377,900	362,388	57,200	6,692	(2)	(2)	404,501
Lincoln	(2)	(2)	431,800	50,521	5,400	551	51,072
Lyon	(2)	(2)					14
Mineral	4,800	1,262	150,500	17,608	900	92	54,485
Nye			1,400	164	100	10	174
Pershing			300	35			3,470
Storey							(2)
Washoe	(2)	(2)	11,300	1,322	300	31	2,659
White Pine	(2)	(2)	249,300	29,168	61,000	6,222	35,390
Undistributed	130,649,500	34,360,819	810,200	94,794	99,600	10,160	38,267,237
Total	132,274,000	34,788,062	8,300,000	971,100	182,000	18,565	40,299,938

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1958, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Gold	40	183,309	17,101	15,125	----------	1,400	2,000
Gold-silver	6	1,031	677	26,010	2,000	300	200
Silver	21	7,873	680	159,810	3,300	9,500	600
Copper	15	9,573,143	39,008	399,729	132,223,700	304,900	1,500
Lead	19	24,870	7,135	305,338	29,000	7,306,600	146,800
Lead-zinc	2	162	4	3,977	15,600	52,500	30,200
Total	103	9,790,388	64,605	909,989	132,273,600	7,675,200	181,300
Other "lode" material:							
Old tailings (gold)	[2]	114	29	31	----------	100	----------
Lead residue	[2]	1,012	----------	174	400	624,700	700
Total	[2]	1,126	29	205	400	624,800	700
Total "lode" material	102	9,791,514	64,634	910,194	132,274,000	8,300,000	182,000
Gravel (placer operations)	14	[3]	40,453	22,534	----------	----------	----------
Total, all sources	116	----------	105,087	932,728	132,274,000	8,300,000	182,000

[1] Details will not necessarily add to totals, because some mines produce more than one class of material.
[2] From property not classified as a mine.
[3] 1,178,948 cubic yards.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1958, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed, and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation and cyanidation:					
Ore	17,426	93,976	----------	----------	----------
Old tailings	19	14	----------	----------	----------
Total recoverable in bullion	17,445	93,990	----------	----------	----------
Concentration and smelting of concentrates:					
Ore	37,400	142,599	126,019,400	11,900	400
Old tailings	10	17	----------	100	----------
Total	37,410	142,616	126,019,400	12,000	400
Direct smelting:					
Ore	9,779	673,414	6,254,200	7,663,300	180,900
Lead residue	----------	174	400	624,700	700
Total	9,779	673,588	6,254,600	8,288,000	181,600
Placer	40,453	22,534	----------	----------	----------
Grand total	105,087	932,728	132,274,000	8,300,000	182,000

Total gold shipments increased appreciably above the 1957 figures, owing to reactivation of the Nevada Porphyry Gold Mines placer property at Round Mountain, Nye County, by Round Mountain Gold Dredging Corp. The first gold shipment was made by this producer in May, at which time the recovery plant was treating 7,500 cubic yards of placer material a day. Daily plant capacity was increased to 10,000 cubic yards in September, and to 13,000 cubic

yards by yearend. In addition to the Round Mountain dredging facilities, placer gold was recovered at a hydraulic operation in Pershing County, at 2 drift mines in Nye County, and with small-scale methods at 10 other localities.

Iron Ore.—Shipments of usable iron ore by Nevada producers declined 34 percent compared with 1957. The chief reasons for the decline were lower requirements by a curtailed domestic steel industry and loss of some export trade to Canadian producers. Iron ore was produced from eight properties in four counties: The Buena Vista group, Churchill County; Minnesota claims, Douglas County; Iron King mine and Red Bird claims, Humboldt County; and Iron Castle prospect, Iron Horse group, Thomas pit and Segerstrom-Heizer property, Pershing County. Iron ore mined at the Buena Vista group and Minnesota claims was upgraded using magnetic separators. All other production was direct-shipping ore. The Moderalli mine, Eureka County, Black Jack claims, Humboldt County, and Parker pit, Pershing County, were idle. Although no iron ore was mined at the Phelps-Stokes property, Nye County, some stockpiled ore was utilized by the producer in calcining magnesite. At Caselton, Lincoln County, tests were made on equipment to be used in treating Wyoming titaniferous-iron ore preparatory to the operation of a pilot plant for recovery of iron, with the titanium going to the slag for possible later recovery.

Iron and Steel Scrap.—Shipments of iron and steel scrap approximated 25,000 gross tons and originated primarily at yards in Reno and Las Vegas, and at the U.S. Naval Ammunition Depot at Hawthorne. Nearly all of this scrap was consigned to California dealers and brokers. Rail shipments into Nevada during the year were estimated at 35,700 long tons, consisting principally of detinned cans and tin-plate clippings for the copper-leaching plant at Yerington, most of which was from Los Angeles, Calif., and Houston, Tex. A small tonnage of iron and steel scrap was consumed in the production of steel castings at the copper smelter in McGill.

Lead.—Lead mining was further curtailed during 1958 owing to declining prices in the first three quarters of the year. Despite price gains in the last quarter, average sales price was 11.7 cents a pound, 8 percent less than in 1957. The major drop in lead output probably would have been greater had it not been for appreciable quantities of recoverable gold and silver contained in the ores mined. Although mines and prospects in 13 counties contributed to the total lead output, 7 properties in 6 counties accounted for 95 percent of the yield. Lead produced from ore of the Richmond-Eureka mine, Eureka County, was 71 percent of the quantity credited to the State. The other six major sources of lead production were: The Three Kids open-pit mine (lead residue recovered in the treatment of manganese ore), Clark County; Delno lead mine, Elko County; Bristol mine (copper-silver ore) and L.S.Z. mine (lead ore), Lincoln County; Onetha mine (lead ore), White Pine County; and the New Potosi mine (lead ore), Mineral County.

Manganese.—There was little change in production of manganese ore and nodules at Nevada mines; however, shipments of low-grade manganese ore were appreciably below those in 1957 due to the closing of the Butte, Mont., purchasing depot in May when the

Government program limitation was reached. Early in the yea the "A" pit of the Three Kids mine, Clark County, was reopenec The pit had been closed for several months while stockpiled ore wa processed, and by the end of the year a million cubic yards o overburden had been removed to permit mining the ore body. Th Three Kids mine, concentrator, and nodulizing plant was the majo source of Nevada manganese production. One Clark County com pany prepared battery-grade manganese dioxide from ore minec in Mexico. The State's entire manganese output was shipped tc Government stockpiles.

TABLE 8.—Mercury production by methods of recovery

Year	Direct furnaced		Retorted		Unclassified,[1] 76-pound flasks	Total		Operating mines
	Ore (short tons)	76-pound flasks	Ore (short tons)	76-pound flasks		76-pound flasks	Value[2]	
1949–53 (average)	17,495	2,579	150	25	2	2,605	$402,067	8
1954	105,672	15,523	7,649	1,048	12	4,974	1,315,076	21
1955						5,750	1,669,512	33
1956						5,859	1,522,871	51
1957	73,281	11,345	25,583	2,263	41	6,313	1,559,185	45
1958						7,336	1,680,384	35

[1] Includes mercury recovered from miscellaneous dump material.
[2] Value calculated at average price at New York.

Mercury.—The increased mercury output, above that in 1957, was due in part to a market bolstered by a Government purchase program which ended December 31, 1958. A high percentage of the production was recovered from ores of mines in Humboldt County, particularly the Cordero mine near McDermitt and the Red Ore mine in the Bottle Creek district. Only 2 other mines had a yield exceeding 100 flasks, the B & B mine near Dyer, Esmeralda County, and the Hillside prospect in the Spring Valley district, Pershing County. However, 35 producing mines in 10 counties contributed to the total output.

Molybdenum.—Molybdenite concentrate was recovered from copper ores of the Robinson district, White Pine County. The product was shipped to a domestic consumer outside the State, as was molybdenite concentrate produced in 1957 as a byproduct in the processing of tungsten ore at the Getchell mine, Humboldt County.

Silver.—The quantity of recoverable silver produced decreased from 1957 due to curtailed copper, lead, and zinc mining. The lower silver yield as a byproduct from these base metals ores was offset somewhat by the silver yield at the Round Mountain gold-dredging operation, Nye County. The overall result was a decline of only 3 percent in total silver output from all material treated, compared with 1957. Although mines and prospects in every county except Ormsby contributed to the silver output, more than 50 percent of the total was recovered from ores of three mining operations: The Bristol copper mine, Lincoln County; Richmond-Eureka lead mine, Eureka County; and the open-pit copper mines, White Pine County. Other sources of major silver production were: The United States Mining & Milling Co. operations and the Mohawk mine (silver ore), Esmeralda County; Delno mine (lead ore), Elko County; Inde-

pendence mine (gold-silver ore) and Copper Canyon property (copper ore), Lander County; and Northern Belle mine (silver ore), Mineral County.

Titanium.—Titanium metal was produced by Titanium Metals Corp. of America at its Henderson plant. The company reported development of a titanium alloy, containing aluminum, molybdenum, and vanadium, with a tensile strength approaching 200,000 pounds per square inch. The alloy was expected to find application in the construction of high-speed aircraft scheduled for production in 1960.

Tungsten.—Nevada's two remaining major tungsten producers ceased operations. Gabbs Exploration Co., Nye County, closed down in March and Nevada-Massachusetts Co., Pershing County, stopped mining and milling operations in June. The latter was the State's oldest and most consistent tungsten producer. In September the mill of Minerva Scheelite Mining Co., White Pine County, was destroyed by fire, and no plans were made to replace it. A comparatively minor tonnage of high-grade tungsten ore was mined and concentrated at three deposits, one each in Churchill, Mineral, and Washoe Counties. The concentrates were shipped to a former major producer in Mineral County and consumed in the company's tungsten-carbide pilot plant. Tungsten concentrate was recovered from a placer property near Coaldale, Esmeralda County, but the values were too low to make the operation profitable.

Uranium.—Uranium ore shipments, all of which were made to Utah processing plants, increased 57 percent compared with 1957. In comparison with States of the Rocky Mountain area and the Colorado plateau, Nevada production was not significant and the ore reserve is small. The number of producing properties dropped to three, from six in 1957. Major production was from the Racetrack claims in Elko County, a new producer and shipper. Lesser tonnages of uranium ore were shipped from the Early Day property, Lander County, and the Lowary group, Washoe County, both of which had marketed ore in previous years. Exploration was at a low level elsewhere in the State, and development was limited to annual assessment work.

Vanadium.—Union Carbide Nuclear Co., Division of Union Carbide Corp., optioned and located a number of mining claims in the Fish Creek Range of northern Nye County, searching for vanadium ore.

Zinc.—The lower average unit price of 10.2 cents per pound for zinc was responsible for the precipitous drop in production of this metal, compared with 1957. Although the base metal ores from many mines and prospects throughout the State, treated at smelter-fuming plants, contributed small quantities of recoverable zinc, only eight properties were credited with more than one ton of metal in 1958. Five mines in three counties produced ore that yielded 90 percent of the total output; they were: The Delno and Diamond Jim mines (lead ore), Elko County; Copper King mine (lead ore), Eureka County; and the Onetha (lead ore) and Great Valley (lead-zinc ore) mines, White Pine County.

NONMETALS

Barite.—Production and shipments of crude and ground barite declined 46 percent and 63 percent respectively, compared with 1957. A lower demand for barite used in well-drilling mud was the chief

reason for the marked decline. Mines that had been the source of major production in 1957 were idle throughout 1958. The State's only grinding plant ceased operation in May. Stocks were depleted by shipments at two mines, and appreciably reduced at two others. The California grinding plants of Nevada producers received 81 percent of all crude barite shipped.

Brucite and Magnesite.—Two companies in the Gabbs area of Nye County mined magnesite and fired the material to produce caustic-calcined magnesia and various refractory products. One of the producers also mined brucite and upgraded the mineral by dense-medium separation. The product was utilized by the company at its Ohio refractories plant. Compared with 1957 figures, magnesite and brucite production decreased 21 percent and 73 percent, respectively, owing primarily to a lower demand for refractories by a curtailed steel industry.

Clays.—The increased output of clays from Nevada deposits, compared with 1957, was utilized primarily in the manufacture of heavy clay products. Pits near Reno, Washoe County, yielded fire clay and miscellaneous clay used by a Reno producer of building brick and other clay products. Clays mined at the McDonough Clay Beds near Ely, White Pine County, were shipped to the McGill smelter at Kennecott Copper Corp. and used in maintenance and repair at the smelter facilities. Bentonitic clays mined near Weeks, Lyon County, and near Beatty, Nye County, were shipped to a California plant for processing into pharmaceutical, ceramic, and building products.

Diatomite.—Four open-pit operations, one each in Churchill, Esmeralda, Pershing, and Storey Counties, were the sources of diatomite production. Preparation plants processed the crude mineral near Basalt (Esmeralda County) at Fernley (Lyon County), at Colado (Pershing County), and at Clark Station (Storey County). The Colado plant, a new $2.5-million operation, made its first shipment of a finished product in September. The raw material source for this plant was the company's Tunnel Hill mine, 30 miles west of the plant. Development at the mine was completed earlier in the year, and actual production began shortly before the plant was placed in operation. Although Nevada production of prepared diatomite was less than in 1957, the average unit value of the products was slightly greater owing to the output of filter-grade material for the first time. The prepared material was also sold for use as filler in rubber, paint, and paper, and as a carrier in insecticides. An important tonnage was exported to Canada and a lesser quantity of the crude mineral was shipped to California and prepared for poultry litter.

Fluorspar.—Production of crude fluorspar by a California cement company for its own use was responsible for a slight quantity increase in fluorspar production. Because of its comparative low grade this output led to a 48-percent overall value decline below 1957. Two producers, one each in Lincoln and Nye Counties, supplied nearly twice as much metallurgical-grade fluorspar as in 1957. A small quantity of acid-grade, and some metallurgical-grade material, were shipped to the GSA stockpile under Government purchase programs.

Gem Stones.—Turquois from a property in the Cortez district, Lander County; the Lone Mountain Turquoise mine, Esmeralda County; and the Turquoise Bonanza mine in the Pilot Mountains district, Mineral County; was responsible for a large part of the total value of Nevada gem-stone output. The Virgin Valley area, Humboldt County, yielded fewer opals than in 1957. Appreciable quantities of petrified wood were gathered in the Seven Troughs Range, Pershing County, and near Gilbert, Esmeralda County. Although the latter area also supplied most of the agate, collections were made in Lake Valley, Lincoln County, and the Monte Cristo Range, Mineral County. Sulfur and calcite crystals were found in Eureka County, onyx in Nye County, and garnet in White Pine County.

Gypsum.—The slightly increased production of crude gypsum, compared with 1957, was credited to the output from Clark County quarries. Gypsum, quarried near Henderson, was shipped to the producers' California wallboard plants at Newark and South Gate, and the crude mineral from the Blue Diamond quarry was processed in Nevada at an adjacent plant for wallboard, lath, and plaster. The Empire Quarry, Pershing County, supplied crude gypsum for calcined products made at the company's nearby plant in Washoe County.

Lime.—Nevada production of quick and hydrated lime, sold and used, declined 6 percent below 1957. The lower output was due to curtailed copper production in White Pine County, where the producer used the material at concentrator and smelter facilities. A new lime plant in Clark County, adjacent to the Apex limestone quarry, began operation in May. The same company also operated lime plants at Henderson and Sloan on limestone and dolomite produced at the Apex and Sloan quarries. Although some of the quicklime and hydrated lime from these plants was consumed locally, most of the products were shipped to other western States and to Canada. Ultimate consumption was principally in construction materials, for metallurgical use, in paper manufacturing, and in petroleum refining.

Perlite.—A sharp rise in output of crude perlite over 1957 was due entirely to the output of a Lincoln County producer who, in addition to his normal shipments outside Nevada, supplied the demand from customers of an out-of-State producer during a changeover in operations and provided a Clark County expansion plant with crude material used in the preparation of construction materials. Another Lincoln County deposit was the source of crude perlite shipped to a California expansion plant. Perlite quarried in Pershing County was expanded at the producer's Washoe County plant and used in the manufacture of plasterboard.

Pumice and Volcanic Cinder.—Only cinder was produced. The tonnage was double that in 1957. Construction projects in the Reno and Lake Tahoe areas created a heavy demand for this material, which was used for lightweight aggregate and obtained from a deposit near Carson City, Ormsby County. At yearend the producer also had a backlog of orders for cinder to be used as drain rock for road construction in California. Near Lathrop Wells, Nye County, volcanic cinder was quarried and used by a Clark County manufacturer of building block. An additional tonnage was produced for use in road construction by the Nevada Highway

Department in Nye County. Cinder for concrete aggregate was quarried and used by a producer-contractor at a deposit near Mina, Mineral County.

Salt.—The State's salt production, which was increased in 1957 to offset losses in California output due to a labor strike, was reduced in 1958 to local needs. The total yield was limited to a single producer in Churchill County who surface-mined the solar-evaporated salt from a dry lake bed.

Sand and Gravel.—The requirements for structural and paving sand and gravel used in the construction, maintenance, and repair of State highways declined to 3.2 million tons from 3.4 million tons in 1957; however, production of these materials by crews and contractors of Clark, Elko, Pershing, Washoe, and White Pine County road agencies comprised a substantial percentage of Nevada's increased total output. Clark County pits yielded 1.7 million tons of sand and gravel, most of which was prepared for use in the Las Vegas and Lake Mead areas, and which included specialty sands from the Overton area that were produced for out-of-State glass, molding, and furnace use. Pits in the Reno area were the source of approximately 80 percent of the 1.3 million tons of sand and gravel produced in Washoe County during the year for building and paving.

TABLE 9.—Sand and gravel sold or used by producers, by classes of operations and uses

	1957		1958	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Glass	(1)	(1)	(1)	(1)
Molding	77,042	$258,402	76,733	$309,131
Building	184,201	221,979	181,805	224,998
Paving	75,218	90,550	252,777	292,931
Other	(1)	(1)	70,578	130,634
Gravel:				
Building	164,424	216,785	105,262	147,402
Paving	685,500	596,040	837,887	727,254
Other	328,328	353,604	92,903	156,889
Undistributed sand and gravel	176,812	473,266	44,756	156,148
Total sand and gravel	1,691,525	2,210,626	1,662,701	2,145,387
GOVERNMENT-AND-CONTRACTOR OPERATION [2]				
Sand:				
Building	5,540	3,040	14,700	18,400
Paving	29,576	17,154	68,064	33,275
Total	35,116	20,194	82,764	51,675
Gravel:				
Building	13,560	13,932	187,380	267,316
Paving	3,492,764	2,945,250	3,569,994	2,846,816
Total	3,506,324	2,959,182	3,757,374	3,114,132
Total sand and gravel	3,541,440	2,979,376	3,840,138	3,165,807
ALL OPERATIONS				
Sand	548,389	1,064,391	709,413	1,165,517
Gravel	4,684,576	4,125,611	4,793,426	4,145,677
Grand total	5,232,965	5,190,002	5,502,839	5,311,194

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes figures for State, counties, municipalities, and other Government agencies.

Stone.—The overall decline in stone production, compared with 1957, was due in part to the increased use of unconsolidated material in lieu of quarried stone for concrete and roadstone in most areas of the State. The tonnage of limestone quarried in Clark County and sold for blast furnace flux and the output of crushed miscellaneous stone for railroad ballast in Lincoln County were lower than in 1957. The quantities of dimension and crushed sandstone and quartzite prepared for use as building stone and roofing granules at quarries in Clark and White Pine Counties were also less. Contractors on special projects for the Lake Mead Recreational Area, Clark County, and for the Bureau of Indian Affairs, Elko County, utilized crushed basalt for building and paving. More than 100,000 tons of granite was quarried and crushed in the Reno area, Washoe County, for use in construction. Marble was quarried for terrazzo near Luning, Mineral County, and marl was produced near Flanigan, Washoe County, and ground for use in poultry and livestock feed. There was a slightly greater output of sawed-dimension sandstone in Humboldt County than was reported in 1957.

TABLE 10.—Stone, commercial and Government-and-contractor, sold or used by producers, by uses [1]

Use	1957		1958	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rubble, short tons	(2)	(2)		
Rough construction, short tons			710	$14,100
Rough architectural, cubic feet	3,154	$6,223	2,230	3,960
Approximate equivalent in short tons	246		174	
Sawed stone and cut block, cubic feet	21,512	[3] 46,373	10,807	23,815
Approximate equivalent in short tons	[3] 1,693		843	
Flagging, cubic feet	4,551	9,754		
Approximate equivalent in short tons	355			
Total dimension stone (quantities approximate, in short tons)	2,294	62,350	1,727	41,875
Crushed and broken stone, short tons	922,928	1,522,172	811,259	1,293,229
Grand total (quantities approximate, in short tons)	925,222	1,584,522	812,986	1,335,104

[1] Includes basalt, granite, limestone, marble, calcareous marl, sandstone, and miscellaneous stone.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes "rubble."

Sulfur.—Shipments of sulfur ore from Nevada's only active sulfur deposit, in Humboldt County, were nearly 30 percent higher than in 1957 with no change in grade of ore mined. The crude ore was crushed, ground, screened, and sacked for sale in Nevada and neighboring States, primarily for use as a soil aid. Sulphur Products, Inc., Ukiah, Calif., acquired operational control of the property.

Talc and Soapstone.—Production of talc and soapstone, limited to deposits in Esmeralda County, continued the decline reported in 1957, due to the inability of Nevada producers to supply specification grades required by California grinders. Ultimate consumption for the State output was as filler for various products.

MINERAL FUELS

Petroleum.—The two-well Eagle Springs unit, Nye County, which was discovered by Shell Oil Co. in 1954, supplied Nevada's entire petroleum output. Production dropped 9 percent below that in 1957. The crude oil was delivered to a Bakersfield, Calif., refinery. Exploration activity was at a low level, and geological and geophysical work was limited to three companies: Standard Oil Co. of California, Union Oil Co., and Shell Oil Co. A deep-test well in Clark County was under consideration by Shell. Two shallow tests drilled by independent operators were abandoned as dry.

REVIEW BY COUNTIES

Churchill.—More than 300,000 tons of sand and gravel, both pit-run and prepared, was produced by crews and contractors of the Nevada Highway Department for structural and paving use. Pits in the Fallon area were the principal source of this material. Iron ore mined in the Buena Vista Hills was upgraded at an adjacent magnetic separation plant and shipped for use in iron, steel, and cement at plants outside the State. While most of the diatomite produced at a pit southwest of the *Jessup* district was processed at a Lyon County plant, a portion was prepared for poultry-litter use. A few flasks of mercury was retorted from ore mined at the Red Bird claims in an unsurveyed area east of the Humboldt Salt Marsh and sold to a San Francisco buyer. Gold, silver, and lead were recovered from lead ores mined at one property in the *Chalk Mountain* district, and at two in the *Holy Cross* district. The former also yielded a small quantity of zinc. A few ounces of gold was produced at a gold prospect in the *Truckee* district. The State's only salt production from near Fallon, was used locally. Concentrates produced from some high-grade tungsten ore mined at the Quick Tungsten No. 6 claim in the *Shady Run* district were shipped to a Mineral County tungsten-carbide pilot plant.

Clark.—Nevada's major source of manganese ore was the Three Kids open-pit mine northeast of Henderson. The ore was concentrated by flotation and nodulized at the producer's plant. Over 1.7 million tons of sand and gravel was produced at various places in the county; most of it was required by city, county, State, and Federal agencies for structural and paving use in the Las Vegas and Lake Mead areas. Approximately 150,000 tons of silica (specialty) sands was prepared for glass and molding use from deposits in the Overton area and sold to out-of-State consumers. Gypsum quarried near Henderson and at Blue Diamond was calcined at the producers' plants in Nevada and California. Quick- and hydrated lime was prepared at Apex, Henderson, and Sloan from limestone and dolomite quarried at Apex and Sloan. Most of the output was shipped to neighboring States for industrial uses. A high percentage of the silver and lead production, as well as small quantities of zinc and copper, was contained in lead residue recovered in processing manganese ore from the Three Kids mine. Gold and silver were recovered from ores mined at three properties in the *Eldorado Canyon* district, and at one mine each in the *Searchlight* and *Gold Butte* districts. Copper ore mined near Mesquite yielded most of the copper output.

TABLE 11.—Value of mineral production in Nevada, by counties

County	1957	1958	Minerals produced in 1958 in order of value
Churchill	$723,091	$574,146	Sand and gravel, iron ore, diatomite, tungsten, mercury, silver, salt, lead, gold, stone, zinc.
Clark	13,048,042	12,891,631	Manganese ore, sand and gravel, gypsum, lime, stone, lead, gold, copper, silver, zinc.
Douglas	1,708,699	1,294,355	Iron ore, sand and gravel, gold, silver.
Elko	669,224	953,463	Sand and gravel, gold, lead, stone, barite, silver, uranium, zinc, copper, mercury.
Esmeralda	677,937	879,107	Diatomite, silver, mercury, talc and soapstone, gold gem stones, sand and gravel, zinc, lead, copper.
Eureka	1,764,471	1,306,822	Lead, gold, silver, stone, copper, sand and gravel, manganese, zinc, gem stones.
Humboldt	2,775,163	2,576,970	Mercury, iron ore, sand and gravel, sulfur ore, stone, gold, molybdenum, lead, silver, gem stones, manganese, copper, zinc.
Lander	1,718,465	1,319,452	Gold, copper, barite, sand and gravel, silver, gem stones, uranium, manganese, mercury, lead, antimony, zinc.
Lincoln	[1] 3,831,311	[1] 1,783,966	Copper, perlite, silver, fluorspar, lead, gold, stone, zinc, sand and gravel, gem stones.
Lyon	16,439,227	14,351,198	Copper, sand and gravel, diatomite, clays, mercury, silver.
Mineral	919,641	187,433	Sand and gravel, silver, lead, gold, stone, mercury, barite, tungsten, copper, gem stones, zinc, volcanic cinder.
Nye	2,766,489	3,204,129	Gold, magnesite, sand and gravel, fluorspar, petroleum, volcanic cinder, brucite, silver, antimony, mercury, barite, gem stones, stone, clays, lead, zinc.
Ormsby	120,780	108,022	Sand and gravel, volcanic cinder, mercury, stone.
Pershing	3,809,204	2,001,029	Iron ore, gypsum, sand and gravel, mercury, tungsten, perlite, diatomite, gold, gem stones, silver, lead.
Storey	1,399,936	1,361,046	Diatomite, gold, silver.
Washoe	1,202,150	1,453,839	Sand and gravel, stone, clays, lead, gold, uranium, silver, tungsten, copper, zinc.
White Pine	[1] 32,397,804	[1] 21,976,963	Copper, gold, sand and gravel, lime, stone, silver, molybdenum, lead, manganese, zinc, clays, gem stones.
Undistributed [2]	51,806	69,225	
Total	86,023,000	68,293,000	

[1] Excludes value of manganese and low-grade manganese ores sold and blended at Government low-grade stockpiles for future beneficiation.
[2] Includes gem stones and mercury not listed by counties as data are not available.

Douglas.—The Minnesota claims in the *Buckskin* district were the source of iron ore upgraded by the producer, using magnetic separators, and shipped for export. Most of the pit-run gravel and prepared sand and gravel produced during the year was used by crews and contractors of county and State road agencies. Near Gardnerville, gold ore produced at the Monarch mine yielded a few ounces of gold and silver.

Elko.—Sand and gravel was produced by crews and contractors of city, county, State, and Federal agencies for structural and paving use. Basalt and miscellaneous stone quarried near Elko was utilized by the Bureau of Indian Affairs and the city of Wells. Important quantities of lead, zinc, and silver, containing some copper and gold, were recovered from lead ores produced at mines in the *Delano*, *Island Mountain*, *Loray*, and *Ruby Range* mining districts. Most of the county gold output was obtained from ore of an underground gold mine in the *Boulder Creek* district. Silver ore mined at a property in the *Merrimac* district contained recoverable silver, copper, lead, and zinc. Bench gravel and old tailings were reworked at the Blackbird group in the *Island Mountain* district, yielding considerable placer gold and silver. Crude barite was mined in the latter district and shipped to a Merced, Calif., grinding plant. The *Mountain City* district was the location of uranium claims from which most of the State's uranium ore was mined and shipped to

a Utah processing plant. Mercury was retorted from ores mined at properties in the *Battle Mountain*, *Midas*, and *Tuscarora* districts.

Esmeralda.—Diatomite quarried and processed at the producers' mine and mill near Basalt was shipped for use as a filler in various products. Two open-pit mines in the *Fish Lake Valley* district were the sources of mercury ore retorted or furnaced to produce the metal which was sold to California buyers. The entire output of talc and soapstone came from the Lida, Palmetto, and Dyer areas. The crude material was shipped to out-of-State grinders. Silver ore previously mined at several properties in the *Silver Peak* district was treated at the Bruhi mill in Silver Peak and yielded a large quantity of silver. The Mohawk mine, in the same area, was the source of ore that contained an important quantity of recoverable silver and some zinc. Gold ore produced at the Ohio mine near Goldpoint was treated at the Bruhi mill, and gold and silver were recovered. Silver was recovered from a small tonnage of ore mined at a property in the *Klondyke* district. Lead-zinc ore produced at a mine in the *Lone Mountain* district contained recoverable lead, zinc, silver, and copper.

Eureka.—A lead mine in the *Eureka* district yielded most of the State's lead output. These ores also contained important quantities of silver and gold and some recoverable copper. Gold, silver, lead, and copper were recovered from silver ore mined at a property in the *Cortez* district, and one producer in the *Maggie Creek* district mined copper and lead ore from which much of the copper and all of the zinc production in the county was recovered, together with some gold, silver, and lead. At three locations in the *Lynn* district stream and bench gravels were worked and yielded a few ounces of gold and silver. Sand and gravel produced in the county was utilized by county and State road agencies. A contractor for the Southern Pacific Co. quarried miscellaneous stone used for track ballast. Manganese ore mined from the Black Hill pit in the *Fish Creek* district was shipped to an Arizona vendor.

Humboldt.—A high percentage of the State mercury output was obtained from ores mined in the county. The Cordero mine near McDermitt, Nevada's largest producer, furnaced the ore to recover the metal, while the Red Ore mine in the *Bottle Creek* district upgraded the ore by flotation and retorted the concentrate. Other areas with lesser production were the *Golconda* and *Winnemucca* mining districts. The *Jackson Creek* district was the source of a large tonnage of direct-shipping iron ore sold to out-of-State pig-iron and steel producers. Sand and gravel were produced at various pits by crews and contractors of the Nevada Highway Department and used in road construction and maintenance. Dimension sandstone was quarried in Virgin Valley and sold for architectural use. Sulfur ore mined in the *Sulphur* district was prepared for use as a soil-aid. Various lode mines and prospects in the *Awakening*, *Disaster*, *Warm Springs*, *Shon*, *Slumbering Hills*, and *Winnemucca* mining districts were the sources of modest quantities of recoverable gold and silver. Ore from the Charleston Hill property in the *Shon* district yielded small quantities of lead and zinc. Ore obtained from the Rainbows End mine in the *Warm Springs* district contained recoverable lead and some copper. Stream gravel was worked at one placer property in the *Potosi* district, yielding a few ounces

of gold and silver. In the same district molybdenite concentrate, produced in 1957 as a byproduct in tungsten ore milling, was shipped to an out-of-State consumer. A few tons of manganese ore was produced at the Hot Spot group of claims and shipped to a Government stockpile.

Lander.—In the *Battle Mountain* district four active mining properties yielded most of the silver, copper, and lead produced in the county, while the Goldacres open pit in the *Bullion* district was the source of a high percentage of the gold output and of all the zinc recovered. Gold ores mined at one property each in the *Birch Creek* and *McCoy* districts contained modest quantities of gold and silver. Bench gravel at the Dahl placer property near Battle Mountain was worked for gold and silver. Three barite properties were active during the year, two in the *Battle Mountain* district and one in the *Argenta* district. Crude barite from one property was shipped to the producer's plant at Modesto, Calif. Another producer shipped to grinders in California and Kansas, while the third sold to a grinder and a broker in the San Francisco Bay area. Crews and contractors of county and State agencies produced sand and gravel at various pit locations and used the material in paving. Uranium ore mined at a property in the *Reese River* district was shipped to a Utah processing plant. Near Battle Mountain, the Black Devil manganese deposit was worked and the ore shipped to a Government stockpile. A few flasks of mercury was retorted from ore of the McCoy mine in the *Wild Horse* district and sold to a California buyer. Antimony concentrate produced from ore previously mined in the *Big Creek* district was shipped to an eastern broker for export.

Lincoln.—Silver recovered from ores mined in the county totaled more than that from any other county. Major copper and silver production was from the Bristol mine in the *Jack Rabbit* district. The ore was shipped to a Utah smelter and contained recoverable gold, lead, and zinc. Lead ore from the L. S. Z. mine in the *Pioche* district contained high silver and lead values as well as some gold, copper, and zinc. Gold ore produced at the Atlanta mine in the *Atlanta* district yielded modest quantities of gold and silver. Silver, lead, and zinc were recovered from a few tons of silver ore mined in the *Tempiute* district. Lincoln County was the location of perlite deposits that supplied most of the State output. Crude perlite from the Hollinger mine was sold to a Clark County expansion plant and to out-of-State consumers. The Delamar mine southwest of Caliente yielded crude perlite sold to a California expansion plant. Lincoln County fluorspar production was also the highest in the State. Fluorspar mined at the Tule Valley deposit near Carp was sold to steel producers or shipped to the Government stockpile. At Tempiute acid-grade fluorspar, produced as a byproduct of former tungsten-ore milling, was sold to the GSA for stockpiling. A contractor for Union Pacific Railroad Co. quarried miscellaneous stone near Caliente for use as ballast. Crews of the Nevada Highway Department produced sand from county pits for use in the maintenance and repair of roads. A small tonnage of low-grade manganese ore was produced from the Southpaw mine near Hiko during development and exploration work and was shipped to a Government low-grade stockpile.

Lyon.—The *Yerington* district was the location of an open-pit copper deposit which was the source of major copper output (second largest) in the State. Copper precipitate, produced at the company leaching plant, was shipped to the producer's smelter and refinery in Mont. In the same area, copper ore from the Mason Valley mine yielded recoverable copper and silver. Sand and gravel used by the Nevada Highway Department was mined from a number of pits, and sand and gravel produced near Dayton was sold for use in construction. Pits near Weeks yielded bentonitic clays, which were shipped to a California plant. A few flasks of mercury was produced from ore obtained at two prospects in the county.

Mineral.—More than 100,000 tons of sand and gravel was produced from various pits by crews and contractors of the Nevada Highway Department. Much of the county gold, silver, copper, lead, and zinc was produced by two operators in the *Candelaria* district and one in the *Whiskey Flat* district. Antimonial-lead ore shipped to out-of-State smelters from the New Potosi mine yielded the largest quantities of gold, silver, lead, and recoverable antimony. Most of the county silver was recovered from ore produced at the Northern Belle mine and milled in a flotation plant at Columbus Marsh. Ore from the Digmore mine near Babbitt contained recoverable gold, silver, and copper. Gold and silver were recovered from gold ores mined in the *Acme*, *Aurora* and *Eagleville* districts. Mercury ores from the Mercury Mountain and Poinsetta mines, *Pilot Mountain* district, and the Stockton property, *Rawhide* district, were retorted, yielding a few flasks of the metal. The Noquez barite deposit was worked during the year, and the crude material was shipped to the producer's plant at Terminal Island, Calif. Mill-cleanup operations at Nevada Tungsten Corp. holdings east of Luning yielded a small quantity of tungsten concentrate sold to the operator of a tungsten-carbide pilot plant near Coaldale.

Nye.—Gold output was the highest of any county in the State owing to the reactivation of a placer property at Round Mountain. Two drift mines and several small-scale stream-gravel operations produced small quantities of gold. Lode gold was recovered from the ores of 10 mines and prospects, but most of the gold output was from a few tons of ore from the Flagstaff property in the *Lodi* district. The Victory mine in the same district was the source of all zinc produced. Silver output was principally from the Round Mountain dredging operation and from ore produced at the Summit (Tonopah) King mine north of Tonopah, which was treated at the Bruhi mill, Esmeralda County. Recoverable lead production was limited to ore from the Shoe property in the *Troy* district and lead ore from a prospect in the *Tybo* district.

The Gabbs area was the location of considerable mining activity during the year. Magnesite was mined at the Betty O'Neal pit, the Nevada-Massachusetts lease, and the Greenstone Extension pit. Some brucite was recovered from ores of the first two properties. The crude minerals were processed at two nearby preparation plants, producing various magnesia products. A small tonnage of iron ore, from a stockpile at the Phelps-Stokes lease, was utilized at one plant in preparing dead-burned magnesia. A few miles north of Gabbs the Victory tungsten mine was active during the first half of 1958. Tungsten concentrate produced from the milled ore was

stockpiled. Near the Mineral County line, northwest of Gabbs, exploration and development were done at the Spardome fluorspar mine, but no shipments were made. All fluorspar output came from the Beatty area, where Metallurgical-grade fluorspar was produced and shipped from the Crowell property. A California cement company mined the mineral at the Gold Spar deposit for its own use. Petroleum production again was limited to the Eagle Springs unit south of Currant. Volcanic cinder quarried near Lathrop was trucked to the producer's plant in Clark County. A few flasks of mercury was retorted from ores of the Horse Canyon mine near Manhattan and from an open-pit mercury prospect near Ione. Crude barite was shipped from stocks at the Jumbo mine near Tonopah to the producer's plant at Oakland, Calif.

Ormsby.—Most of the county's mineral production value was derived from sand and gravel output. Crews and contractors of the Nevada Highway Department and a Carson City road agency produced these materials for structural and paving use and for sanding icy roads. An important tonnage of volcanic cinder was quarried from a deposit near Carson City that had been opened in 1957. Mercury was retorted from ore produced at two prospects in the county.

Pershing.—Iron-ore production was limited to four properties in the *Relief* district: The Iron Castle claim, Iron Horse group, Thomas pit, and Segerstrom & Heizer lease. All production was direct-shipping grade, which was shipped for export or sold to iron and steel producers. Crude gypsum was quarried in the *Hooker* mining district and processed into manufactured calcined products in the producer's adjacent Washoe County plant. Over 200,000 tons of sand and gravel was produced for paving use by crews and contractors of the Nevada Highway Department from pits at various county locations. More than 200 flasks of mercury was retorted from ores produced at mines and prospects in the *Goldbanks*, *Humboldt*, *Kennedy*, *Relief*, and *Spring Valley* districts. Most of the output came from ore of the Hillside mine in the last-named district. Tungsten production was from two properties. High-grade ore at the Hillside group in the *Seven Troughs* district was concentrated, and the Tungsten group mine, and mill, in the *Mill City* district was in production until the end of June, at which time the operation was shut down. Concentrates from both properties were shipped to a tungsten-carbide pilot plant in Esmeralda County. Crude material from the Pearl Hill perlite quarry northwest of Lovelock was trucked to a crushing plant at Kodak, where most of the perlite was transshipped to the producer's Washoe County expansion facilities for processing into manufactured products. A modest tonnage of the crushed and graded crude mineral was shipped to a New York consumer. During the year Eagle-Picher Co. opened up a diatomite deposit in the *Velvet* mining district east of Lovelock and built a processing plant at Colado. The first plant products were available in September. A high percentage of the county gold output, and more than one-third of the silver, was recovered at two placer operations in the *Willow Creek* district, principally by hydraulic methods. A few ounces of lode gold and silver were obtained from ores of various gold and silver prospects. Old tailings

at a former gold operation in the *Mill City* district yielded some recoverable lead, as did some silver ore of a prospect in the *Sierra* district.

Storey.—The Celatom open-pit mine southwest of Wadsworth was the source of most of Nevada's diatomite production. The crude mineral was processed in the producer's plant at Clark Station on Highway No. 40. The county gold and silver output was limited to the recovery from ores of three mines in the *Comstock Lode* district. Silver ore from the Tarto open-pit deposit was the major source of the recovered metals.

Washoe.—Pits in the Reno area yielded more than one million tons of building and paving sand and gravel produced in the county to meet the requirements of commercial contractors and city, county, and Federal agencies. Crushed granite was produced at a quarry near Reno for use in building and road construction. Clays mined at pits near the Geiger grade south of Reno were used by the producer in the manufacture of heavy-clay products. Lead ore produced at the Galena Hill mine yielded recoverable silver, lead, and zinc. Silver and copper were recovered from silver ore mined from the Silver Queen claims in the *Peavine* district. A small tonnage of gold ore obtained at two properties in the *Olinghouse* district was the source of a few ounces of gold and silver. A shipment of uranium ore was made from the Lowary group of claims, in the *Pyramid* district, to a Utah processing plant. Tungsten concentrate, produced from a few tons of high-grade ore mined near Wadsworth, was shipped to a tungsten-carbide pilot plant in Esmeralda County.

White Pine.—Copper ores mined from open pit operations in the *Robinson* district supplied much of Nevada's copper output. These ores were the source of appreciable quantities of recoverable gold and silver, and of molybdenite concentrate. In the same district, gold and silver were recovered from the gold-silver ore of the Tipple mine and the Eldorado lead mine. Lead, zinc, and copper were also recovered from the Eldorado ore. Lead and lead-zinc ores mined at two properties in the *White Pine* district yielded most of the county lead and zinc output as well as silver and copper, and a few ounces of gold. Several lesser operations in the *Cherry Creek*, *Granite*, *Osceola*, *Taylor*, and *Tungstonia* districts produced ore containing recoverable gold and silver. More than 500,000 tons of sand and gravel was produced from pits in the county, principally for use by county and State road agencies. Granite was quarried and crushed by construction and maintenance crews of White Pine County and used in the preparation of macadam. Quartzite quarried near Baker was used for exterior building block at an elementary school in Utah. Lime was produced by Kennecott Copper Co., from limestone quarried at McGill, and used by the company in its concentrator and smelter.

The Mineral Industry of New Hampshire

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the New Hampshire State Planning and Development Commission.

By Joseph Krickich [1] and Mary E. Otte [2]

INCREASED production of sand and gravel in 1958 spurred by an extensive road-building program, resulted in an increase of more than 16 percent above the 1957 New Hampshire mineral valuation. The year also was highlighted by increased valuation of mica output. Stone displaced feldspar as the mineral commodity that ranked third in the State.

Legislation and Government Programs.—The Federal Government through the General Services Administration (GSA) continued purchasing strategic minerals for stockpiling. Mica produced in New Hampshire was purchased by GSA at its Franklin, N.H., Spruce Pine, N.C. and Custer, S. Dak. depots. Beryl recovered in the State was sold to the Government through the depot at Franklin, N.H., only.

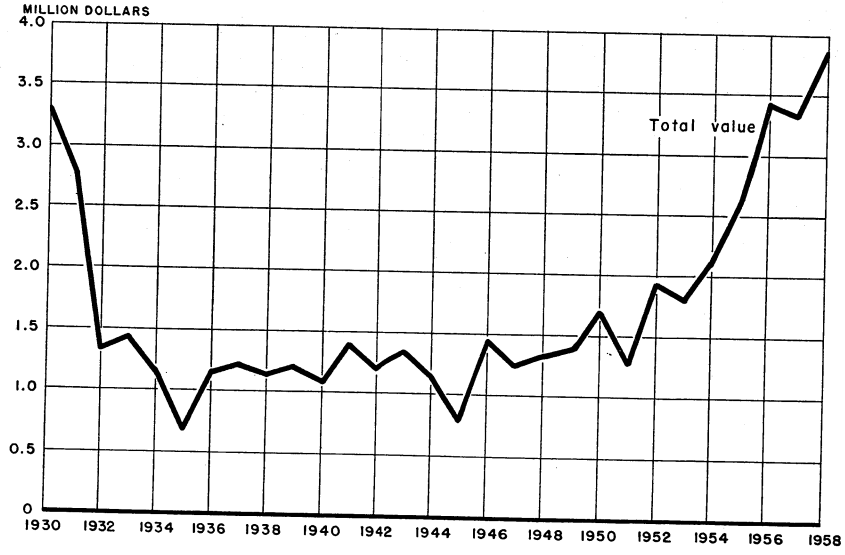

FIGURE 1.—Total value of mineral production in New Hampshire, 1930–58.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.
[2] Statistical clerk, Region V, Bureau of Mines, Pittsburgh, Pa.

TABLE 1.—Mineral production in New Hampshire [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate, gross weight	4	$2	14	$8
Clays	37,300	51	26,100	26
Gem stones	(2)	(3)	(2)	5
Mica:				
Sheet pounds	53,554	460	75,173	604
Scrap	522	17	314	12
Peat	85	(4)	100	(4)
Sand and gravel thousand short tons	4,505	1,970	4,940	2,620
Value of items that cannot be disclosed:				
Abrasive stones (1957), feldspar, stone, and values indicated by footnote 3	----------	831	----------	602
Total New Hampshire	----------	3,331	----------	3,877

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $1,000.
[4] Figure withheld to avoid disclosing individual company confidential data.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives (Scythestones).—Norton Pike Co. discontinued sales of scythestones (a quartz-mica schist) from the Pike quarry as the stockpiled material was exhausted at the end of 1957. The quarry near Piermont, Grafton County, had been closed since 1953.

Clays.—Total output of miscellaneous clay fell sharply because a brick plant in Strafford County closed. The output of the three remaining producers increased slightly and was used exclusively for manufacturing building brick. Two producers in Rockingham County and one in Grafton County were active.

Feldspar.—Production of crude feldspar increased but valuation declined sharply compared with 1957. The number of feldspar-producing mines, rose from three to five. Valuation declined sharply due to lower content of potash feldspar in the ore mined. The bulk of the crude feldspar came from two mines in Cheshire County; some was also produced in Grafton and Sullivan Counties. Two grinding mills in Cheshire County operated during the year. The ground feldspar was sold for pottery and glass manufacturing and shipped mainly to plants in New York, Ohio, New Jersey, and Massachusetts.

Gem Stones.—Valuation of gem stones and mineral specimens produced in the State rose sharply owing to increased coverage of the industry by the Bureau of Mines in 1958. Total output was produced or collected by amateur gem collectors in five counties, principally Grafton and Cheshire Counties. Varieties of gem stones and mineral specimens collected included aquamarine, beryl, garnet, gummite, quartz, topaz, tourmaline, and various other specimens.

Mica.—The mica industry was marked by increased production and sales of sheet mica to both industry and the Government and decreased sales of scrap mica to industry. In addition, total valuation increased to its highest level since 1944, when mica valued at $673,000 was produced. Increased recovery of strategic hand-cobbed and full-trim mica from producing mines, particularly the Keyes and Ruggles mines in Grafton County, was also an important factor in increasing the State's total mica valuation. The Government purchased only hand-cobbed and full-trimmed mica produced in New Hampshire through GSA purchase depots at Franklin, N.H., Custer, S. Dak., and Spruce Pine, N.C. Industry purchased limited quantities of punch, hand-cobbed, and full-trim mica, but decreased quantities of scrap mica. Grafton County supplied 86 percent of the State's total mica valuation. Ground mica was produced in Merrimack County and used in manufacturing paint, rubber, wallpaper, and for other uses. Quantities of scrap mica recovered from New Hampshire were shipped out of State for grinding.

Peat.—Peat used chiefly for soil improvement was recovered in Belknap County.

Sand and Gravel.—Sand and gravel continued as New Hampshire's principal mineral; as production and value increased for the fourth consecutive year. Stimulated by the increased roadbuilding program, output of paving sand and gravel by the commercial and Government-and-contractor operations increased from 3,940,000 tons in 1957 to 4,380,000 tons in 1958. In addition 395,000 tons of building sand and gravel was produced, 8 percent less than in 1957. Limited quantities of engine, filter, and other sands, as well as fill sand and gravel, were also produced. In 1958 22 percent of the State's total production was washed, crushed, sized, or otherwise prepared as compared with 28 percent in 1957. The New Hampshire Department of Public Works and Highways, by far the leading producer, either mined or produced sand and gravel under contract in all counties of the State. Sand and gravel production by Government-and-contractor operations was also reported in Hillsboro and Merrimack Counties by other governmental agencies. Combined commercial and Government-and-contractor tonnage came chiefly from Merrimack, Strafford, and Cheshire Counties. No commercial production was reported from Carroll and Sullivan Counties.

Stone.—Production and value of stone increased 49 and 5 percent compared with 1957. The sharp increase in output was due mainly to increased road construction and repair work by Government-and-contractor operations. Valuation did not increase as sharply as output because of decreased production of dimension granite, the State's leading stone in terms of value. In addition to dimension granite, crushed granite, and crushed quartz also were produced. Three commercial stone producers were active; two granite producers in Merrimack County and one quartz producer in Sullivan County. Increased tonnage of granite used for riprap and fill was produced under contract for the New Hampshire Department of Public Works and Highways.

TABLE 2.—Production of sand and gravel and stone by Government-and-contractor operations, by counties, in short tons

County	Sand and gravel		Stone	
	1957	1958	1957	1958
Belknap	153,711	90,221	1,590	
Carroll	275,379	334,199	103	112
Cheshire	342,106	363,572	90	
Coos	270,550	139,998	497	3,898
Grafton	243,643	189,644		1,590
Hillsboro	466,062	427,916	846	11,501
Merrimack	219,850	774,046	45	4,400
Rockingham	688,668	551,607	339	20
Strafford	300,526	729,070	20	13,076
Sullivan	123,091	105,931		67
Total	3,083,586	3,706,204	3,530	34,664

METALS

Beryllium.—Production and sales of beryl in New Hampshire increased substantially as more producers were active. The Government purchased all beryl through the depot at Franklin, N.H. Ore purchased ranged from 11.1- to 12.7-percent BeO content and averaged 28.6 cents per pound. Strafford County, a non-beryl-producing county in 1957, was the center of beryl production in 1958 and supplied over half of the State's output. Sales were also reported from Cheshire, Grafton, and Sullivan Counties.

REVIEW BY COUNTIES

Mineral production was recorded in all 10 counties in the State. Merrimack, Grafton, and Cheshire Counties, in decreasing order of value, were the centers of greatest mineral activity. Strafford County increased most in mineral valuation because of its sand and gravel output, particularly by the New Hampshire Department of Public Works and Highways. Cheshire County showed the greatest decline from the preceding year, owing to decreased valuation of feldspar and mica recovered in the county.

Increased road work by the New Hampshire Department of Public Works and Highways required tonnages of paving sand and gravel from every county, and granite for riprap and stone fill, from all counties except Belknap and Cheshire. Table 2 summarizes by county the production of sand and gravel and stone for the department and includes quantities of paving sand and gravel produced by the Manchester Department of Highways in Hillsboro County and by the Concord Commissioner of Public Works in Merrimack County. The sand and gravel was produced by the department's own crews and by operators under contract. The granite was produced under contract only. With the exception of Carroll County, sand and gravel production by Government-and-contractor operators is not discussed in the county review.

Belknap.—Tilton Sand & Gravel, Inc., stationary plant near Tilton produced structural and paving sand and gravel and fill sand. Perkins Peat Bog produced reed-sedge peat near Barnstead.

Carroll.—Sand and gravel and stone were produced for the New Hampshire Department of Public Works and Highways. Topaz, smoky quartz, and various other mineral specimens were recovered near Conway and Baldface Mountain.

TABLE 3.—Value of mineral production in New Hampshire, by counties

County	1957	1958	Minerals produced in 1958 in order of decreasing value
Belknap	(1)	(1)	Sand and gravel, peat.
Carroll	$36,821	$120,366	Sand and gravel, gem stones, stone.
Cheshire	818,559	665,566	Sand and gravel, feldspar, mica, gem stones, beryllium.
Coos	65,673	(1)	Sand and gravel, stone.
Grafton	600,854	688,784	Mica, sand and gravel, feldspar, clays, beryllium, gem stones, stone.
Hillsboro	(1)	312,538	Sand and gravel, stone.
Merrimack	(1)	(1)	Sand and gravel, stone, gem stones, mica.
Rockingham	130,449	217,913	Sand and gravel, clays, stone.
Strafford	(1)	(1)	Sand and gravel, stone, beryllium, mica, gem stones.
Sullivan	17,903	59,965	Sand and gravel, feldspar, mica, stone, beryllium.
Undistributed [2]	1,661,209	1,812,249	
Total	3,331,000	3,877,000	

[1] Value included with "Undistributed".
[2] Includes value of production in counties, as indicated by footnote 1 and a quantity unspecified by county.

Cheshire.—Sand and gravel mainly for paving and building purposes was produced by Cold River Sand & Gravel Corp. (Walpole). The company constructed a flume to carry water used in processing. Keene Sand & Gravel, Inc., (Swanzey), produced paving sand and gravel and filter and other sands.

Golding-Keene Co. recovered crude potash-type feldspar from the Kidder and Colony mines, both near Alstead, and ground the material at the local company-owned grinding mill. The company reactivated the Colony mine, which had been idle in 1957. Crude feldspar mined in Sullivan County was ground at the Cold River plant of Foote Mineral Co. for use in manufacturing pottery.

Cheshire County continued to rank second in mica production. Output of sheet mica dropped despite the increase from 3 to 12 in the number of reporting producers. Punch, hand-cobbed, and full-trim mica was recovered from mines near Alstead, Gilsum, Marlow, and Sullivan. Otto K. Lassman recovered beryl and mica from the French mine near Gilsum.

Aquamarine, beryl, fluorite, quartz, and green tourmaline gem materials were recovered, mainly near Alstead, Gilsum, and Westmoreland.

Grafton.—Grafton County ranked second in value of mineral production; it led in value of mica and ranked second in beryl. Both beryl and mica production increased and was centered in the southern part of the county. In some mines, notably the Keyes and Ruggles mines near Orange and Grafton, respectively, both mica and beryl were recovered. The Government purchased the entire beryl output and most of the sheet mica produced.

Hand-cobbed, full-trim, and scrap mica were sold to industry. Thirty-nine mica and 7 beryl producers were active in the county, compared with 37 and 6, respectively, in 1957. The average value of the sheet mica sold to the Government decreased from $9.25 a pound in 1957 to $8.76 in 1958. The average value per pound of beryl sold to the Government increased from 29 to 30 cents for the same period.

Commercial sand and gravel production was reported near Campton and Littleton and was used mainly for building and paving purposes. Both crude potash-type feldspar and beryl were recovered from the Ruggles mine near Grafton by Whitehall Co., Inc. The crude feldspar was produced for the parent company, The Orford Soap Co., Manchester, Conn., for use in soap manufacture. Densmore Brick Co. (Lebanon) mined and processed miscellaneous clay for manufacturing building brick. Gem minerals recovered near Alexandria, Grafton, and North Groton included golden beryl, gummite, triphyllite, and uranium. The stockpile of scythestones from the Norton Pike Co. quarry near Piermont was exhausted at the end of 1957, and no sales were made in 1958.

Hillsboro.—Commercial sand and gravel used chiefly for structural and paving purposes was produced by four operators, mainly near Manchester and Peterborough.

Merrimack.—Merrimack County continued as the leading sand-and-gravel-producing area in the State. Manchester Sand, Gravel & Cement Co., Inc, was the only reporting commercial producer of sand and gravel, mainly structural and paving material. The John Swenson Granite Co., Inc., Concord, produced dimension granite for rough and dressed construction, architectural work, and curbing. The company also produced crushed and broken stone for riprap, concrete aggregate, and roadstone. Frank Pallazzi & Sons, Inc., produced crushed granite for roadstone. Beryl, garnet, quartz, and other mineral specimens were recovered near New London.

Smith & Smith Co. produced limited quantities of full-trim mica and beryl from the Independence No. 2 mine near Elkins and sold the mica to the Government. Both domestic and imported mica were ground by Concord Mica Corp. at its Penacook plant.

Rockingham.—Structural sand and gravel and fill gravel were recovered commercially near Exeter. Miscellaneous clay used for manufacturing building brick was produced by Enos Bros. Brick Co. (Exeter) and W. S. Goodrich, Inc. (Epping). Crude gypsum shipped from Clarence Center, N.Y., was calcined at the National Gypsum Co. plant by the kettle process at Portsmouth. The calcined gypsum was used for manufacturing finished building materials such as lath, wallboard, and various building plasters.

Strafford.—Building sand and gravel and fill gravel were produced near Dover and Durham. Beryl was recovered from the Cilley mine near Center Strafford by William and Ruth Richardson and Wallace Carroll. The combined output made the Cilley mine the principal beryl producer in the State. Hand-cobbed and full-trim mica were also recovered from the mine and sold to the Government. Eucryptite, a lithium silicate, was recovered near Strafford. The clay pit

and brick plant of New England Brick Co. (Rochester) did not operate in 1958.

Sullivan.—Foote Mineral Co. produced crude feldspar from the Yuhas No. 2 mine near South Acworth and shipped the output to its grinding mill at Cold River, Cheshire County, for processing. William Hoyt leased the Ledge Pond mine near Sunapee and recovered a limited quantity of crude feldspar, which was sold to the Golding-Keene Co. grinding mill at Alstead, Cheshire County. Hand-cobbed and full-trim mica was recovered near Alexandria, Springfield, and Sunapee. Total output was sold to the Government. Trusiani Mining Co., South Acworth, produced quartz at the Beryl Mountain mine. The output was crushed for terrazzo building blocks. Four beryl producers were active near Acworth, Sunapee, and Unity. The beryl produced in the county and sold to GSA averaged 25.7 cents per pound.

The Mineral Industry of New Jersey

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the New Jersey Division of Planning and Development, Bureau of Geology and Topography.

By Joseph Krickich [1] and Stanley A. Feitler [1]

MINERAL production in New Jersey in 1958 was highlighted by reduced mine output of metals. Smaller production of stone and sand and gravel contributed to an overall decline of $14.3 million to the lowest value since 1954.

Trends and Development.—The addition of a feldspar grinding plant in Mercer County emphasized the trend toward producing finished materials close to final marketing areas. The ground feldspar should find ready markets in the State ceramics- and glass-producing industries.

Future use of New Jersey iron ore was assured when Alan Wood Steel Co. began constructing a direct hydrogen reduction unit for the production of high-quality iron powder adjacent to its Conshohocken, Pa., steel plant. Construction of the $3.5-million iron powder plant began in April 1958 and was scheduled for completion in early 1959. Magnetite from the company Scrub Oaks mine in Morris County was to be used as the primary raw material.

TABLE 1.—Mineral production in New Jersey [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Clays	[2] 593,402	$1,872	684,306	$2,181
Gem stones	[3]	[4]	[3]	4
Iron ore (usable)—long tons, gross weight	876,605	16,668	[3]	[5]
Sand and gravel	10,322,742	17,619	9,876,896	16,145
Stone	8,791,866	21,222	8,228,860	19,193
Peat	[5]	[5]	18,397	185
Zinc (recoverable content of ore, etc.)[6]	12,530	2,857	607	125
Value of items that cannot be disclosed: Ball clay (1957), lime, manganiferous residiuum, magnesium compounds, marl (greensand), and values indicated by footnote 5. Excludes limestone used in manufacturing lime	----------	[7] 4,404	----------	12,547
Total New Jersey	----------	[7] 64,642	----------	50,380

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes ball clay.
[3] Quantity not recorded.
[4] Less than $1,000.
[5] Figure withheld to avoid disclosing individual company confidential data.
[6] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.
[7] Revised figure.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

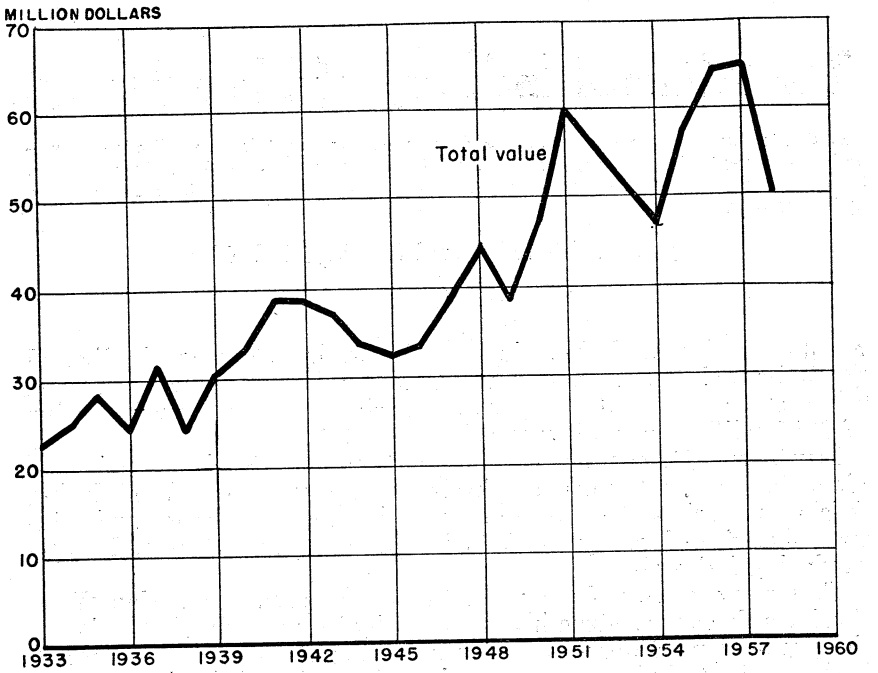

FIGURE 1.—Total value of mineral production in New Jersey, 1933–58.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Decreased output of fire clay was offset by increased production of miscellaneous clay, resulting in larger total clay production than in 1957. There was no ball-clay production. Eighty percent of the clay output was comprised of miscellaneous clay, used mainly for manufacturing building bricks and lightweight aggregate. Fire clay, mined in Middlesex and Cumberland Counties, was used chiefly for refractories, heavy clay products, and as a filler. Other uses were in manufacturing architectural terra cotta, pottery and stoneware, floor and wall tile, artificial abrasives, and as rotary-drilling mud. There were 21 open-pit clay operations in 9 counties. Middlesex, Somerset, and Cumberland, in decreasing order of value, were the leading clay-producing counties.

Gem Stones.—The value of gem stones and mineral specimens reported rose sharply, owing to increased coverage of the industry by the Bureau of Mines. Total output was produced or collected by amateur gem and mineral collectors in 13 counties. Calcite, franklinite, prehnite, spinel, willemite, zincite, and various other mineral specimens were collected during the year, chiefly from Sussex County.

Gypsum.—Crude gypsum from outside New Jersey was calcined and finished into gypsum building products by two companies at plants in Bergen, Burlington, and Essex Counties. Finished building materials produced included plaster (stucco), lath, sheathing, and wallboard.

Lime.—Although the Somerset County plant of Peapack Limestone Quarry, Inc., resumed operations, total output of hydrated lime produced in New Jersey declined. The decline was due primarily to decreased demand for building, agricultural, chemical, and industrial lime produced by the other State lime producer in Sussex County.

Magnesium Compounds.—The quantity and value of refractory magnesia produced declined compared with 1957. However, an increase in the average value of refractory magnesia was recorded during the year. Production in Cape May County was from dolomite and from raw sea water. Various refined magnesium compounds were prepared in Warren County from purchased magnesium-bearing chemicals.

Marl, Greensand.—Production and value of greensand marl increased. There were two producers compared with only one in 1957. Output was from Burlington and Gloucester Counties and was used for fertilizer, water softening, and other purposes.

Peat.—Compared with 1957, production and value of reed-sedge peat recovered in the State decreased, owing to lower demand for peat as a soil conditioner. Output was from Passaic and Sussex Counties.

Perlite.—Crude perlite from Southwestern United States was expanded at plants in Middlesex, Passaic, Somerset, and Union Counties. The processed perlite was used for building plaster, concrete aggregate, soil conditioning, and pipe-covering insulation.

Pigments.—Various iron oxide pigments were manufactured at plants in Essex, Mercer, and Middlesex Counties. Titanium oxide pigments were manufactured at plants in Middlesex and Camden Counties.

Roofing Granules.—Natural and artificially colored roofing granules were produced at plants in Bergen, Passaic, and Somerset Counties. Raw materials consumed at the plants consisted mainly of basalt quarried in the State.

Sand and Gravel.—For the second consecutive year, output of sand and gravel declined, reflecting decreased activity in the construction industry. Compared with 1957, sand and gravel values decreased in all but five of the State producing counties. Output of paving sand and gravel by Government-and-contractor operations increased as production was reported from three counties in 1958 compared with one in 1957. In terms of value Cumberland County continued as the center of the sand and gravel industry and was followed by Morris, Ocean, and Passaic Counties. These four counties supplied 65 percent of the State total value of sand and gravel.

Most of the sand output was used as building, paving, and molding material; gravel was used chiefly for building and paving purposes. Eighty-eight percent of the sand and gravel produced in the State was washed, crushed, screened, or otherwise prepared compared with 87 percent in 1957. Production and value of ground sand declined slightly. Ground sand was produced mainly for foundry and filler uses; other uses were in manufacturing abrasives, enamel, glass pottery, porcelain, and tile.

TABLE 2.—Sand and gravel sold or used by producers, by classes of operations and uses

Uses	1957		1958	
	Thousand short tons	Value (thousand)	Thousand short tons	Value (thousand)
COMMERCIAL OPERATIONS				
Sand:				
Glass	921	$2,493	531	$2,059
Molding	1,626	4,645	1,264	3,645
Structural	3,277	3,119	2,969	2,919
Paving	1,144	1,083	1,590	1,439
Blast	114	521	122	527
Fire or furnace	20	40	(1)	(1)
Filter	(1)	(1)	54	138
Fill	215	79	347	105
Other [2]	503	1,952	474	1,613
Gravel:				
Structural	1,510	2,674	1,409	2,497
Paving	866	887	840	984
Fill	76	46	160	95
Other	24	76	64	98
Total	10,296	17,615	9,824	16,119
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving	5	(3)	10	4
Gravel: Paving	22	4	43	22
Total	27	4	53	26
Grand total	10,323	17,619	9,877	16,145

[1] Included with "Other sand" to avoid disclosing individual company confidential data.
[2] Includes ground, engine, and other sand and those uses indicated by footnote 1.
[3] Less than $1,000.

Stone.—Stone production and value dropped, owing chiefly to decreased output of basalt, the principal stone. In addition to basalt, limestone, granite, miscellaneous stone, and marble, in order of decreasing value, were quarried and crushed. Quantities of basalt, granite, and limestone also were quarried for use in rough construction and as rubble. Oystershell, utilized mainly for poultry grit, was recovered and crushed in Gloucester and Cumberland Counties. In 1958 over 80 percent of the State total stone output was used as concrete aggregate and roadstone. Crushed and broken stone used as riprap, railroad ballast, flux, agstone, terrazzo, and for numerous other purposes also was produced. Production of stone by Government-and-contractor operations was limited to basalt output in Mercer County. Somerset and Passaic Counties furnished over 65 percent of the State total stone valuation and continued as the leading stone-producing areas in New Jersey.

Sulfur.—Beginning in 1958 byproduct sulfur recovered at petroleum refineries and other plants was excluded from the mineral production data for New Jersey, owing principally to difficulty in determining origins of processed crude petroleum and natural gas. Production and recovery of byproduct sulfur continued in 1958 by four companies at plants in Camden, Gloucester, Middlesex, and Union Counties.

Vermiculite.—Crude imported vermiculite was exfoliated at two plants in Essex and Mercer Counties. The material was used primarily in insulation and as concrete and plaster aggregate.

METALS

Base Metals.—New Jersey continued to be an important center for smelting and refining domestic and foreign base-metal ores, intermediate products, and scrap, as well as rare and precious metal byproducts. Federated Metals Division of American Smelting and Refining Co. operated plants at Perth Amboy, Newark, and Trenton. Primary and scrap metals were refined to produce aluminum and magnesium alloys, copper-base alloys, and lead products at Perth Amboy. White-metal alloys, zinc die cast, and zinc dust were produced at Trenton and Newark. United States Metals Refining Co., a unit of The American Metal Company, Ltd., at Carteret smelted and refined copper and precious-metal-bearing materials of domestic and foreign origins to produce electrolytic copper, oxygen-free copper, gold, silver, platinum-group metals, selenium, tellurium, copper and other metal powders, and solder. At Perth Amboy, International Smelting and Refining Co., a subsidiary of The Anaconda Co. produced copper cathodes and furnace shapes from all grades of secondary metals.

Ferroalloys.—Ferroalloys produced were ferrotitanium, ferroboron, ferrocolumbium, and ferrotantalum-columbium.

Iron and Steel.—Steel production by open hearth (Burlington County) and electric furnaces (Essex County) continued. According to American Iron and Steel Institute, annual capacities as of December 31, 1958, were 235,000 tons for open hearth and 7,800 tons for electric furnaces.

Iron and Steel Scrap.—Ferrous scrap dealers were active throughout the State, particularly in Patterson, Newark, and other Northeastern cities. Shipments from yards during the year consisted chiefly of Nos. 1 and 2 heavy melting steel, cast-iron scrap other than borings, and unprepared scrap.

Iron Ore.—Production of crude iron ore in New Jersey fell sharply, ranking iron ore third in the State total mineral value. Four mines were active in Morris and Warren Counties in early 1958; however Colorado Fuel and Iron Company terminated its mining operation in Morris County in March, leaving three mines in production at the end of the year. Usable ore, including both direct shipping ore and concentrate, was used entirely in manufacturing pig iron and steel. The average price realized was higher than in 1957, owing partly to a 2-percent higher average iron content. Beneficiation methods included wet and dry magnetic separation, gravity separation, and flotation.

Rare-Earth Metals.—Concentrates of rare-earth minerals were treated at plants in Bergen, Essex, and Passaic Counties to produce compounds, individual rare-earth metals, ferrocerium, and misch metal. Improvement in methods of recovering and separating rare-earth metals was reflected in lower prices.

Titanium.—Investigation of titanium-bearing sand deposits (chiefly ilmenite) in Ocean and Burlington Counties was continued by the State Department of Conservation and Development and by companies.

Zinc.—A new concentrating plant was under construction at the Sterling Hill mine (Sussex County). Regular production at the mine had been discontinued in August 1957. Crude-ore production in 1958 was from cleanup in the mine and was shipped directly to a smelter at Palmerton, Pa.

TABLE 3.—Mine production of recoverable zinc

Year	Short tons	Year	Short tons
1949–53 (average)	54,764	1956	4,667
1954	37,416	1957	12,530
1955	11,643	1958	607

REVIEW BY COUNTIES

There were significant changes in the pattern of mineral production in several counties. Burlington County mineral value increased substantially, owing to increased sand and gravel output and the addition of greensand marl to its list of recovered minerals. Sussex County had the greatest drop in value, mainly owing to the temporary shutdown of the Sterling Hill zinc mine. In addition, peat in Passaic County, lime in Somerset County, and gem stones and mineral specimens in other counties, that had not been mined in 1957, were produced in 1958. As a result of excluding byproduct sulfur from mineral production data, no mineral production was recorded for Hudson County in 1958.

TABLE 4.—Value of mineral production in New Jersey, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Atlantic	$93,135	$153,955	Sand and gravel.
Bergen	1,104,936	962,532	Sand and gravel, clays, gem stones.
Burlington	620,242	1,076,417	Sand and gravel, greensand marl, clays.
Camden	[2] 961,839	971,880	Sand and gravel, clays.
Cape May	[3]	[3]	Magnesium compounds, sand and gravel, gem stones.
Cumberland	8,310,386	6,753,085	Sand and gravel, clays, stone.
Essex	[3]	[3]	Stone, gem stones.
Gloucester	[2] 487,842	444,874	Sand and gravel, stone, greensand marl, gem stones.
Hunterdon	[3]	591,469	Stone.
Mercer	[3]	1,004,618	Stone, sand and gravel, gem stones.
Middlesex	2,487,495	2,688,922	Clays, sand and gravel, gem stones.
Monmouth	848,906	793,675	Sand and gravel.
Morris	17,168,356	9,978,977	Iron ore, sand and gravel, stone, clays gem stones.
Ocean	1,051,689	1,057,404	Sand and gravel, gem stones.
Passaic	6,598,347	6,037,166	Stone, sand and gravel, clays, peat, gem stones.
Salem	1,762	2,866	Sand and gravel.
Somerset	8,957,297	8,078,228	Stone, clays, lime, gem stones.
Sussex	6,603,091	3,451,592	Stone, manganiferous residuum, lime, peat, sand and gravel, zinc, gem stones.
Union	[3]	[3]	Stone, gem stones.
Warren	[3]	[3]	Iron ore, sand and gravel, stone, clays, gem stones.
Undistributed [4]	[2] 9,346,776	6,332,504	
Total	[2] 64,642,000	50,380,000	

[1] No production reported in Hudson County.
[2] Revised figure.
[3] Value included with "Undistributed."
[4] Includes counties indicated by footnote 3 and a quantity unspecified by county.

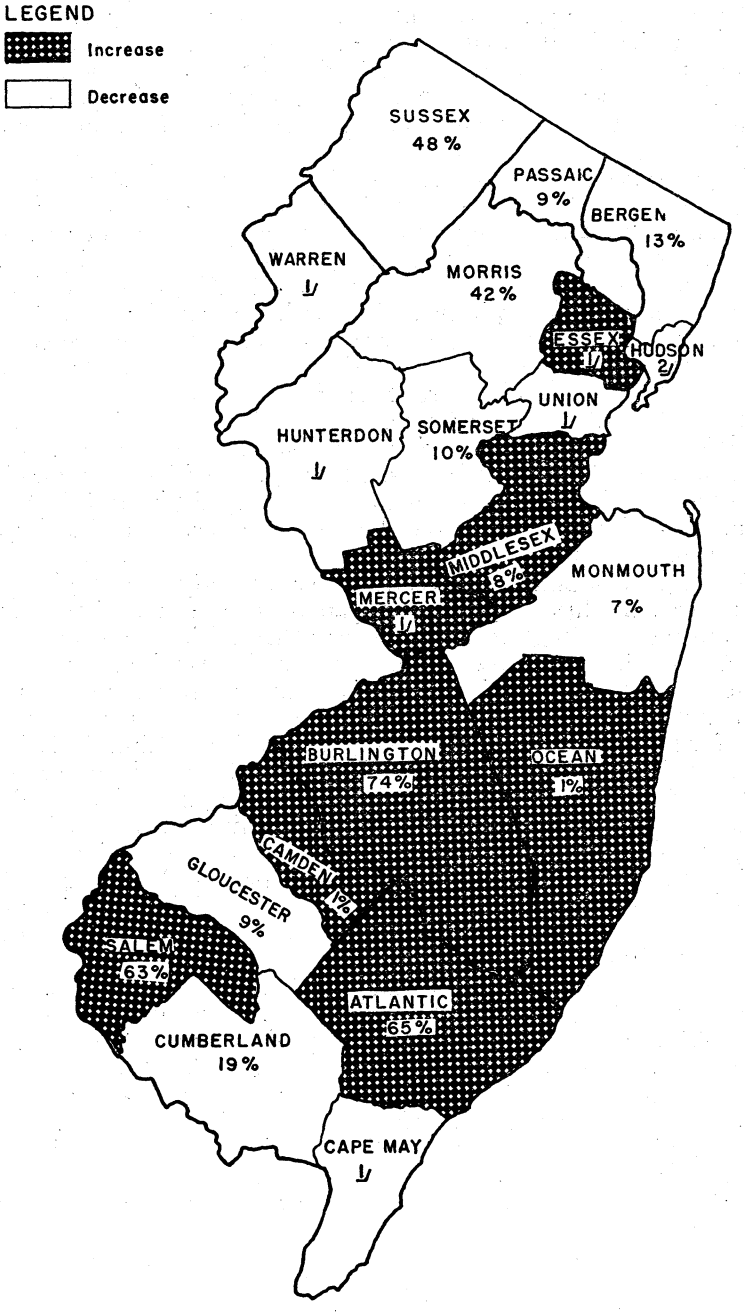

FIGURE 2.—Change in value of county mineral production in 1957–58.

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] No production reported.

Atlantic.—Over 82,000 tons of commercial sand and gravel was produced in the county mainly at Port Republic, Newtonville, Cedar Lake, and Folsom. Output was used chiefly as building and paving material and as molding sand. In addition, crews of the Atlantic County Road Department produced quantities of paving sand and gravel.

Bergen.—Bergen County ranked fifth in value of sand and gravel output compared with third in 1957. Production exceeded 660,000 tons and consisted mainly of building and paving sand and gravel. Output was reported from four operations at Mahwah, Paramus, Ramsey, and Wyckoff. Tri-County Brick Corp. produced miscellaneous clay from a pit near Carlstadt for use in manufacturing building brick. Gem and mineral specimens were collected in the county near Prospect Park and West Passaic during the year and included "Paterson minerals," natrolite, and zeolites. Gypsum lath, wallboard, and sheathing were produced at the Shadyside plant (Edgewater) of Barrett Division, Allied Chemical Corp., from gypsum calcined at its plant in Essex County. Artificially colored roofing granules were produced at East Rutherford by the Flintkote Co. General Cerium Corp. continued to produce misch metal at its Edgewater plant during the year.

Burlington.—Sand and gravel, recovered mostly by dredging operations, was produced by five companies—one each at Riverton, Mt. Holly, and Burlington and two near Riverside. Output consisted mainly of building and paving material. Limited quantities of molding and other sand also were produced. Greensand marl, used as a natural fertilizer and for other purposes, was recovered near Medford by National Soil Conservation, Inc. Church Brick Co. continued to manufacture building brick from miscellaneous clay produced near Fieldsboro. Crude gypsum was calcined and made into finished building materials at the Burlington plant of National Gypsum Co. John A. Roebling's Sons Corp., a subsidiary of Colorado Fuel and Iron Corp., at Roebling, produced steel in both acid and basic open hearths. Production was used in manufacturing a wide variety of steel products, including wire and wire rope at the company Trenton plant.

Camden.—Commercial sand and gravel production was centered near Berlin, Grenloch, Palmyra, and Winslow. Output consisted mainly of molding sand and structural and paving sand and gravel. Construction and maintenance crews of the Camden County Highway Department produced bank-run paving sand and gravel. Miscellaneous clay for use in manufacturing building brick was produced from a pit near Winslow Junction. Shipments of flotation sulfur paste were made from stocks of the Camden Coke plant of Public Service Electric and Gas Co. The New Jersey Zinc Company produced titanium oxide pigments at Gloucester City.

Cape May.—Northwest Magnesite Co. produced refractory magnesia from raw sea water and purchased dolomite. Three sand and gravel producers were active. Tuckahoe Sand and Gravel (formerly Menantico-Tuckahoe Sand and Gravel) installed a jig for removing soft particles in processing its sand and gravel, which was used exclusively for structural purposes. Other producers of sand and gravel were Courtland Sand and Gravel Co. (Cape May Court House) and John F. Gandy (Marmora).

Cumberland.—Sand and gravel produced in the county in 1958 totaled 2,097,000 tons valued at $6,657,000, a 27- and 19-percent decrease, respectively, compared with 1957. Although output and value dropped, the county continued as the leading sand and gravel area in the State; 15 operations were active during the year. Output consisted mainly of glass and molding sand. In addition blast, fire, filter, and engine sand, as well as building, paving, and other sand and gravel were produced. Armstrong Cork Co., a leading producer of glass sand, changed the process at its Vineland plant by installing flotation cells for concentration. Ground sand was produced by National Glass Sand Corp. and Pennsylvania Glass Sand Corp., both of Millville. Plastic fire clay was mined in a pit near Millville for use as an admixture in foundry sand. Ground oystershell, used mostly as poultry grit, was produced by William Edge at Dorchester.

Essex.—The West Orange plant of Orange Quarry Co. was rebuilt and put into operation in March 1958. The plant had been destroyed by fire in October 1957. This company, as well as M. L. Kernan Quarry (South Orange) quarried and crushed basalt, used chiefly as concrete aggregate and roadstone. Various mineral specimens were collected from unspecified places in the county during the year. Barrett Division, Allied Chemical Corp., calcined crude gypsum at its Newark plant and transferred the bulk of the output to its plant in Bergen County, where the material was processed into finished building products. Crude vermiculite from the Union of South Africa was exfoliated at the Newark plant of Vermiculite Industrial Corp. The processed vermiculite was used for insulation and as plaster and concrete aggregate.

Hydrated ferric oxide (iron oxide pigment) was manufactured by E. I. duPont de Nemours & Co., Inc., at Newark. New Process Metals, Inc. (Newark), produced misch metal for lighter flints and both misch metal and ferrocerium for metallurgical applications. Crucible Steel Co. of America continued to make steel in six electric furnaces at its Harrison plant.

Gloucester.—Prepared building sand and gravel was produced at Bridgeport and Mount Royal. A limited quantity of bank-run furnace sand was recovered near Downer. Inversand Co. produced greensand marl (used for water softening) at an open pit near Sewell. Joseph Bauder & Sons (Franklinville) recovered oystershell, which was ground and used mainly for poultry grit. A limited quantity of vivianite was recovered near Mullica Hill by an amateur gem collector. Elemental sulfur (brimstone) was recovered in the liquid purification of gas by the modified Baehr process at the Eagle Point (Westville) plant of Freeport Sulfur Co.

Hudson.—Koppers Co., Inc., produced hydrogen sulfide by the Koppers hot-vacuum activation process at its Seaboard plant near Kearney. Public Service Electric and Gas Co. did not recover any flotation sulfur as a byproduct at its Harrison Gas Works in 1958. F. E. Schundler & Co., Inc., ceased exfoliating vermiculite at its South Kearney plant in September 1957 and was not in operation in 1958.

Hunterdon.—Basalt (trap rock) was quarried by Lambertville Quarry Co. (Lambertville) and Houdaille Construction Materials, Inc. (Oldwick). Granite was quarried near Pattenburg by Trimmer Stone Co. Total stone production was crushed for use mainly as concrete aggregate and roadstone.

Mercer.—Substantial tonnages of diabase (basalt) used entirely for concrete aggregate and roadstone, was quarried and crushed near Pennington by Pennington Quarry Co. Mercer County Work House also quarried basalt, used for concrete aggregate and roadstone. A limited quantity of paving sand was produced from unspecified locations in the county. Golding-Keene Co. processed at its Trenton plant electrostatically beneficiated feldspar shipped from its affiliated company, Spar-Mica Corp., Quebec, Canada. The Zonolite Co. (Trenton) exfoliated crude vermiculite from out of State. Black, brown, red, and yellow iron oxide pigments were manufactured at the Trenton plant of Columbian Carbon Co.

Middlesex.—Middlesex County was again the leading clay-producing county in New Jersey, supplying over 60 percent of the total tonnage and more than 80 percent of the value. Clay production reported by 12 companies in the county found a wide variety of applications. The bulk of the output was consumed in manufacturing heavy clay products, lightweight aggregate, and refractory products. Most of the output came from open pits along the Atlantic Seaboard. Lightweight aggregate was produced by Aglite Division of Sayre and Fisher Co. (Sayreville) on two sintering machines, each with 85- by 5-foot grates. Capacity of each machine was 750 tons per day. Lightweight aggregate produced at Sayreville was sold principally in the Metropolitan New York area for use in lightweight structural concrete and cement blocks. Such Clay Co. (South Amboy) did not produce ball clay in 1958 as in previous years.

Sand and gravel production totaling 749,000 short tons was reported from seven operations throughout the county. Output consisted mainly of building and paving sand and gravel. South River Sand Co., producer of blast and ground sand, erected a wet-screen tower at its old Bridge plant to facilitate processing. Specimens of lignite, marcasite, petrified wood, and pyrites were recovered near Sayreville by three amateur gem collectors. Sulfur was recovered by gas purification at the Perth Amboy plant of the Anlin Co.

Expanded perlite used for building plaster and concrete aggregate was produced at the Metuchen plant of Coralux Perlite Corp. of New Jersey from crude material mined in Nevada and New Mexico. Red iron oxide pigments (calcined copperas) were manufactured by Columbian Carbon Co. (Monmouth Junction) and Stabilized Pigments, Inc. (New Brunswick). Federated Metals Division plant of American Smelting and Refining Company, at Perth Amboy, refined lead and antimony of domestic and foreign origin. These metals were used in alloys and lead products. The company completed installation of a continuous copper-cake casting unit permitting continuous casting of copper cakes up to 25 feet long by 3 feet wide. National Lead Co. produced titanium oxide pigment at its Sayreville plant.

Monmouth.—Production of sand and gravel was reported from eight operations, mainly along the Atlantic seaboard. Output was used chiefly for building and paving purposes. Bennett Sand and Gravel Co., Inc., producers of filter sand, paving gravel, and building sand and gravel, enlarged the screening facilities at the Manasquan plant.

Morris.—Despite a large drop in iron-ore production, Morris County again led the State in value of minerals produced, furnishing more than 19 percent of the total. Iron ore was produced by Alan Wood Steel Company at the Scrub Oak mine, Shahmoon Industries, Inc., at the Mount Hope mine, and Colorado Fuel and Iron Corp. at the Richard Ore mine. Production at the Scrub Oak mine was 80 percent by shrinkage stopes and 20 percent by benching in open stopes. Exploration and development to find and prepare ore for future mining were accomplished by driving 5,496 feet of raise, 1,164 feet of drift, 1,199 feet of crosscut, and by diamond-drilling 3,685 feet. Substantial quantities of crushed granite used for concrete aggregate and paving sand were recovered as byproducts of iron-ore mining. At the Mount Hope mine, the ore was mined by sublevel development and by shrinkage stoping. Exploration and development by the company were continued during the year to maintain reserves and prepare blocks of ore for stoping. This included main drifts, sublevel drifts, raises, and diamond drilling. Colorado Fuel and Iron Corp. discontinued operations at the Richard Ore mine in March 1958.

The county continued to rank second in valuation of sand and gravel output among the 16 producing counties in the State. Commercial output consisting chiefly of building and paving material and totaling 1,496,000 short tons was reported from seven operations. In addition, a limited quantity of bank-run paving gravel was produced under contract for Morristown National Historical Park. Morris County Land Improvement Corp. (Whippany), producers of building sand and gravel, changed the company name to Whippany Sand and Gravel. Crushed granite, used mainly for concrete aggregate and roadstone, was quarried at Riverdale and Wharton. Logansville Pottery, Inc., produced miscellaneous clay from a pit near Bernardsville for use in manufacturing flowerpots.

Ocean.—Ocean county ranked third in valuation of sand and gravel with an output totaling 742,000 short tons, mostly paving and building material. Output was reported from six operations throughout the county. New Jersey Pulverizing Co. produced molding, blast, and engine sand, as well as ground sand used for abrasives, filler, and foundry purposes.

Passaic.—The county ranked second and fourth in valuation of stone and sand and gravel, respectively. Basalt was recovered from quarries near Clifton, Haledon, Hawthorne, Little Falls, Montclair, and Prospect Park. The bulk of the output was used for concrete aggregate and roadstone, and smaller quantities for riprap, filler, and roofing granules. Miscellaneous stone (gneiss) was quarried near Bloomingdale by Passaic Crushed Stone Co. Roofing granules were produced by H. B. Reed Corp. (Passaic) and Great Notch Granule Co. (Little Falls). Sand and gravel production used chiefly for structural purposes was centered near Wayne and Riverdale.

Building brick was made from clay produced in Wayne Township by Paterson Brick Co. Reed-sedge peat was recovered from a bog near Wanaque by Tapawingo Humus Corp.

Gem and mineral specimens were collected during the year near Patterson—amethyst, calcite, chabazite, datolite, pectolite, prehnite, and various others. PerAlex of New Jersey, Inc. (Paterson) expanded crude perlite shipped from Nevada. The processed material was used for concrete aggregate, building plaster, and soil conditioning. Davison Chemical Co., a subsidiary of W. R. Grace and Co., continued to produce individual rare earth oxides at Pompton Plains.

Salem.—A. W. Davis Lumber Co. produced a limited quantity of structural sand by dredging near Salem.

Somerset.—Somerset County continued as the leading stone-producing area in the State, supplying over 40 percent of the State total stone value. One limestone and six basalt quarries were active. The bulk of the basalt output was used as riprap and as concrete aggregate and roadstone. Houdaille Construction Materials, Inc., operated quarries at Bound Brook and Millington. Other basalt quarries were active near Bernardsville, Kingston, Martinsville, and Scotch Plains. The limestone quarry and lime plant of Peapack Limestone Quarry, Inc. (Peapack), resumed operation after being idle for more than 2 years. Remodeling and installing new equipment at the plant was completed during 1957. Limestone output from the quarry was used for concrete aggregate, agricultural purposes, and manufacturing lime. At the lime plant, limestone was calcined in shaft kilns and hydrated in batches with anthracite screenings used for fuel. The hydrated lime was used entirely as agricultural lime and shipped to various destinations within the State. Central Commercial Co. (Bound Brook) produced natural and artificially colored roofing granules. Building brick and other heavy clay products were made from clay mined in pits near Somerville and Middlebush. Expanded perlite used in manufacturing pipe-covering insulation was produced at Manville by Johns-Manville Corp.

Sussex.—Agstone, concrete aggregate, roofing spar, plaster whiting, and asphalt and fertilizer filler were produced from crushed limestone quarried by Farber White Limestone Co., at Franklin. The company also produced a limited quantity of dimension stone used for rough construction. Limestone Products Corp. of America (Newton) quarried and crushed limestone for use as agstone, concrete aggregate, flux, asphalt, rubber, and other fillers; mineral food, poultry grit, and filter beds and for manufacturing lime. Hydrated lime was produced in rotary kilns and continuous hydrators at the company Lime Crest plant. Bituminous coal was used for fuel at the operation. The lime was sold for masonry use and for agricultural and water purification and softening purposes. Most of the output was consumed in New Jersey; the remainder was shipped to New York, Pennsylvania, and the New England States. The company also produced sand and gravel at its Newton Plant, which was in the process of being modernized during the year. Sand and gravel also was produced by other companies near Sparta and Andover.

Although the Sterling Hill mine near Ogdensburg was inactive, quantities of zinc and byproduct manganiferous residuum were re-

covered from ores previously mined and were treated at the Palmerton, Pa., smelter. Exploration and development, including drifting and raising, were done to prepare blocks of ore for mining upon completion of a new concentrating plant. Hyper-Humus Co. and Netcong Natural Products Co. recovered reed-sedge peat from bogs near Andover and Stanhope, respectively. Mineral specimens consisting chiefly of calcite, franklinite, willemite, and zincite were recovered near Franklin. Various other specimens were recovered near Andover, Lime Crest, and Sparta.

Union.—Crushed basalt used as concrete aggregate was quarried near Summit by Houdaille Construction Materials, Inc. Calcite, chalcedony, prehnite, sphalerite, stilbite, and other minerals were collected near Summit. Crude perlite shipped from Colorado was expanded at Hillside by Certified Industrial Products, Inc. General Chemical Division, Allied Chemical Corp., recovered and consumed sulfur at its Bayway Chemical plant. Hydrogen sulfide was produced by diethanolamine treatment at the Bayway refinery of Esso Standard Oil Co.

Warren.—Alan Wood Steel Co. produced iron ore at the Washington mine, 90 percent by sublevel, long-hole stoping, and 10 percent by shrinkage stoping. Crude ore was beneficiated by wet magnetic and gravity methods. Structural and paving sand and gravel was produced near Carpentersville and Phillipsburg. Crushed marble used exclusively for terrazzo was quarried near Phillipsburg by Royal Green Marble Co. The marble was used in the construction of the Albert Einstein Medical Center, Philadelphia, Pa., Norfolk General Hospital, Norfolk, Va., and other buildings in Maryland and New York. Miscellaneous clay mined from a pit near Port Murray was used to manufacture building brick. Specimens of molybdenite were collected near Phillipsburg by three amateur gem collectors. J. T. Baker Chemical Co. (Phillipsburg) produced a variety of refined magnesium compounds from carbonates, chlorides, oxides, and sulfates of magnesium.

The Mineral Industry of New Mexico

By Frank J. Kelly,[1] William H. Kerns,[1] and D. H. Mullen[1]

EFFECTS of the recession in business activity in 1958 were somewhat severe on the mineral industry of New Mexico. The value of nonmetal output declined $5.2 million and that of metals $7.3 million. The value of 21 commodities dropped below 1957 levels compared with increases for only 12 minerals and fuels. The $20-million increase in the mineral-fuels group prevented the total value of all minerals from falling considerably below the $559 million reported in 1958, which was only slightly over 1 percent greater than the $551.2 million recorded in 1957.

The gain in the mineral-fuels group resulted from $10.3-million and $9.3-million increases in the value of crude oil and natural gas, respectively, as well as smaller advances for LP-gases and carbon dioxide. These gains were partly offset by decreases in the output of coal, natural gasoline, and helium.

The production of copper, lead, and zinc suffered substantially as a result of continued reduced prices. Uranium output recorded an $11.7-million increase and was responsible for preventing a more precipitous drop in total metal value.

The value of potash, the nonmetal with the largest decrease in value of output, declined $8.1 million. The value of construction materials (chiefly sand and gravel, pumice, and perlite) increased and lessened the impact of losses in output and sales of other nonmetallic minerals.

No new mills or processing plants were started in 1958. The Homestake-Sapin Partners and Homestake-New Mexico Partners uranium mills in Valencia County, begun in 1957, were completed and placed in operation in 1958. Construction was also completed on the Phillips Petroleum Co. and Kermac Nuclear Fuels Corp. mills in McKinley County. With the operation of these processing facilities, uranium milling capacity for the State increased from 3,800 to 11,075 tons a day.

Legislation and Government Programs.—Three Defense Minerals Exploration Administration (DMEA) contracts were executed in New Mexico. The contracts, totaling $227,430 were for exploration for uranium in McKinley County by E. J. Longyear Co. (one contract for $176,770) and Food Machinery & Chemical Corp. (two contracts for $50,660). DMEA expired on June 30, 1958, and was superseded by the Office of Minerals Exploration (OME), Department of the Interior.

[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

TABLE 1.—Mineral production in New Mexico [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite	4,441	$98	(2)	(2)
Beryllium concentrate, gross weight	29	15	27	$16
Clays, thousand short tons	33	83	[3] 40	[3] 73
Coal, do	137	829	117	719
Columbium-tantalum concentrate, pounds	866	1		
Copper (recoverable content of ores, etc.)	67,472	40,618	55,540	29,214
Gem stones	(5)	30	(5)	28
Gold (recoverable content of ores, etc.), troy ounces	3,212	112	3,378	118
Helium, thousand cubic feet	69,336	1,189	[4] 29,793	[4] 502
Iron ore (usable), long tons, gross weight	150	1	(2)	(2)
Lead (recoverable content of ores, etc.)	5,294	1,514	1,117	261
Lime, thousand short tons	24	290	21	260
Manganese ore and concentrate (35 percent or more Mn), gross weight	25,459	2,114	24,665	1,996
Manganiferous ore (5 to 35 percent Mn), do	42,535	152	(2)	(2)
Mica:				
Scrap	1,347	47	787	24
Sheet, pounds	2,134	16	1,791	18
Natural gas, million cubic feet	723,004	67,962	761,446	79,190
Natural-gas liquids:				
Natural gasoline and cycle products, thousand gallons	309,010	19,941	258,312	15,131
LP-gases, do	375,930	13,046	458,178	17,331
Perlite	187,259	1,568	202,046	1,790
Petroleum (crude), thousand 42-gallon barrels	94,759	283,128	[4] 98,323	[4] 293,400
Potassium salts (K_2O equivalent), thousand short tons	2,080	77,197	1,978	69,106
Pumice, do	321	756	507	959
Salt (common), do	53	429	31	275
Sand and gravel, do	7,991	7,803	13,205	11,413
Silver (recoverable content of ores, etc.), thousand troy ounces	309	280	159	144
Stone, thousand short tons	1,348	1,618	1,730	1,507
Uranium ore	1,175,742	20,538	1,888,499	32,264
Zinc (recoverable content of ores, etc.)	32,680	7,582	9,034	1,843
Value of items that cannot be disclosed: Carbon dioxide, fire clay (1958), magnesium compounds, molybdenum, vanadium, and values indicated by footnote 2		[6] 2,276		1,345
Total New Mexico [7]		[6] 551,155		558,866

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed.".
[3] Excludes fire clay; value included with "Items that cannot be disclosed."
[4] Preliminary figure.
[5] Weight not recorded.
[6] Revised figure.
[7] Total has been adjusted to eliminate duplication in value of raw material used in manufacturing lime.

Employment and Injuries.—Average employment in the mining industry of New Mexico declined 13 percent, and the ratio of mining employment to total nonagricultural employment dropped 1.3 percent. Employment in metal mining and petroleum and natural-gas production declined because of the downturn in the demand for the products of these industries. A slight increase in nonmetal- and coal-mining employment was not sufficient to offset these declines.

The State Inspector of Mines reported [2] 4 fatalities and 685 lost-time accidents from July 1, 1957, to June 30, 1958. All fatalities occurred in underground mines, three by fall of rock and one in haulage operations.

[2] Garcia, John A., Forty-Sixth Annual Report by the State Inspector of Mines for the Year Ending June 30, 1958: 1958, 66 pp.

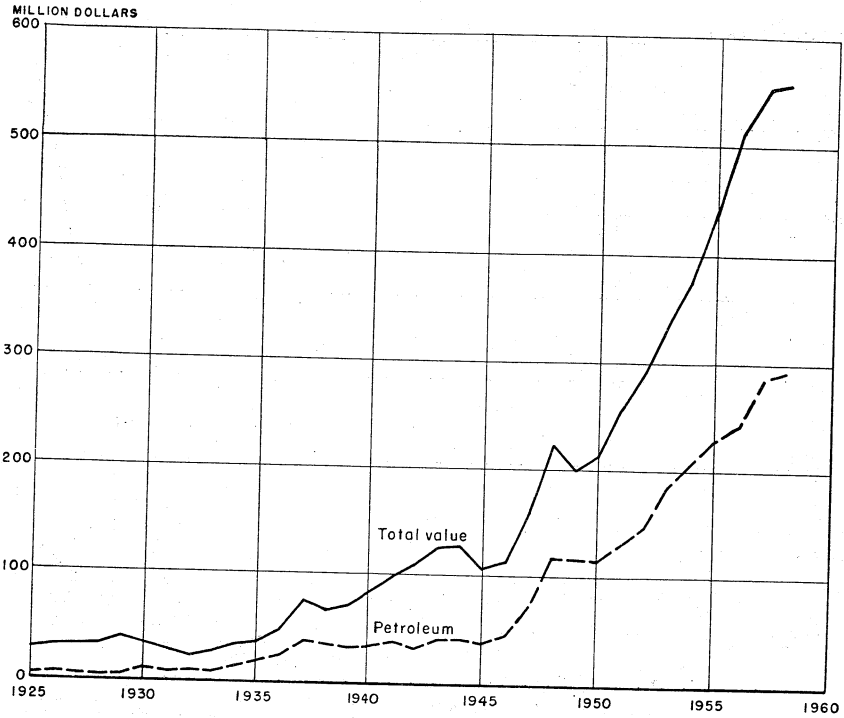

FIGURE 1.—Value of petroleum production and total value of all minerals produced in New Mexico, 1925–58.

TABLE 2.—Mining employment by types of mining

[Bureau of Labor Statistics, U.S. Department of Labor, and Employment Security Commission of New Mexico]

Industry	1957		1958	
	Percent of total	Average number of men	Percent of total	Average number of men
Total nonagricultural	100	208,700	100	217,100
Mining total	8.4	17,600	7.1	15,330
Metal mining	2.3	4,700	1.6	3,575
Petroleum and natural gas	5.0	10,500	4.3	9,260
Nonmetal and coal mining	1.1	2,400	1.2	2,500

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The mineral-fuels group, comprising carbon dioxide, coal, helium, natural gas, natural-gas liquids, and petroleum, accounted for 73 percent of the total value of mineral production in the State—5 percent more than in 1957. Gains were recorded in all of the mineral fuels except coal, helium, and marketed natural gasoline.

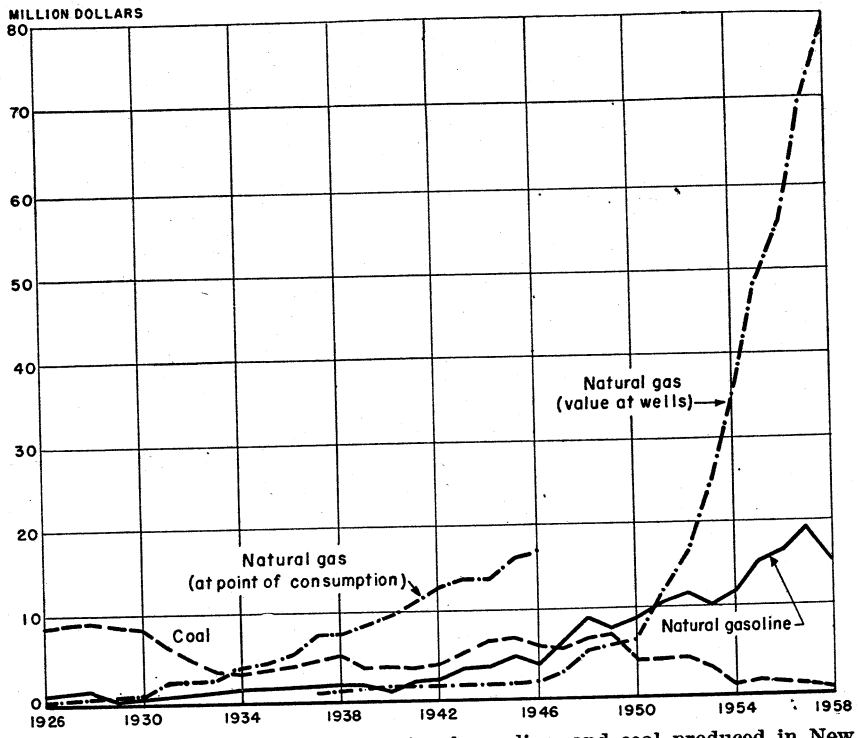

FIGURE 2.—Value of natural gas, natural gasoline, and coal produced in New Mexico, 1926–58.

Carbon Dioxide.—Production of carbon dioxide from wells in Harding and Union Counties rose 13 percent above 1957. The gas was marketed as dry ice and liquid carbon dioxide. A substantial quantity of liquid carbon dioxide was used in combating a coal-mine fire in Colfax County.

Coal.—Coal output from 24 mines producing 1,000 tons or more in six counties, chiefly Colfax and McKinley, declined 15 percent from 1957. The decline was due largely to a fire in the Koehler mine, Colfax County, where production dropped 21 percent. Production in McKinley County decreased 10 percent.

Helium.—Helium production, from the Hogback and Rattlesnake fields in San Juan County, declined 57 percent compared with 1957. Encroachment of water made continued operation of the fields unprofitable. The Government-owned helium-extraction plant at Shiprock was shut down in August pending development of additional gas.

Natural Gas.—Sales of natural gas increased 5 percent in quantity and 17 percent in value over 1957. The greatest production came from the northwestern counties, principally San Juan and Rio Arriba Counties.

Natural-Gas Liquids.—Natural gasoline recovered from natural gas declined 16 percent in quantity and 24 percent in value, whereas butane

TABLE 3.—Production of coal by counties

(Exclusive of mines producing less than 1,000 tons annually)

County	1957		1958	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Colfax	48,396	$6.01	38,286	$6.32
McKinley	62,400	6.16	55,932	6.47
Rio Arriba	16,786	5.37	12,312	5.64
Sandoval	2,198	2.82	1,306	2.96
San Juan			6,820	4.34
Santa Fe	5,371	7.84		
Socorro	2,000	7.81	2,000	6.00
Total	137,151	6.05	116,656	6.16

[1] Value received or charged 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 as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

and propane (LP-gases) increased 22 percent in quantity and 33 percent in value over 1957. Production was from 20 plants, 17 in the southeastern counties and 3 in the San Juan basin.

Petroleum.—Petroleum output was 98 million barrels, an increase of 4 percent over 1957. The value of petroleum output represented 52 percent of the total value of mineral production in the State. Although the Permian basin in the southeastern part of the State continued to be the major producing area, output in the San Juan basin in the northwestern area increased substantially.

The Texas-New Mexico Pipe Line Co. completed its 16-inch crude-oil pipeline from the Aneth area in Utah across the San Juan basin to connect with existing facilities at Jal for transshipment to gulf coast refineries. Operation of the 50,000-barrel-per-day pipeline began in July. It was built primarily to transport crude oil from the Aneth area and provided an additional outlet for oil from San Juan County.

TABLE 4.—Production of crude petroleum by counties [1]

(Thousand barrels)

County	1957	1958 [2]	Principal fields in 1958 in order of production
Chaves	4,405	3,215	Caprock.
Eddy	5,900	6,574	Square Lake-Grayburg, North Mason, Red Lake-Grayburg.
Lea	82,122	79,923	Monument-Grayburg, Eunice-Grayburg, Denton, Drinkard.
McKinley	132	114	Hospah.
Rio Arriba	327	572	South Blanco.
Roosevelt	179	372	Milnsand.
Sandoval	18	15	Otero.
San Juan	1,676	7,538	Bisti, Verde, Horseshoe Canyon, Gallegos.
Total	94,759	98,323	

[1] Distribution by county effected by use of New Mexico Oil Conservation Commission data adjusted to Bureau of Mines total.
[2] Preliminary figures.

Exploratory drilling was approximately the same as in 1957—267 and 266 completions, respectively. The number of oil discoveries declined from 56 in 1957 to 30 in 1958. Nine gas discoveries, five in the

TABLE 5.—Wildcat- and development-well completions in 1958, by districts and counties

[Oil and Gas Journal]

District and county	Total	Crude	Condensate	Gas	Dry	Service	Footage
WEST NEW MEXICO							
Wildcat:							
Catron	1				1		5,600
Hidalgo	1				1		2,700
McKinley	12	1			11		35,600
Rio Arriba	12	2	1		9		56,700
Sandoval	16	1			15		72,000
San Juan	59	5	2	4	48		242,300
Valencia	2				2		7,700
Total	103	9	3	4	87		422,600
Development:							
McKinley	2				2		700
Rio Arriba	335	27	2	287	19		1,584,100
Sandoval	1			1			3,200
San Juan	496	286	6	176	28		1,986,500
Total	834	313	8	464	49		3,574,500
EAST NEW MEXICO							
Wildcat:							
Chaves	20	2			18		110,800
Colfax	1				1		1,600
De Baca	4				4		10,900
Eddy	54	7	1	4	42		189,700
Guadalupe	5				5		21,700
Harding	1				1		2,900
Lea	64	11	1	1	51		521,900
Mora	1				1		7,800
Otero	1				1		5,000
Quay	1				1		2,700
Roosevelt	5	1			4		39,700
San Miguel	4				4		19,800
Union	2				2		7,400
Total	163	21	2	5	135		941,900
Development:							
Chaves	41	30			11		110,200
Eddy	256	195	3	4	48	6	796,700
Lea	503	437	5	14	47		2,936,100
Roosevelt	10	7			3		87,400
Total	810	669	8	18	109	6	3,930,400
Total, all drilling	1,910	1,012	21	491	380	6	8,869,400

southeast and four in the northwest, also were made. Development drilling in the Permian basin declined from 1,044 wells in 1957 to 810 in 1958, whereas development drilling in San Juan basin increased from 818 wells in 1957 to 834 in 1958. The number of successful development completions likewise increased in the San Juan basin from 194 to 313 and declined in the Permian basin from 863 to 669.

NONMETALS

Barite.—Output of ground barite dropped considerably, because the San Antonio mill of Mex-Tex Mining Co., Inc., was closed in June. The company recovered barite from a lead-barite deposit near Bingham.

Construction of a barite mill was begun near Bernalillo by Barite Corp. of America, but work ceased before the building was completed.

Cement.—A cement industry in New Mexico came closer to reality in 1958 as a result of construction activities by Ideal Cement Co. at Tijeras, where the company's new $12-million, single-kiln, dry-process

cement plant began to take shape. One-half of the facility, constructed during the year, included nine cement silos, finish and raw mills, and coolers. All major items of equipment were on hand, and completion is expected by mid-1959.

Clays.—Output of clays (exclusive of fire clay) increased 21 percent over 1957. The gain resulted from the use of more miscellaneous clay by brick companies in captive operations. The principal producers continued to be Kinney Brick Co., Inc., and El Paso Brick Co. A small building-brick operation was begun at Kirtland by San Juan Brick & Tile Co., Inc.; 10 tons of miscellaneous clay was mined from the Kirtland pit.

Gem Stones.—Gem and ornamental stones collected in 1958 and valued at $28,000, consisted largely of agate, travertine, and onyx, plus assorted mineral specimens. The Deming area of Luna County was the major source of the material.

Lime.—The Chino Mines Division of Kennecott Copper Corp. continued to be the only producer of lime. The lime was used at the company's copper recovery plant. Output dropped 13 percent below 1957 owing to a reduction in the quantity of copper ores processed.

Magnesium Compounds.—Magnesium compounds were recovered as a byproduct of potash refining by International Mineral & Chemical Corp.

Mica.—Shipments of sheet mica declined again in 1958, dropping 16 percent from 1957. For the first time since 1954 no mica was sent to the Government purchase depot at Custer, S. Dak. Shipments of hand-cobbed mica to the Spruce Pine (N.C.) Government purchase depot totaled 97,780 pounds, from which 1,615 pounds of sheet mica was recovered. In addition, 176 pounds of full-trimmed mica was sold to the North Carolina depot. The New Mexico Mining Co. leased the Globe mine from Continental Mine Products Co. and accounted for the bulk of the hand-cobbed output. The same organization worked the Apache mine on a lease arrangement and produced 16,000 pounds of cobbed mica.

TABLE 6.—Mica sold or used by producers

	1954	1955	1956	1957	1958
Hand-cobbed mica,[1] total pounds	45,457	219,894	174,367	52,150	97,780
Sheet mica: [1]					
Full trimmed:					
Pounds	8	399	11	----------	176
Value	$208	$5,559	$256	----------	$2,654
Average per pound	$26.00	$13.93	$23.27	----------	$15.08
From hand-cobbed mica:					
Pounds	2,046	9,032	6,236	2,134	1,615
Value	$13,637	$59,371	$52,310	$15,645	$15,743
Average per pound	$6.67	$6.57	$8.39	$7.33	$9.75
Total:					
Pounds	2,054	9,431	6,247	2,134	1,791
Value	$13,845	$64,930	$52,566	$15,645	$18,397
Average per pound	$6.74	$6.88	$8.41	$7.33	$10.27
Scrap mica, total:					
Short tons	----------	84	767	1,347	787
Value	----------	$2,475	$22,213	$46,865	$24,466
Average per ton	----------	$29.46	$28.96	$34.79	$31.09
Total sheet and scrap mica:					
Short tons	1	89	770	1,348	788
Value	$13,845	$67,405	$74,779	$62,510	$42,863

[1] Sold to the Government through GSA.

When Minerals Engineering Co. ceased operation of the Petaca mica-grinding mill, the plant was closed by the owners, Petaca Mining Corp. Before discontinuing operations, Minerals Engineering Co. mined 619 tons of scrap mica and purchased 168 tons. Of the 787 tons of ground mica produced, 502 tons was used in manufacturing paint and 285 tons for roofing. The purchased scrap mica came from the Francis mine of Mineral Resources Co., Inc., and the Globe mine of Continental Mine Products Co.

Perlite.—New Mexico continued to lead the Nation as a source of perlite, and shipments advanced to 202,000 tons valued at $1.8 million—8 percent above 1957. Great Lakes Carbon Corp. shipped the first crushed perlite from its El Grande mill in July. Gains in shipments of crushed perlite by Great Lakes Carbon Corp. and F. E. Schundler & Co., Inc., made the Seven Hills of Taos region the principal producing area. Great Lakes Carbon Corp. continued to mine and expand perlite at Socorro, and United States Gypsum Co. produced crude perlite and milled the rock at its crushing plant at Grants.

TABLE 7.—Production of crude perlite

Year	Short tons	Value (thousands)	Year	Short tons	Value (thousands)
1954	111,040	$886	1957	187,259	$1,568
1955	147,805	1,091	1958	202,046	1,790
1956	167,705	1,271			

Potash.—In 1958, 12.2 million tons of potash-bearing material was mined by six companies, and 3.4 million tons of potash salts was produced (with a K_2O equivalent of 2 million tons) valued at $69.1 million. The output of potash was 5 percent less than in 1957. There were shutdowns of 2 to 7 weeks, either by companies or due to strikes, and shortened workweeks were in effect. Nevertheless potash sales increased 9 percent over 1957. Producer's stocks were reduced 36 percent to allow fulfillment of all orders.

A series of developments changed operational procedures or improved methods of mining or refining. United States Potash Co. Division, United States Borax & Chemical Corp., planned to begin mining from its northeast ore-body extension near Carlsbad. During a shutdown from June 8 to July 14 the company completed repairs to the mine and refinery in preparation for handling material from the northeast ore body. The company also installed a German Humboldt centrifuge in its granular plant. The experimental installation will be tested to determine whether it can replace four solid, bowl-type centrifuges that have been in use for many years.

International Minerals & Chemical Corp. hoisted the 30 millionth ton of sylvite ore from its mine. When the mine began producing in 1940 its capacity was 1,800 tons per day; in 1958, owing to expansion and modernization, as much as 14,500 tons was hoisted during a 24-hour period.

Farm Chemical Resources Development Corp. completed the sinking of its 1,623-foot, concrete-lined circular shaft in 1957 northeast of

TABLE 8.—Production and sales of potassium salts, in thousand short tons

Year	Crude salts [1]; mine production		Marketable potassium salts					
			Production			Sales		
	Gross weight	K_2O equivalent	Gross weight	K_2O equivalent	Value [2] (thousands)	Gross weight	K_2O equivalent	Value (thousands)
1954	9,975	1,986	3,008	1,763	$65,538	2,954	1,732	$64,367
1955	10,956	2,159	3,221	1,899	71,839	3,122	1,841	69,641
1956	11,941	2,305	3,384	1,997	75,122	3,279	1,931	72,802
1957	12,893	2,430	3,528	2,080	77,197	3,353	1,977	73,243
1958	12,224	2,309	3,355	1,978	69,106	3,650	2,157	75,343

[1] Sylvite and langbeinite.
[2] Derived from reported value of "Sold or used."

Carlsbad; work continued on investigating process techniques and designing surface facilities.

Plans were announced for acquisition by Central Farmers Fertilizer Co. of a stock interest in National Potash Co. and production of potash by National for distribution by Central Farmers.

Pumice.—Output of pumice and scoria increased to 507,000 tons, a 58-percent gain over 1957. Greater production of scoria for use as railroad ballast from the Twin Mountain ballast pit of Colorado & Southern Railway Co. was the principal factor in the overall increase in output. Higher output also was reported by Volcanic Cinder Co., Dona Ana County; General Pumice Corp., Rio Arriba County; Lava Pumice, Inc., Sandoval County; and Crego Block Co., Inc., and Copar Pumice Co., Inc., both in Santa Fe County. James H. Rhodes & Co. reported a decrease in production of ground pumice in Santa Fe County, and no activity was reported by Associated Materials Co., Dona Ana County. The Maynez Block Co. of Las Cruces reported initial production of scoria for use in making building block.

Salt.—The loss of the Texas oil-well-drilling market and poor economic conditions in southwestern New Mexico reduced salt sales to 31,000 tons, a drop of 42 percent from 1957. Except for solar-evaporated salt produced in Catron County by Curtis Salt Co., all production came from the processing of potash tailing. Virtually all the salt was for cattle feed.

Sand and Gravel.—Output of sand and gravel established a record of 13.2 million tons, 65 percent above 1957. The stimulus for this increased production continued to be the Federal interstate highway program, as well as the State highway-construction program. A report [3] showed that New Mexico ranked 23d in the Nation in mileage of highway construction underway in 1958, with 57.5 miles. Of the planned 41,000-mile superhighway network, New Mexico ranked second in mileage completed with 199 miles of the 3,159 miles completed in all States.

Socorro County was the leading producing area, supplying 35 percent of the total output of sand and gravel. Individual county data and information on class of operation and end use are shown in tables 9 and 10.

[3] Bureau of Public Roads, Status of Federal-Aid Highway Programs, press release BPR 59–2, Dec. 31, 1958.

TABLE 9.—Production of sand and gravel in 1958, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Bernalillo	1,476	$1,381	Rio Arriba	243	$352
Chaves	388	541	Roosevelt	250	250
Colfax	41	61	Sandoval	346	358
De Baca	17	16	San Juan	549	807
Dona Ana	969	612	San Miguel	82	72
Eddy	144	146	Santa Fe	324	453
Grant	192	174	Sierra	59	42
Guadalupe	381	250	Socorro	4,662	2,420
Hidalgo	364	268	Taos	19	21
Lea	96	249	Torrance	466	488
Lincoln	14	14	Union	4	5
Luna	35	71	Valencia	971	1,088
McKinley	437	577	Total	13,205	11,413
Otero	247	424			
Quay	429	273			

TABLE 10.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Building	714	$846	1,019	$1,204
Paving	342	255	117	143
Engine	(1)	(1)		
Other	(1)	(1)	3	2
Gravel:				
Building	949	1,168	1,094	1,312
Paving	2,279	2,085	4,629	3,772
Railroad ballast	12	9	4	2
Other	249	200	161	132
Undistributed	3	3		
Total sand and gravel	4,548	4,566	7,027	6,567
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	4	5	62	168
Paving	21	20	20	29
Gravel:				
Building	28	53	46	59
Paving	3,390	3,159	6,050	4,590
Total sand and gravel	3,443	3,237	6,178	4,846
Grand total	7,991	7,803	13,205	11,413

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Stone.—Highway-construction activities in New Mexico once again provided the stimulus for increased production in 1958. Total stone sold or used reached 1.7 million tons, a 28-percent gain over 1957. Detailed data on county production and types of stone quarried are shown in tables 11 and 12.

Sulfur.—Production of elemental sulfur was only 560 long tons, and shipments were only 2,000 tons; both totals were considerably under totals for 1957. The Eunice plant of El Paso Natural Gas Co. was the only acting producing facility. The Monument Works of Warren Petroleum Corp. was idle, and plans called for dismantling the plant.

Vermiculite.—Production of exfoliated vermiculite by Southeast Vermiculite Co. of Albuquerque was triple the 1957 total. The crude ore was obtained from Libby, Mont., and the processed material was sold for insulation.

TABLE 11.—Production of stone in 1958, by counties

County	Short tons	Value	County	Short tons	Value
Bernalillo	(1)	(1)	San Miguel	533	$11,750
Chaves	132,700	$119,100	Santa Fe	15,000	32,700
Eddy	78,500	98,710	Socorro	8,175	8,000
Grant	52,600	87,200	Taos	6,000	5,700
Lea	2,800	9,900	Torrance	7,500	8,000
Lincoln	50,900	34,000	Valencia	64,600	73,640
McKinley	64,300	90,300	Other counties	1,072,677	822,277
Otero	162,800	92,500			
Rio Arriba	10,400	9,900	Total	1,730,485	1,507,277
San Juan	1,000	3,600			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

TABLE 12.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1954			88,704	$126,750	100	$700	(1)	(1)
1955			20,722	17,400	90	1,260	276,306	$354,896
1956			10,915	9,100	350	4,900	(1)	(1)
1957			9,300	6,100			715,900	1,147,400
1958	26,100	$24,500	9,075	9,000	200	2,500	795,077	801,487

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1954	890	$4,190	681,936	$582,397	771,630	$714,037
1955	812,491	496,991	463,832	676,118	1,573,441	1,546,665
1956	685,129	532,017	571,841	725,820	1,268,235	1,271,837
1957	615,060	456,845	8,100	7,200	1,348,360	1,617,545
1958	900,033	669,790			1,730,485	1,507,277

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

METALS

Beryllium.—Shipments of beryllium concentrate (beryl) were limited to material produced from the Harding pegmatite by Arthur Montgomery. The output was marketed under the Government purchase program administered by the General Services Administration (GSA).

Columbium-Tantalum.—No columbite-tantalite ore was mined in 1958.

Copper.—Copper production declined 18 percent, mainly because of reduced output from the principal copper mine, Chino open pit of the Chino Mines Division, Kennecott Copper Corp. The output from this mine accounted for 98 percent of New Mexico's copper production.

TABLE 13.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1949–53 (average)	72	2	8,060	3,237	$113	369	$334
1954	37	4	6,764	3,539	124	109	99
1955	50	6	7,447	1,917	67	251	227
1956	75	1	8,752	3,275	115	393	356
1957	60	----------	8,060	3,212	112	309	280
1958	20	----------	5,873	3,378	118	159	144
1848–1958	--------	----------	[3]	2,220,901	51,066	71,877	56,676

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1949–53 (average)	68,767	$32,689	4,922	$1,529	33,675	$10,424	$45,089
1954	60,558	35,729	887	243	6	1	36,196
1955	66,417	49,547	3,296	983	15,277	3,758	54,582
1956	74,345	63,193	6,042	1,897	35,010	9,593	75,154
1957	67,472	40,618	5,294	1,514	32,680	7,582	50,106
1958	55,540	29,214	1,117	261	9,034	1,843	31,580
1848–1958	2,153,258	837,876	330,125	45,677	1,190,928	222,638	1,213,933

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old tailings, old slag, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Figure not available.

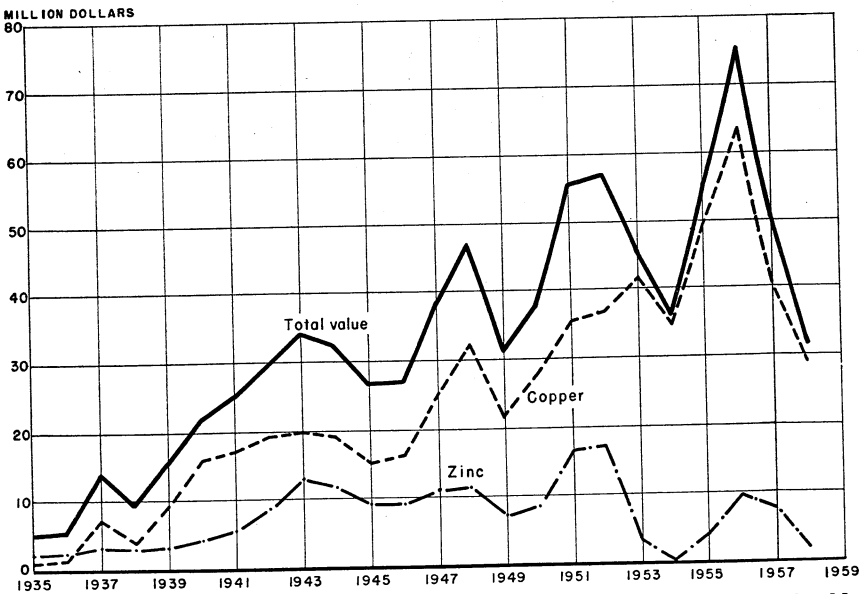

FIGURE 3.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1935–58. The value of gold, silver, and lead produced annually has been relatively small.

The value of the copper output declined 28 percent compared with 1957, as a result of a lower weighted-annual-average price of 26.3 cents a pound for the metal, compared with 30.1 cents in 1957.

Gold.—Gold production increased 5 percent, chiefly as a result of greater output from the Chino and Atwood-Henry Clay mines. Production from these two properties and from the Bayard and Miser's Chest mines accounted for 97 percent of the State's output of gold.

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in 1958, by counties, in terms of recoverable metals

County	Mines producing (lode) [1]	Lode material sold or treated [2] (short tons)	Gold		Silver	
			Troy ounces	Value	Troy ounces	Value
Catron	1	11	7	$245	379	$343
Grant	6	5,830,995	2,158	75,530	71,141	64,386
Hidalgo, Rio Arriba, and Santa Fe [3]	5	24,810	1,190	41,650	66,904	60,552
Sierra	2	10			200	181
Socorro	5	16,938	19	665	20,132	18,220
Taos	1	4	4	140	2	2
Total:						
1958	20	5,872,768	3,378	118,230	158,758	143,684
1957	60	8,059,888	3,212	112,420	309,385	280,009

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Catron							$588
Grant	55,075	$28,969,634	579	$135,533	8,576	$1,749,341	30,994,424
Hidalgo, Rio Arriba, and Santa Fe [3]	462	242,591	30	7,114	13	2,733	354,640
Sierra	(4)	105	1	187	(4)	31	504
Socorro	3	1,710	507	118,544	445	90,831	229,970
Taos							142
Total:							
1958	55,540	29,214,040	1,117	261,378	9,034	1,842,936	31,580,268
1957	67,472	40,618,144	5,294	1,514,084	32,680	7,581,760	50,106,417

[1] Operations at miscellaneous cleanups not counted as a producing mine.
[2] Does not include tonnage of precipitates shipped.
[3] Combined to avoid disclosing individual company confidential data.
[4] Less than 1 ton.

Iron Ore.—Iron ore was shipped from two mines, and the output was virtually the same as in 1957. Magnetite from the Hanover-Bessemer mine in Grant County was shipped to the Los Alamos Scientific Laboratory, University of California, for use as a cement aggregate, and magnetite from the Oro Quay mine in Santa Fe County was shipped to a pig-iron plant.

Lead.—The 79-percent decline in output of lead was due primarily to inactivity at the Ground Hog Unit mines throughout the year and to the shutdown of the Linchburg and Bayard mines in midyear. In past years these mines were the leading lead producers in the State. Producers of significant quantities of lead in 1958 included the Hornet mine (Grant County), Atwood-Henry Clay mines (Hidalgo County) and Mex-Tex and Queen mines (Socorro County).

Manganese.—The quantity of manganese ore and concentrate

TABLE 15.—Mine production of gold, silver, copper, lead, and zinc in 1958, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	1	4	4	2			
Dry gold-silver	3	17,300	1,135	63,278	533,700	60,800	26,800
Dry silver	2	2		812			
Total	6	17,306	1,139	64,092	533,700	60,800	26,800
Copper	6	5,725,600	1,717	29,152	80,958,400		300
Lead and lead barite [2]	3	10,541	6	1,645	1,100	305,100	2,500
Lead-zinc and zinc [2]	4	119,320	514	63,851	1,176,300	1,867,500	18,038,300
Total	13	5,855,461	2,237	94,648	82,135,800	2,172,600	18,041,100
Other "lode" material:							
Copper precipitates	2	18,549			28,410,500		
Lead-zinc cleanup	1	1	2	18		600	100
Total	3	18,550	2	18	28,410,500	600	100
Total "lode" material	20	5,891,317	3,378	158,758	111,080,000	2,234,000	18,068,000

[1] Detail will not necessarily add to totals because some mines produce more than 1 class of material.
[2] Combined to avoid disclosing individual company confidential data.

TABLE 16.—Mine production of gold, silver, copper, lead, and zinc in 1958, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation: Ore		757			
Concentration and smelting of concentrates: [1] Ore	2,226	93,540	81,278,700	2,127,700	18,038,300
Direct-smelting:					
Ore	1,150	64,443	1,239,900	105,700	29,600
Copper precipitates			28,410,500		
Lead-zinc cleanings	2	18		600	100
Total	1,152	64,461	29,650,400	106,300	29,700
Other: Leaching of copper ore			150,900		
Grand total	3,378	158,758	111,080,000	2,234,000	18,068,000

[1] Includes lead-barite ore concentrate.

shipped under the Government "carlot" program, administered by GSA, was only slightly less than in 1957. This material came from mines in 8 counties. Socorro, Sierra, Grant, and Luna, in order, were the counties with the greatest output. The Black Canyon, RFC, Manganese Chief Nos. 12–17 and 21, and West Niggerhead mines, all in Socorro County, were the major producers. Manganiferous ore (ferruginous ore containing an average of 9 percent manganese and 36 percent iron) was shipped from the Boston Hill mine in Grant County to the Pueblo (Colo.) steel plant of Colorado Fuel & Iron Corp.

Silver.—Silver output was one-half that of 1957. The Atwood-Henry Clay group of mines was the major producer, followed by the Chino and Bayard mines. Although these three properties accounted

for 69 percent of the silver output, the Linchburg, Hanover, and Miser's Chest mines also produced significant quantities of silver.

Uranium.—The production of uranium ore increased 61 percent, and the value of the crude ore at the mine gained 57 percent over 1957. The increase in output was largely due to the completion of development programs at mines in McKinley County and the beginning of sustained production. Shipments were reported from 56 operations compared with 40 in 1957. Shipments continued at the same rate from mines in Valencia County. Shipments also were made from mines in San Juan and Socorro Counties.

Four new processing plants, two in Valencia County and two in McKinley County, were completed and placed in operation. The completion of these plants increased the daily milling capacity of plants in the State from 3,800 to 11,075 tons.

The reserve of uranium ore, estimated by the Atomic Energy Commission (AEC) as of December 31, 1958, was 54.9 million tons, averaging 0.26 percent (5.2 pounds per ton) uranium oxide. The estimate on December 31, 1957, was 53.3 million tons of ore having the same average grade.

AEC announced on May 24, 1956, that it would guarantee the purchase of uranium oxide in concentrates from domestic ores produced and delivered from April 1, 1962, through December 31, 1966, at the previously established price of $8 per pound acceptable concentrate.

On November 24, 1958, the program was modified to the extent that the previously announced guarantee would be limited to concentrate recovered from ores developed before November 24, 1958. The Commission could, however, make contracts to purchase concentrate recovered from ores developed after November 24, 1958, to the extent that conditions dictate and on such terms, conditions, and prices as the Commission determines to be equitable to both the producer and the Government. The purpose of the revision was to prevent overproduction and to assure an adequate supply of uranium for military and domestic uses.

Vanadium.—Some uranium ores, principally in San Juan County, contain enough vanadium to warrant the cost of recovery. These ores were processed at mills in Colorado, and the recovered vanadium was credited to New Mexico. The quantity recovered in 1958 was substantially less than in 1957.

Zinc.—Output of zinc was one-fourth that of 1957. The decline resulted from inactivity throughout the year at a former major producer and the shutdown for the latter half of the year of two other producers. The Bayard and Hanover mines in Grant County accounted for most of the zinc output.

REVIEW BY COUNTIES

Bernalillo.—The value of sand and gravel from 12 operations represented 83 percent of the value of mineral production in the county. The mining of miscellaneous clay by the Kinney Brick Co., Inc., made the county the leading producer of clay. Pumice (scoria) was produced from a deposit near Isleta by Edgar D. Otto & Sons, Inc.,

and crushed limestone and basalt for highway construction also was reported.

Chaves.—Petroleum produced from 555 wells in 12 fields declined to 3.2 million barrels, a drop of 27 percent from 1957 because of gradual depletion of the fields. The county ranked fourth in petroleum output, compared with third in 1957. Natural gas was recovered from one well.

No clay was produced during the year because Native Blanca Clay Co. of Lovington was inactive, and a decrease from 10 to 8 in the number of sand and gravel operations reduced output of this commodity 7 percent.

TABLE 17.—Value of mineral production in New Mexico, by counties

County	1957	1958	Minerals produced in 1958, in order of value
Bernalillo	$833,300	$1,670,169	Sand and gravel, stone, pumice, clays.
Catron	96,546	21,071	Salt, silver, gem stones, gold.
Chaves [1]	13,527,677	10,254,200	Petroleum, sand and gravel, stone.
Colfax	615,117	303,420	Coal, sand and gravel.
Curry	500		
De Baca	83,200	15,800	Sand and gravel.
Dona Ana	293,004	827,464	Sand and gravel, pumice, clays, manganese ore and concentrate.
Eddy [2]	93,703,768	85,044,360	Potassium salts, petroleum, magnesium compounds, salt, sand and gravel, stone, gem stones.
Grant	49,929,518	32,423,674	Copper, zinc, molybdenum, lime, sand and gravel, lead, manganiferous ore, manganese ore and concentrate, stone, gold, silver, iron ore.
Guadalupe	373,652	250,400	Sand and gravel.
Harding [3]	4,200		
Hidalgo	1,391,730	628,903	Sand and gravel, copper, silver, gold, clays, lead, zinc, manganese ore and concentrate.
Lea [2]	[4] 248,594,624	243,358,541	Petroleum, potassium salts, sand and gravel, salt, stone.
Lincoln	25,700	47,800	Stone, sand and gravel.
Los Alamos	15,800		
Luna	319,195	126,100	Sand and gravel, manganese ore and concentrate, gem stones.
McKinley	3,681,106	13,782,004	Uranium ore, sand and gravel, coal, petroleum, stone, clays.
Mora	800		
Otero	661,844	516,231	Sand and gravel, stone, gem stones.
Quay	(5)	273,400	Sand and gravel.
Rio Arriba [1]	1,682,447	2,293,767	Petroleum, sand and gravel, pumice, coal, mica (scrap), mica (sheet), stone, silver.
Roosevelt [1]	843,710	1,361,000	Petroleum, sand and gravel.
Sandoval [1]	313,269	487,187	Sand and gravel, pumice, petroleum, manganese ore and concentrate, coal, gem stones.
San Juan [6]	6,862,204	23,868,236	Petroleum, sand and gravel, helium, uranium ore, coal, stone, clays.
San Miguel	139,497	83,950	Sand and gravel, stone.
Santa Fe	555,161	732,813	Sand and gravel, pumice, stone, copper, iron ore, manganese ore and concentrate, silver, gold.
Sierra	80,637	169,860	Manganese ore and concentrate, sand and gravel, lead, silver, copper, gem stones, zinc.
Socorro	3,672,901	4,624,595	Sand and gravel, manganese ore and concentrate, perlite, lead, zinc, barite, silver, coal, stone, uranium ore, copper, gold.
Taos	914,756	946,668	Perlite, sand and gravel, beryllium concentrate, stone, gold, silver.
Torrance	1,093,392	496,000	Sand and gravel, stone.
Union	[4] 345,835	343,368	Pumice, sand and gravel.
Valencia	(5)	(5)	Uranium ore, sand and gravel, perlite, stone, gem stones.
Undistributed [7]	[4] 120,578,210	133,975,819	
Total [8]	[4] 551,155,000	558,866,000	

[1] Excludes natural gas.
[2] Excludes natural gas and natural-gas liquids
[3] Excludes carbon dioxide (natural).
[4] Revised figure.
[5] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[6] Excludes natural gas, natural-gas liquids, and vanadium.
[7] Includes all natural gas, natural-gas liquids, carbon dioxide, vanadium, and some stone, manganese ore and concentrate (1958), gem stones, and values indicated by footnote 5.
[8] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing lime.

Colfax.—Coal output in 1958 came from six mines; the principal producers were Kaiser Steel Corp. (Koehler mine) from the Raton seam and Sonchar Coal Co. from the Sugarite seam. The bulk of the production by Kaiser Steel was shipped to the company's steel plant at Fontana, Calif., for manufacturing of coke. A fire at the Koehler mine sharply curtailed production. The fire, caused by a cave-in, was confined and then bypassed by additional openings. Carbon dioxide was used in combating the fire.

Dona Ana.—Nine sand and gravel operations produced 970,000 tons of aggregate and accounted for most of the nearly threefold increase in total value of mineral production in the county. Large quantities of pumice (scoria) were produced for building-block manufacture, and El Paso Brick & Tile Co. reported increased output of miscellaneous clay used by the company in manufacturing brick. The Alamo Mining & Exploration Corp. shipped 31 tons of manganese ore from the Blackie Nos. 1 and 2 mines under the GSA "carlot" program.

Eddy.—Potash and petroleum accounted for nearly all the value of minerals produced. Potash mining and refining continued to be the principal source of income to the mineral industry of the region, and shipments increased despite a decline in quantity mined. The companies active in 1957 also reported production in 1958.

The county ranked third in the State in petroleum production. Output, from 2,368 wells in 75 fields was 11 percent above 1957. Natural gas was recovered from 36 wells in 14 fields. Two plants at Loco Hills processed wet-petroleum gas for recovery of natural gasoline, butane, and propane.

Grant.—Copper (valued at $29 million) supplied 89 percent of the value of mineral production ($32.4 million). The combined value of output of other metals—gold, silver, lead, and zinc—was $2.0 million. The $17.5-million drop in total value of mineral output resulted chiefly from a $10.4-million decline in value of copper output and a $5.4-million fall in value of zinc produced.

The Chino open-pit copper mine at Santa Rita in the Central district of Grant County, operated by the Chino Mines Division of Kennecott Copper Corp., produced most of the State's output of copper, all of the molybdenum, and substantial quantities of gold and silver. In its annual report for 1958, the company stated that 54,342 tons of copper was produced from all sources at this mine, compared with 63,454 tons in 1957. The copper came from copper precipitates recovered by leaching of dumps and from 5.5 million tons of ore (containing 18.3 pounds of copper per ton) mined and milled. In 1957, 7.3 million tons (containing 16.3 pounds of copper per ton) was mined and milled.

Because of a decline in the domestic demand for copper, production was curtailed to a 6-day workweek at the mine and mill and to a 5-day week at the smelter on January 5. On the 6-day week, operations continued for 12 consecutive days, then were suspended for 2 days; the 5-day week consisted of 10 days on and 4 off. The copper fire refinery was closed on May 2 because of a drop in demand for this product. To further curtail operations, a 4-day week (Monday through Thursday and closed Friday through Sunday) was begun at the mine and mill on May 5. The copper fire refinery was reopened on a 4-day

workweek on July 20 as a result of a rise in demand for fire-refined copper. With increased copper sales, operations were changed to a 6-day workweek at the mine and mill and a 5-day week at the smelter and refinery on September 8. This schedule prevailed until the end of the year.

Studies progressed on the planned installation of a skip hoist on the side of the open pit. Through a combination truck-haulage and skip hoist, ore can be taken from the lower levels of the pit more economically than by the present rail-haulage system. The skip-hoist system will consist of an inclined railway running from the perimeter of the pit to the bottom. Two skips will run on the railway in balance. To provide additional electric power needed by this division, work was in progress on the central power station to increase its capacity by adding a 16,000-kw. turbogenerator and auxiliary equipment.

The lessees of the mines in the Bayard group at Bayard, owned by United States Smelting Refining & Mining Co., discontinued operations in April, and on May 7 the company closed its mill. In addition to zinc, the principal metal produced, substantial quantities of gold, silver, copper, and lead were recovered from the ore mined. This group was the largest producer of zinc in the State.

The Hanover mine at Hanover, in past years an important lead, zinc, and silver producer in the State, was closed May 1 by The New Jersey Zinc Co. The Ground Hog Unit group of mines at Vanadium, owned by American Smelting and Refining Co. and the principal lead and silver producer in New Mexico in 1957, was closed in July 1957 and remained inactive throughout 1958, as did the company's custom mill at Deming. The Kearney mine at Hanover and the Peru mill at Deming, closed by Peru Mining Co. in May 1957, also were idle in 1958.

In addition to the three major producing mines (Chino, Bayard, and Hanover), two other mines (Zuniga and Hornet) were active, and 10 operations recovered copper from Santa Rita Creek water by precipitation. Copper ore from the Zuniga mine was heap-leached, and lead-zinc ore from the Hornet mine was concentrated; the lead and zinc concentrates were shipped to smelters.

Manganese ore and concentrate, shipped from three mines and valued at $88,000, was sold to the GSA under the "carlot" program. The Luck Mining Co. shipped manganiferous ore from the Boston Hill mine near Silver City to The Colorado Fuel and Iron Corp. at Pueblo, Colo. The ore, containing 9 percent manganese and 36 percent iron, was used for making steel. A small quantity of iron ore (magnetite) was produced from the Hanover-Bessemer mine near Silver City and used as an aggregate in making cement.

Hidalgo.—The Banner Mining Co.'s Bonney and Miser's Chest group of mines near Lordsburg, in preceding years the county's leading metal producer, was unproductive throughout 1958. However, a small development crew sunk the main shaft from just below the 1440 level to approximately 25 feet below the 1560 level and began driving drifts and raises to open the new level. Ore from this development was milled, and the concentrates were sold monthly beginning in July. At the end of the year, the company officials stated

that they planned to expand development and reopen the mine for full production as soon as copper prices increased sufficiently.

Brannan & Fuller produced gold-silver ore containing some recoverable copper, lead, and zinc from the Atwood-Henry Clay mines and shipped it to the American Smelting and Refining Co.'s, El Paso, (Tex.) copper smelter.

One commercial and three noncommercial sand and gravel producers reported output of 364,000 tons. The bulk of the output resulted from activities of contractors for the State highway department. Phelps Dodge Corp. continued to mine fire clay for use at company smelters and for resale.

Lea.—Lea County led the State in the production of petroleum; crude oil was recovered from 7,916 wells in 200 fields. Total petroleum output declined 3 percent compared with 1957. Natural gas was produced from 1,113 wells in 20 fields. Fifteen processing plants recovered natural gasoline, butane, and propane. Sinclair Oil & Gas Co. began operating its No. 29 plant in the southeastern corner of the county in June. Carbon black was produced from natural gas at three plants, and Skelly Oil Co. recovered this product at two of its natural-gasoline plants near Eunice.

National Potash Co. operated its potash mine and refinery throughout 1958 and increased output 66 percent over 1957. Despite production cutbacks by operators in Eddy County, National Potash was able to continue operations because of small stocks and the availability of storage space for finished products in excess of orders. With the closing of the Monument sulfur plant of Warren Petroleum Corp., all sulfur produced in 1958 came from the Eunice plant of El Paso Natural Gas Co. Salt continued to be recovered from potash tailing by local concerns. Structural sand and gravel and paving gravel were produced by Lea County Sand & Gravel Co., Inc.

Luna.—One-third of the value of mineral production came from manganese ore and concentrate produced from seven mines and shipped under the Government "carlot" program administered by the GSA. By far the largest producing mine was the Manganese Valley operated by Florida Manganese, Inc. Sand and gravel output comprised 700 tons of noncommercial and 34,200 tons of commercial aggregate produced by four operators. Luna County ranked first in gem or ornamental stones collected.

McKinley.—Coal was produced at nine mines—six underground and three strip operations. Major producers were Gibson Coal Co., Navajo Tribal Enterprises, and Roberts Coal Co. The county led the State in output of coal.

Petroleum production from 21 wells in 3 fields declined slightly from 1957. Operation of the Cinizia refinery of El Paso Natural Gas Products Co. reached capacity early in the year. The last unit to operate was the 1,600-barrel hydrofluoric acid alkylation plant. Other units became operative late in December 1957, 14 months after construction was begun.

Uranium-ore production increased nearly fivefold compared with 1957. The completion of development and the start of scheduled production at numerous mines accounted for the increase. Most of the ore bodies are at depths of 300 to 1,000 feet, in the Westwater

member of the Morrison formation, and require deep shafts, extensive development, and substantial surface plants before production can be started. At some mines considerable water was encountered in the Dakota formation above the ore; shafts were difficult to sink, and it was necessary to provide water seals and instigate grouting procedures to reach the ore horizons. At other mines the water increased as development of the ore bodies progressed, and additional pumping facilities were required.

Construction of two processing plants was completed and operations were started during the year. The 1,725-ton-a-day plant of Phillips Petroleum Co. at Berryhill Village, 25 miles north of Grants, began operating in July. The 3,300-ton-a-day plant of Kermac-Nuclear Fuels Corp., 22 miles north of Grants, began operating in November.

At the Phillips Petroleum Co. plant a carbonate leach was used, and the uranium oxide was precipitated from the filtrate with sodium hydroxide. The first shipment of uranium oxide was made in August.

The Kermac-Nuclear Fuels Corp. plant, comprising two identical circuits in which an acid leach was followed by solvent extraction, was the first commercial application of the system. A 450-ton-per-day sulfuric acid plant provided the acid requirements. The first shipment of uranium oxide was made in December.

Three contracts for Government assistance in exploration of uranium-ore deposits were approved by DMEA. Government participation was 75 percent in two contracts and 50 percent in the third. Total amount of the contracts was $227,430.

Rio Arriba.—Petroleum production of 572,000 barrels accounted for 74 percent of the value of minerals produced. Sixty-three oil wells in 5 fields were active. Natural-gas production came from 1,105 wells in 18 fields. Southern Union Gas Co. operated a processing plant at Lybrook for recovering natural gasoline, butane, and propane from wet-natural gas. Coal production continued to decline, falling 27 percent below 1957. The entire output was sold locally.

Highway-construction activities used 243,000 tons of sand and gravel and 10,400 tons of crushed granite and limestone. A small quantity of hand-cobbed and full-trimmed mica was shipped from the Apache and Globe mines to the Government purchase depot at Spruce Pine, N.C. The Petaca mica-grinding plant of Petaca Mining Corp. was shut down during the year, but 787 tons of ground mica was produced before it closed.

Roosevelt.—Petroleum production from 17 wells in 4 fields amounted to 372,000 barrels in 1958—82 percent of the value of mineral production.

Sandoval.—Sand and gravel output, valued at $358,000, accounted for 74 percent of the value of minerals produced. Pumice (scoria), valued at $64,000, was the second most important mineral in value. Petroleum production dropped to 15,000 barrels, 17 percent below 1957. Crude-oil output came from 12 wells in 3 fields and natural gas from 2 wells in 1 field. Coal production from the Padilla mine, the only active mine, declined 41 percent from 1957.

Jim McRee operated the Jicarilla Tribal No. 180 and the Lander mines in 1958 and shipped manganese ore and concentrate under the Government "carlot" program. No silver or copper ore was produced from mines in the county as in previous years.

San Juan.—Petroleum production from 658 wells in 12 fields increased more than fourfold compared with 1957. The county ranked second in the State in petroleum production, exceeding Eddy and Chaves Counties, which were second and third, respectively, in 1957.

Principal output came from the Bisti, Verde, Gallegos and Horseshoe Canyon fields, all of which produced from the Gallup formation. Considerable attention was given to deeper drilling to the Dakota formation. Most of the exploratory drilling in the Horseshoe Canyon and Verde areas was successful. Drilling in the Bisti and Gallegos areas was confined largely to development drilling, and both fields were extended to the northwest and southeast.

Natural gas was produced from 2,890 wells in 28 fields. Two plants recovered natural gasoline, butane, and propane from wet-petroleum gas. Residual gas was marketed through natural-gas pipelines.

Helium production from the Hogback and Rattlesnake fields declined steadily because of water encroachment. The Federal Bureau of Mines helium-extraction plant at Shiprock was shut down in August pending development of additional supplies of helium-bearing gas from the two fields. Coal was produced at two mines; the entire output was consumed locally.

Uranium ore, produced at four mines, was processed at mills in Colorado and at Shiprock. The 300-ton-a-day Shiprock concentrator of Navajo Uranium Division, Kerr-McGee Oil Industries, Inc., operated the entire year. Ores treated were from deposits in New Mexico and Arizona.

Santa Fe.—Increased highway-construction activity was mainly responsible for the more than twofold increase in output of sand and gravel in 1958, as well as for the production of crushed granite and limestone. Pumice (pumice and scoria) processing plants were operated by Copar Pumice Co., Inc., at Espanola, and Crego Block Co., Inc., and James H. Rhodes & Co. at Santa Fe.

Tom B. Scartaccini produced a small quantity of copper ore containing gold and silver from the San Pedro mine and shipped it to the American Smelting and Refining Co.'s, El Paso (Tex.), copper smelter. The Pecos & Northwestern Telephone Co. produced a small quantity of iron ore (magnetite) from the Oro Quay mine; the ore was shipped for making pig iron and steel.

Sierra.—Three-quarters of the value of the mineral production came from the sale of manganese ore and concentrate from eight mines to the Government under the "carlot" program. Four mines, Tall Pine, Lake Valley, Black Jack, and Iron King, listed in order of output, were the leading producers and accounted for most of the output in the county. Copper and lead ores containing small quantities of silver were produced from the Blackhawk and Smiling Jane Mines, respectively.

Socorro.—Eight noncommercial and two commercial sand and gravel operations accounted for 52 percent of the value of minerals produced; highway construction was the principal reason for the in-

creased output. Production of crude and expanded perlite was continued by Great Lakes Carbon Corp. at its Socorro mine and mill.

A total of 19,531 short wet tons of manganese ore and concentrate valued at $1.6 million was produced from 31 mines and shipped under the Government "carlot" program. This output accounted for one-third of the total value of mineral production in Socorro County. By far the leading manganese producer was the Black Canyon (Joe Gianera), followed by the RFC (The Rific Co.), West Niggerhead (Rico Mining Co.), and three groups of Managanese Chief claims (Frank A. King, Tom E. Kelly, and Birchfield Mining Co., respectively).

The Linchburg mine, owned by The New Jersey Zinc Co. and operated by C. S. Elayer (lessee), was closed on May 1, coincident with the shutdown of the Hanover mill in Grant County, where ore from this mine was milled. The Linchburg mine had been one of the State's principal lead, silver, and zinc producers. Lead concentrate was produced as a coproduct of barite from ore mined at the Mex-Tex mine by Mex-Tex Mining Co., Inc. Both mining and milling were suspended in June.

Coal for local consumption was produced at the Carthage No. 3 mine. Uranium ore from two mines was shipped to processing plants at Grants and Shiprock.

Taos.—Perlite was the principal mineral product, and the county led the State in output of this commodity. Taos County also was the only source of beryl in 1958, the entire output coming from the Harding pegmatite of Arthur Montgomery.

Valencia.—The county led the State in uranium-ore production, which came from seven operations. The major producer, The Anaconda Co., operated its Jackpile, Section 9, and Section 33 SEQ mines.

The entire production of The Anaconda Co. and some ore from independent operators was processed at the company's 3,500-ton-a-day plant at Bluewater.

The 750-ton-a-day Homestake-New Mexico Partners mill, 5 miles north of Grants, was completed and began operating in February. The plant was officially dedicated in April, and the first shipment of uranium oxide also was made in that month. Homestake-Sapin Partners completed construction of a 1,500-ton-a-day plant on a site adjacent to the Homestake-New Mexico Partners plant and began operations in July. The first shipment of uranium oxide was made in September. Ores for the two mills came from deposits owned or controlled by members of the respective partnerships and from independent producers in the Ambrosia Lake area, McKinley County. Both mills used a sodium carbonate leach and extracted the uranium oxide from the leach liquors with sodium hydroxide.

Sand and gravel produced by contractors for the State highway department was an important product of the mineral industry of the county and output reached 971,000 tons. Crude perlite, mined at a property 9 miles north of Grants by United States Gypsum Co., also provided income to the mineral industry. The crude material was crushed at the company plant at Grants.

The Mineral Industry of New York

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, Department of the Interior, and the New York State Science Service.

By Joseph Krickich [1] and Robert W. Metcalf [1]

MINERAL production in New York in 1958 was highlighted by a sharp decline in output of metals; consequently, total valuation was the lowest since 1954. The mineral industry was affected by declines in the State and national economy. According to the New York State Department of Commerce the New York State index of business activity averaged 130 (1947–49=100) compared with 134 for 1957 and was the lowest since 1955. During the fourth quarter most segments of the State's economy began an uptrend.

TABLE 1.—Mineral production in New York [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clay----thousand short tons	1,002	$1,270	1,085	$1,418
Emery	11,893	184	7,687	126
Gem stones	(2)	5	(2)	8
Gypsum----thousand short tons	864	3,749	834	3,869
Iron ore (usable) thousand long tons, gross weight	3,329	44,567	1,944	25,683
Lead (recoverable content of ores, etc.)	1,667	477	579	135
Natural gas----million cubic feet	2,869	815	2,808	859
Peat	(3)	(3)	13,606	117
Petroleum (crude)----thousand 42-gallon barrels	2,677	12,662	[4] 1,664	[4] 7,039
Salt (common)----thousand short tons	3,691	28,002	3,896	30,609
Sand and gravel----do	25,640	26,480	24,730	27,541
Silver (recoverable content of ores, etc.) thousand troy ounces	64	58	67	60
Slate----thousand short tons	59	961	(5)	(5)
Stone----do	24,265	43,276	22,598	38,219
Zinc (recoverable content of ores, etc.)	64,659	15,001	53,014	10,815
Value of items that cannot be disclosed: Abrasive garnet, cement, crude iron oxide pigments, lime, talc, titanium concentrate, wollastonite, and items indicated by footnote 3	----------	70,699	----------	61,859
Total New York [6]	----------	244,114	----------	204,920

[1] Production as measured by mine shipments, sales or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Figure withheld to avoid disclosing individual company confidential data, included with "Value of items that cannot be disclosed."
[4] Preliminary figure.
[5] Included with stone.
[6] The total has been adjusted to avoid duplicating value of clays and stone.

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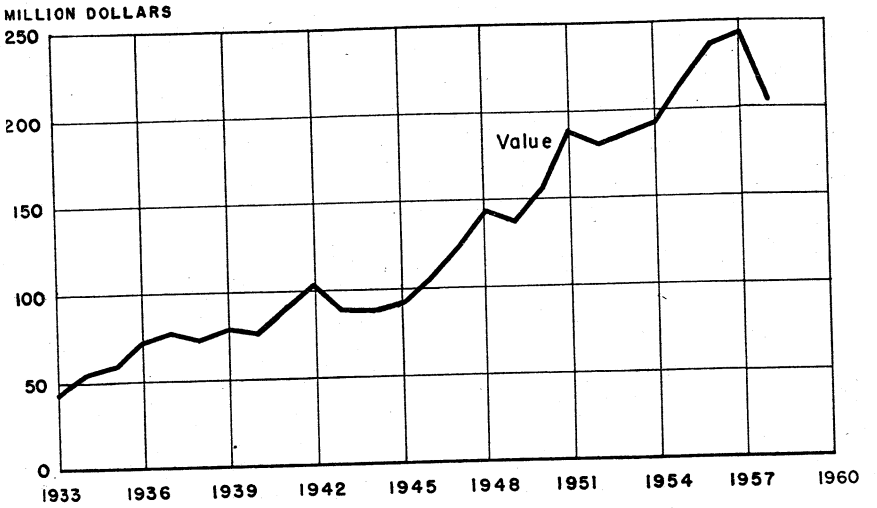

FIGURE 1.—Total value of mineral production in New York, 1933–58.

Trends and Developments.—Continued expansion and interest in the aluminum, rare metal, and atomic energy industries marked the year. Mineral exploration also was active.

Indicative of the newly developed atomic power sources, a full-scale pressurized power reactor was under construction by Babcock & Wilcox for Consolidated Edison Co., of New York City, at Indian Point. Capacity was rated at 163,000 kw.; date of completion, 1960. Also under construction at West Milton, Ulster County, across the Hudson River from Poughkeepsie, was a propulsion prototype Submarine Advanced Reactor (S3G), a pressurized type sponsored by the U.S. Navy.

The Carborundum Co. began construction at Niagara Falls of a $6 million plant to manufacture 4- to 14-inch grinding wheels. The plant will feature specially designed automatic and semiautomatic equipment. Preliminary plans were made for subsequent addition of facilities to make other vitrified abrasive products costing $4 million.

Exploration was undertaken by W. S. Moore Co., Duluth, Minn., of several magnetite deposits near Newton Falls. The ore, similar to that at Jones & Laughlin's Benson Mines, is owned by Newton Falls Paper Mill, Inc., and International Talc Co. If a sufficient reserve is developed a concentrating plant to produce 300,000 to 400,000 tons of pellets annually is projected. According to the company, a reserve capable of yielding 4 to 6 million tons of concentrate would be requisite to erection of a magnetic treatment plant.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—In value, cement continued to be the leading mineral commodity produced. Portland, masonry, and natural cements were produced; the portland type composed 93 percent of the total value.

Total output and value decreased 8 and 6 percent, respectively, compared with 1957, owing primarily to less construction and somewhat to a 3-month curtailment of production at one plant by a labor dispute. The average value of portland cement a barrel increased from $3.27 in 1957 to $3.31 in 1958; the average value of masonry cement dropped from $3.60 to $3.44. The average value of natural cement increased. Production was reported from 12 plants, 10 of which produced portland and masonry cement. One plant produced masonry cement exclusively and one plant produced masonry and natural cements. Annual finished-cement capacity at the 10 portland-cement plants was 21,536,000 barrels, a 1,185,000-barrel increase over 1957. Of the capacity, 54 percent was by the wet process and 46 percent by the dry process. The plants reported consuming 391 million kw.-hr. of electrical energy; 309 million kw.-hr. was purchased from public utility companies.

Cement-producing counties for all types of cement, in decreasing order of value, were Columbia, Greene, Erie, Schoharie, Warren, Onondaga, and Ulster. Natural cement was produced in Ulster County.

Alpha Portland Cement Co. began constructing additional silos capable of storing 100,000 barrels of finished cement at its Jamesville (Onondaga County) plant. The work was scheduled for completion in mid-1959 and would permit direct loading of both trucks and rail cars.

In November Hudson Cement Co., a subsidiary of Colonial Sand & Stone Co., Inc., New York, completed construction of its new cement plant at Kingston (Ulster County). Annual capacity of the $3.5 million plant was 600,000 barrels.

A $1 million storage and bagging plant was opened at Rochester by the Rochester Portland Cement Co. The plant is on the Genesee River and has a 200-foot loading dock, four 100- by 40-foot silos and a cement-bagging building. Cement produced by an affiliate company in Canada supplied the plant.

Clays.—The total output of clays (all miscellaneous clay) increased slightly. The increase was due primarily to increased demands for clay used in manufacturing cement and producing lightweight aggregate. Production for manufacturing heavy clay products, particularly building brick, declined. Some clay was used for pottery and stoneware and in artificial abrasives. In 1958, 18 producers in 9 counties were active compared with 20 producers in 10 counties in 1957. The leading clay-producing counties, in decreasing order, were: Albany, Ulster, Orange, and Erie. The increased demand for lightweight aggregate showed a general trend toward more and greater use of the material used for manufacturing concrete masonry units and in structural applications.

Emery.—Three emery mines in Westchester County continued to be the only domestic sources of emery. Output was used for general abrasive purposes and as aggregate for heavy-duty, nonslip floors.

Garnet.—Abrasive garnet was recovered in Essex and Warren Counties. Refined garnet (andradite) produced in Essex County was recovered as a byproduct of wollastonite mining.

Gem Stones.—The increased value of gem-stone output was due primarily to increased coverage of the industry by the Bureau of Mines. Output of gem material and mineral specimens recovered mainly by amateur collectors included beryl, calcite, garnet, opal, serpentine, tremolite, and various other varieties.

Graphite (Manufactured).—Manufactured graphite was produced at two plants in Niagara County. Output was used to manufacture anodes, electrodes, and lubricants, and in foundry and specialty uses.

Gypsum.—Output of gypsum came from five underground operations—three in Erie County and one each in Genesee and Monroe Counties. Most crude production was calcined at company-owned plants for use in manufacturing building material, such as plaster and gypsum lath. Crude gypsum was calcined at plants in Bronx, Erie, Monroe, Richmond, and Rockland Counties.

Iron Oxide Pigments.—Crude natural red iron oxide pigment was recovered and processed at a mine and mill in Oneida County.

Lime.—Production and valuation of lime produced increased. Quicklime and hydrated lime were produced in Clinton, Erie, and Niagara Counties. Output was used for chemical, industrial, agricultural, and building purposes. Most of the lime was consumed in New York and the New England States. Some was shipped to Canada. Most lime produced in Erie County was quicklime consumed at nearby steel plants in metallurgical applications.

Nitrogen Compounds.—Anhydrous ammonia was produced at two plants at Niagara Falls, Niagara County. Output was used in manufacturing fertilizers, explosives, and numerous other chemical and industrial applications.

Perlite.—Expanded perlite was produced at six plants—three in Erie County and one each in Bronx, Genesee, and Onondaga Counties. Crude perlite shipped from Western United States was processed mainly for use as plaster aggregate. Quantities of expanded perlite also were used for loose fill insulation, concrete aggregate, soil conditioning, filler, and other uses. Production of expanded perlite dropped from 20,000 short tons in 1957 to 19,000 in 1958, but the value increased from $841,000 to $897,000 in 1958.

Salt.—Salt (rock, evaporated, and brine) was the third ranking mineral in value of output. Valuation increases were reported for all salts. The average value of evaporated salt increased more than $2 a ton over that in 1957. Rock salt was used principally for chlorine and other chemical manufacture and for melting snow and ice on roads. Evaporated salt, recovered primarily by the vacuum pan process, was used mostly for chemical manufacturing and for miscellaneous other uses. Brine, recovered in Onondaga County, was

TABLE 2.—Production of crude gypsum

Year	Active mines	Thousands short tons	Value (thousands)	Year	Active mines	Thousands short tons	Value (thousands)
1949-53 (average)	5	1,117	$3,601	1956	5	1,140	$4,817
1954	5	1,134	4,005	1957	5	864	3,749
1955	5	1,249	4,404	1958	5	834	3,869

TABLE 3.—Total salt sold or used by producer

Year	Thousands short tons	Value (thousands)	Year	Thousands short tons	Value (thousands)
1949–53 (average)	3,203	$15,553	1956	3,873	$27,545
1954	3,413	22,754	1957	3,691	28,002
1955	3,780	25,214	1958	3,896	30,609

used exclusively for manufacturing chemicals. Rock salt was recovered from underground mines in Livingston and Tompkins County. Other salt-producing counties were Schuyler and Wyoming Counties. The bulk of the salt produced was consumed in New York and other Northeastern States.

Sand and Gravel.—Decreased demand for structural and paving material was the major factor contributing to the decline in total output of sand and gravel, reflecting decreased activity in the construction industry. A 67-percent increase in output of sand and gravel by Government-and-contractor operations could not overcome a 9-percent decrease in commercial production. Even though the total output of sand and gravel dropped, a value increase was recorded. Primarily, this resulted from increases in the average value a ton of building and paving sand and gravel by both commercial and Government-and-contractor operations. In addition, more prepared material was marketed than in 1957.

There were 213 active commercial operations in 1958, of which 168 produced sand, and 178 produced gravel. Four sand operations produced over 1 million short tons of sand, 15 operations 100,000 to 999,999 short tons, 64 operations 25,000 to 99,999 short tons, and 36 operations 10,000 to 24,999 short tons. Of the 178 gravel operations, 3 plants produced over 500,000 short tons, 39 operations 100,000 to 499,999 short tons, 56 operations 25,000 to 99,999 short tons, and 35 operations 10,000 to 24,999 short tons. Of the total commercial sand and gravel output 84 percent was transported by truck, 15 percent by waterways and 1 percent by railroad. Seventy-one percent of the total sand and gravel output (commercial and Government-and-contractor) was washed, screened, or otherwise prepared compared with 56 percent in 1957.

Commercial production of sand and gravel was reported in 47 counties compared with 52 in 1957. Twenty-three producing counties reported increases; output in the remainder declined. Suffolk, Nassau, and Erie Counties, in decreasing order of output, were the principal centers of the sand and gravel industry in the State.

Stone.—Stone ranked second in value among the 21 mineral commodities produced in New York. Output of stone (including slate) decreased in both tonnage and value (7 and 12 percent, respectively). The decline was due primarily to lower demand for crushed or broken stone as riprap, flux, concrete aggregate, railroad ballast, and for agricultural purposes. Stone (basalt, limestone, marble, miscellaneous stone, sandstone, and slate) was produced in 36 of New York's 62 counties.

Limestone (the leading stone produced in New York) output decreased as demand for concrete aggregate declined. The output consisted entirely of crushed or broken stone and came from 27 counties. Onondaga, Dutchess, and Rockland Counties, in decreasing order of output, were the leading producing areas. Limited quantities of limestone were produced by Government-and-contractor operations in Jefferson County.

Basalt (traprock) was the second-ranking stone. Output declined 3 percent owing primarily to decreased demand for crushed basalt as concrete aggregate, the principal use. Production was reported from Rensselaer and Rockland Counties.

Sandstone, third-ranking stone in New York, was marketed as both dimension and crushed stone. Although the output of sandstone as rough construction, rubble, and rough architectural stone increased, total dimension standstone decreased owing to decreased demand for sawed and dressed stone and curbing and flagging, the principal uses. Crushed or broken standstone was marketed as riprap and concrete aggregate; both uses declined. Sandstone was produced in seven counties, dimension sandstone in six counties, and crushed sandstone in two. In terms of value, Delaware and Tompkins Counties were the leading dimension-standstone areas. Crushed or broken sandstone was produced in Broome and Greene Counties.

Compared with 1957, the total output and value of slate decreased. Dimension slate was marketed principally as flagging and roofing slate. Substantial quantities of slate granules (used for manufacturing natural and artificial colored roofing granules) and flour were also produced. Ten producers were active in Washington County—the center of the slate industry—compared with 14 in 1957. Quantities of slate granules were exported to Canada.

Marble was produced in St. Lawrence and Westchester Counties; miscellaneous stone, in Clinton and Broome Counties.

New York Trap Rock Corp. (West Nyack) acquired the Cornell Steamboat Co., to facilitate deliveries of stone by tug to its principal market in metropolitan New York. The company also constructed a new crushing plant in West Nyack. Callanan Road Improvement Co., South Bethlehem, announced it would construct a $2 million crushed-stone plant near Newburgh, on a 125-acre tract of dolomitic limestone purchased in 1954.

Talc.—Talc production was centered in St. Lawrence County and came entirely from the underground production of two companies. Crude talc was ground at company-owned mills and used principally in ceramics and paint manufacture. Other uses included paper, rubber, building materials, and floor- and wall-tile manufacture.

Vermiculite.—Exfoliated vermiculite was produced at a plant in Oneida County from crude material shipped from other States and the Union of South Africa.

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

	1957		1958	
	Thousands short tons	Value (thousands)	Thousands short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Molding	199	$569	191	$667
Building	6,735	7,730	5,822	6,990
Paving	6,241	5,498	5,621	6,922
Blast	1	(1)		
Filter	(2)	(2)	26	38
Fill			359	208
Other	856	454	431	365
Total	14,032	14,252	12,450	15,190
Gravel:				
Building	3,690	5,324	3,999	5,931
Paving	4,034	4,370	3,017	3,679
Railroad ballast	68	68	(2)	(2)
Fill			805	429
Other	1,669	1,219	1,075	756
Total	9,461	10,981	8,896	10,795
Undistributed [3]	164	449	77	53
Total sand and gravel	23,657	25,682	21,423	26,038
GOVERNMENT-AND-CONTRACTOR OPERATIONS [4]				
Sand:				
Building			34	29
Paving	246	157	506	288
Total	246	157	540	317
Gravel:				
Building			215	95
Paving	1,737	642	2,552	1,091
Total	1,737	642	2,767	1,186
Total sand and gravel	1,983	799	3,307	1,503
Grand total	25,640	26,480	24,730	27,541

[1] Less than $1,000.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes glass sand (1957), engine sand, and data indicated by footnote 2.
[4] Includes data for State, counties, municipalities, and other Government agencies.

TABLE 5.—Limestone sold or used by producers, by uses

Use	1957		1958	
	Thousands short tons	Value (thousands)	Thousands short tons	Value (thousands)
Riprap	127	$187	117	$173
Concrete aggregate and roadstone	14,301	25,888	13,076	21,129
Fluxing stone	116	239	57	93
Agricultural	419	1,200	358	2,224
Railroad ballast	531	805	381	613
Cement and lime	3,608	3,809	3,517	3,116
Miscellaneous uses	2,472	3,985	2,540	4,150
Total	21,574	36,113	20,046	31,498

METALS

Aluminum.—The Aluminum Company of America aluminum-reduction plant at Massena began operation with one potline in September. The second of the three potlines was started in October. ALCOA thus became the first industrial consumer of power from the St. Lawrence Power Project. Initial annual capacity of the new lines were 54,000 tons of aluminum. This modernization and expansion program, utilizing the newly developed St. Lawrence Project power, is estimated to cost $25 million. Work on the Reynolds Metals Co. 100,000-ton-capacity alumninum-reduction plant, also near Massena, progressed rapidly. The three-potline installation will cost $80 million and was programed for 1959 completion.

Ferroalloys.—Production of ferroalloys totaled 133,000 tons and consisted of 13 major categories. Shipments totaling 129,000 short tons and valued at $39,568,000 was reported for the year. Types of alloys produced included ferrochromium, chrome briquets, silvery pig iron, siliconmanganese, ferrosilicon, ferrotitanium, and other alloys.

Iron and Steel.—The rated capacity of blast furnaces increased 3 percent. Two plants reported small gains in capacity. In all, five companies at six locations operating 17 stacks were active. Except for one installation at Troy, all furnaces were in Erie and Niagara Counties in the extreme western part of the State. According to the American Iron and Steel Institute, seven firms at nine plants produced ingots and steel for castings; capacity was slightly higher than in 1957. All three open-hearth plants were in Erie County. The six electric furnace plants were at Watervliet, Syracuse, Cortland, Lockport, Tonawanda, and Dunkirk.

Iron Ore.—In spite of appreciable recovery toward the end of the year, the production of iron ore dropped sharply owing to lower industrial activity. Most usable ore shipped was sinter, although both direct-shipping ore and concentrate contributed sizable quantities. Three firms were active at four different mines, compared with five in 1957; one of the four active mines was idle 8 months of the year. Two were in Essex County and one each in Clinton and St. Lawrence Counties. All ore mined in the State was magnetite, mostly from

TABLE 6.—Annual capacities of blast furnaces, January 1, 1959

[American Iron and Steel Institute]

Company	Location of plant	Number of stacks	Total annual capacity (thousands short tons)
	Erie County:		
Hanna Furnace Corp.	Buffalo	4	850
Republic Steel Corp.	do.	2	683
Bethlehem Steel Co.	Lackawanna	7	3,590
Colorado Fuel & Iron Corp.	Tonawanda	2	390
Tonawanda Iron Division, American Radiator & Standard Sanitary Corp.	Niagara County: North Tonawanda	1	165
Republic Steel Corp.	Rensselaer County: Troy	1	263
Total		17	5,941

open-pit mines. Ore treatment consisted of concentration, agglomeration, spiraling, jigging, and magnetic separation.

Lead.—Production of recoverable lead dropped to the lowest tonnage at least since 1930. The value also declined sharply because of a lower average price. Lead was mined in New York only at the Balmat mine in St. Lawrence County.

Silver.—Concentration of zinc-lead ore at Balmat, St. Lawrence County, yielded recoverable silver as a byproduct. The output was somewhat higher than in 1957.

Titanium Concentrate (Ilmenite).—The output of ilmenite declined about 25 percent in quantity compared with the record year 1957, owing to lower demand for titania pigment. The titaniferous magnetite ore was mined by National Lead Co. in Essex County and beneficiated nearby.

TABLE 7.—Annual steel capacity (ingots and steel for castings) as of January 1, 1959 [1]

[American Iron and Steel Institute]

Type of furnace and company	Location of plant	Number of furnaces	Total annual capacity (short tons)
OPEN HEARTH			
Republic Steel Corp.	Erie County: Buffalo	9	900,000
Bethlehem Steel Co.	Lackawanna	35	6,000,000
Colorado Fuel & Iron Co.	Tonawanda	3	295,000
Total open hearth		47	7,195,000
ELECTRIC			
Allegheny Ludlum Steel Corp.	Albany County: Watervliet	7	77,000
Do.	Chautauqua County: Dunkirk	3	33,000
Wickwire Brothers, Inc.	Cortland County: Cortland	2	32,400
Allegheny Ludlum Steel Corp.	Erie County: Tonawanda	2	4,500
Simonds Saw & Steel Co.	Niagara County: Lockport	3	21,600
Crucible Steel Co. of America	Onondaga County: Syracuse	11	61,380
Total electric		28	229,920
Grand total		75	7,424,920

[1] Capacities of foundries that normally produce steel only for castings are not included.

TABLE 8.—Mine production of silver, lead and zinc, in terms of recoverable metals

Year	Mine producing	Material sold or treated (short tons)	Silver		Lead		Zinc		Total value (thousands)
			Fine ounces	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1949–53 (average)	2	516,521	34,573	$31	1,371	$415	40,102	$11,513	$11,959
1954	2	662,665	34,576	31	1,187	325	53,199	11,491	11,847
1955	2	650,877	66,162	60	1,037	309	53,016	13,042	13,411
1956	2	657,445	84,158	76	1,608	505	59,111	16,196	16,777
1957	2	660,638	63,880	58	1,667	477	64,659	15,001	15,536
1958	2	563,644	66,738	60	579	136	53,014	10,815	11,011

TABLE 9.—Mine production of silver, lead, and zinc in 1958 by months, in terms of recoverable metals

Month	Silver (fine ounces)	Lead (short tons)	Zinc (short tons)	Month	Silver (fine ounces)	Lead (short tons)	Zinc (short tons)
January	6,059	58	5,652	August	5,633	33	4,562
February	5,547	28	4,081	September	5,150	40	4,300
March	5,636	48	3,858	October	5,198	46	4,826
April	5,166	53	4,243	November	5,562	48	4,169
May	5,806	51	4,124	December	5,562	63	4,297
June	5,217	55	4,243				
July	6,202	56	4,659	Total	66,738	579	53,014

Zinc.—After having a record production and being the leading zinc producing State in 1957, New York slipped to second place in zinc output in 1958. The lower demand for nonferrous metals brought about a reduction from 6- to a 5-day week in early February. The reduced work week, continued throughout the year. Production came from the Balmat and Edwards mines near Gouverneur in southern St. Lawrence County.

MINERAL FUELS

Coke and Coal Chemicals.—New York ranked sixth nationally in quantity of coke produced. Over 2.9 million short tons of coke valued at $49.8 million was produced—a 25-percent decline compared with 1957. Of the 4.3 million tons of coal used for coke, most came from Pennsylvania (64 percent) and the remainder from West Virginia (19 percent), Virginia (11 percent), and Kentucky (6 percent).

Most (79 percent) of the coke was consumed by producing companies for blast-furnace operations and other purposes. The remaining coke was sold to blast-furnace plants, foundries, and other industrial users and for residential heating. Coke byproducts recovered at coke plants included 203,000 short tons of coke breeze, 44,893 million cubic feet of coke-oven gas, 42,944 tons of ammonium sulfate, 2,089 tons NH_3 content of ammonium liquor, 37.9 million gallons of coke-oven tar, and 13.3 million gallons of crude light oil (from which 11.6 million gallons of benzene, 2,877,000 gallons of toluene, 701,000 gallons of xylene, and 78,000 gallons of solvent naphtha were derived).

TABLE 10.—Number, type, and capacities of coke oven plants in New York as of December 31, 1958

Company	Location	Classification of plant	Number and type of ovens	Annual coke capacity (thousand short tons)
Allied Chemical Corp	Erie County: Buffalo	Merchant	120 Semet-Solvay	900
Bethlehem Steel Co	Lackawanna	Furnace	171 Koppers-Becker 60 Semet-Solvay 228 Wilputte	2,514
Donner-Hanna Coke Corp	Buffalo	do	186 Koppers 66 Koppers-Becker	1,169

Peat.—Output of peat rose sharply, as three producers were active compared with only one in 1957. Production was reported from Orange, Seneca, and Westchester Counties and was used mainly for soil improvement.

Petroleum and Natural Gas.—Petroleum production in 1958 dropped one-third from 1957 and represented the lowest output in recent years. No discoveries or extensions or revisions in present fields were reported. According to the American Petroleum Institute, the proved reserve of crude petroleum, as of December 31, 1958, was 35.8 million barrels. Production was obtained largely from Allegany, Steuben, and Cattaraugus Counties in the extreme southwestern part of the State. Of the field wells drilled, all the oil wells and all the service wells were holed out between 1,250 and 2,500 feet; of the gas wells, five were 1,250 to 2,500 feet and three 2,500 to 3,750 feet deep. The dry holes were drilled to depths of 3,750 to 5,000 feet.

TABLE 11.—Well completions and drilling footage for field wells and wildcats, 1958 [1]

Type of well	Fieldwells		Wildcats		Total	
	Well completions	Drilling footage	Well completions	Drilling footage	Well completions	Drilling footage
Crude	256	324,600			256	324,600
Condensate						
Gas	8	22,148	7	23,073	15	45,221
Dry			37	139,456	37	139,456
Service	236	324,600			236	324,600
Total	500	671,348	44	162,529	544	833,877

[1] Source: Oil and Gas Journal, Annual Review Issue: Vol. 57, No. 4, Jan. 26, 1959.

TABLE 12.—Production of sand and gravel by Government-and-contractor operations, by counties, in short tons

County	1957	1958	County	1957	1958
Albany	28,054	211,410	Niagara	24,473	
Allegany		44,623	Oneida	47,250	47,250
Broome	47,584		Onondaga	(1)	75,689
Cattaraugus	69,109		Ontario	35,063	1,054
Cayuga	8,235	7,380	Orange	102,222	85,680
Chautauqua	10,424	641,079	Orleans	12,655	15,258
Chemung	9,604		Oswego	38,750	37,800
Chenango	7,887		Otsego	29,632	20,250
Clinton	90,563	78,809	Rensselaer	97,565	141,357
Columbia	4,631		St. Lawrence	70,200	278,341
Cortland	25,000	8,375	Saratoga	84,905	262,546
Delaware	37,768	5,000	Schenectady		97,624
Dutchess	14,704	20,349	Schoharie	4,462	
Erie	316,391	461,960	Schuyler	21,304	35,723
Essex	124,891	18,805	Steuben	156,600	
Franklin	31,050	181,773	Suffolk	36,619	39,982
Fulton	29,109	11,726	Sullivan	78	
Genesee	34,010	29,718	Ulster	5,486	
Greene	23,166	3,746	Warren		31,590
Herkimer	16,863	26,112	Washington	28,663	37,482
Jefferson	50,415	186,115	Wayne	42,514	28,976
Lewis	1,431	8,248	Yates	76,123	78,300
Livingston	(1)	40,000	Undistributed	71,607	
Monroe	15,900	4,452			
Montgomery		2,484	Total	1,982,960	3,307,066

[1] Figure withheld to avoid disclosing individual company confidential data.

Natural gas output also dropped. Production was mostly from the Oriskany and Medina horizons; no distribution by counties is available. As of January 1, 1959, the gas reserve according to the American Gas Association, was 96,439 million cubic feet. Gas strikes in wildcat drillings were brought in at 1,250 to 2,500 feet (one), 2,500 to 3,750 feet (three), and 3,750 to 5,000 feet (three). Deep exploration for gas was started by independents, gas companies, and subsequently by major oil and gas companies in the Appalachian province.

Four petroleum refineries were in operation. Daily crude capacity at the plants, as of January 1, 1959, was 102,500 barrels. Refineries in operation were Frontier Oil Refining Co., Division Ashland Oil & Refining Co. (North Tonawanda), Gulf Oil Corp. (Staten Island), and Mobil Oil Co., with plants at Brooklyn and Buffalo.[3]

REVIEW BY COUNTIES

Production of metals and nonmetals was reported in 56 of New York's 62 counties in 1957. St. Lawrence, Erie, Columbia, Essex, and Greene Counties, in decreasing order of value, were the centers of greatest mineral activity.

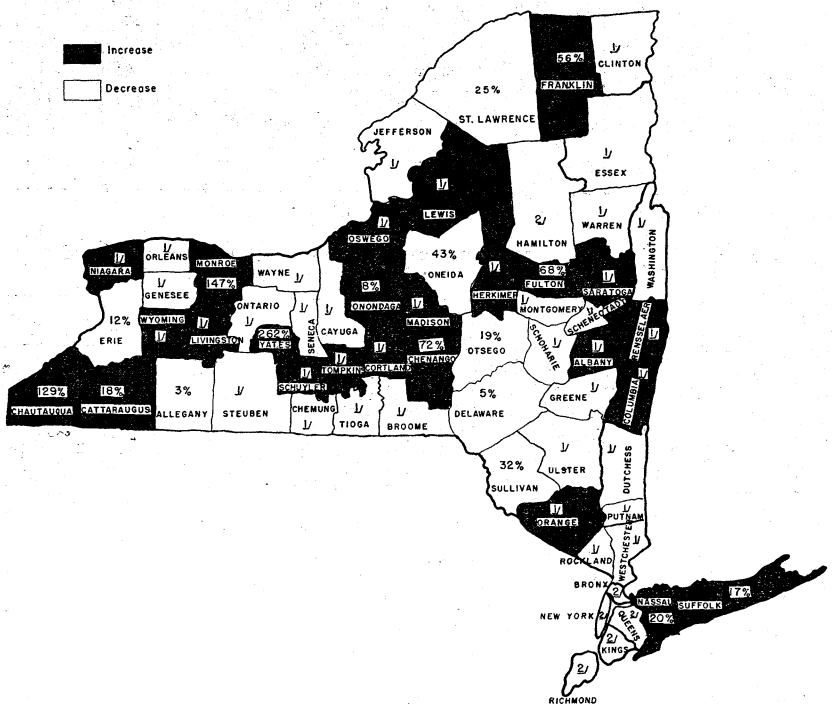

FIGURE 2.—Change in value of county mineral production, 1957–58.

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] No production recorded.
[3] Oil and Gas Journal, vol. 57, No. 14, Mar. 30, 1959.

TABLE 13.—Value of mineral production in New York, by counties[1 2 3]

County	1957	1958	Minerals produced in 1958 in order of value
Albany	(4)	(4)	Stone, sand and gravel, clays.
Allegany	$369, 239	$359, 422	Sand and gravel.
Broome	(4)	(4)	Sand and gravel, stone, clays.
Cattaraugus	705, 450	329, 312	Sand and gravel.
Cayuga	(4)	(4)	Stone, sand and gravel.
Chautauqua	193, 817	444, 155	Sand and gravel.
Chemung	(4)	(4)	Sand and gravel, clays.
Chenango	87, 312	150, 020	Sand and gravel.
Clinton	(4)	(4)	Iron ore, stone, lime, sand and gravel.
Columbia	(4)	(4)	Cement, sand and gravel, stone.
Cortland	(4)	111, 431	Sand and gravel.
Delaware	799, 634	758, 229	Stone, sand and gravel.
Dutchess	(4)	(4)	Stone, sand and gravel, clays, gem stones.
Erie	21, 728, 108	19, 091, 801	Cement, sand and gravel, gypsum, stone, lime, clays.
Essex	(4)	(4)	Iron ore, titanium concentrate, wollastonite, sand and gravel, garnet, gem stones.
Franklin	75, 222	192, 782	Sand and gravel, stone.
Fulton	36, 449	61, 364	Sand and gravel.
Genesee	(4)	(4)	Gypsum, stone, sand and gravel.
Greene	(4)	(4)	Cement, stone, sand and gravel.
Herkimer	(4)	(4)	Stone, sand and gravel, gem stones.
Jefferson	(4)	(4)	Do.
Lewis	(4)	(4)	Stone, sand and gravel.
Livingston	(4)	(4)	Salt, sand and gravel.
Madison	(4)	338, 481	Stone, sand and gravel, gem stones.
Monroe	1, 067, 443	2, 633, 130	Stone, sand and gravel, gypsum, gem stones.
Montgomery	(4)	424, 756	Stone, sand and gravel.
Nassau	5, 260, 847	6, 337, 330	Sand and gravel, clays.
Niagara	(4)	(4)	Stone, lime, sand and gravel, gem stones.
Oneida	2, 841, 999	1, 630, 230	Stone, sand and gravel, crude iron oxide pigments.
Onondaga	11, 661, 712	12, 580, 611	Stone, salt, cement, sand and gravel, clays.
Ontario	(4)	(4)	Stone, sand and gravel.
Orange	(4)	(4)	Sand and gravel, clays, stone, peat, gem stones.
Orleans	(4)	(4)	Stone, sand and gravel.
Oswego	(4)	(4)	Sand and gravel.
Otsego	74, 072	(4)	Do.
Putnam	(4)	31	Gem stones.
Rensselaer	(4)	(4)	Stone, sand and gravel.
Rockland	(4)	(4)	Stone, sand and gravel, gem stones.
St. Lawrence	40, 981, 733	30, 929, 412	Iron ore, zinc, talc, stone, sand and gravel, lead, silver, gem stones.
Saratoga	(4)	(4)	Sand and gravel, stone, gem stones.
Schenectady	370, 531	(4)	Sand and gravel.
Schoharie	(4)	(4)	Cement, stone.
Schuyler	(4)	(4)	Salt, sand and gravel.
Seneca	(4)	(4)	Peat.
Steuben	338, 934	(4)	Sand and gravel.
Suffolk	4, 846, 887	5, 651, 386	Do.
Sullivan	343, 068	235, 000	Sand and gravel, stone.
Tioga	(4)	(4)	Sand and gravel.
Tompkins	(4)	(4)	Salt, sand and gravel, stone.
Ulster	(4)	(4)	Stone, cement, clays, sand and gravel, gem stones.
Warren	(4)	(4)	Cement, garnet, stone, sand and gravel, gem stones.
Washington	(4)	801, 466	Stone, sand and gravel.
Wayne	(4)	(4)	Do.
Westchester	(4)	(4)	Stone, emery, sand and gravel, peat, gem stones.
Wyoming	(4)	(4)	Salt, stone.
Yates	7, 574	27, 406	Sand and gravel.
Undistributed[5]	152, 324, 383	121, 332, 325	
Total	244, 114, 000	204, 920, 000	

[1] Bronx, Hamilton, Kings, New York, Queens, and Richmond Counties are not listed because no production was reported.

[2] Fuels, including natural gas and petroleum, not listed by counties, but value is included with "Undistributed."

[3] Excludes value of clays and stone used in manufacturing lime and cement.

[4] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[5] Includes values of items not specified by counties and data indicated by footnote 4.

Albany.—Limestone for riprap, blast-furnace flux, concrete aggregate, railroad ballast, and agricultural uses was produced at Plant No. 1 (South Bethlehem) of Callanan Road Improvement Co. The nearby company sand and gravel plant was not operated. Sand and gravel output from eight pits consisted mainly of buildings and molding sand and paving gravel. Albany Gravel Co., Inc., the leading producer, operated five pits. The company installed equipment for treating usable fines at its Cedar Hill plant. Molding sand was produced by Whitehead Bros. at Selkirk and Slingerland. Bank-run paving gravel was recovered at Selkirk.

Albany County replaced Ulster as the leading clay-producing area. Miscellaneous clay used chiefly for manufacturing building brick was mined near Coeymans and Albany. Expanded clay was produced at the Cohoes plant of Northern Lightweight Aggregate, Inc. The company utilized a 10- by 200-foot rotary kiln in processing clay into lightweight aggregate (Norlite). Rex Clay Products Co. Inc. (Albany), mined and sold miscellaneous clay used primarily for manufacturing artificial abrasives. Building brick was made from miscellaneous clay mined near Coeymans by Roah Hook Brick Co., Powell & Minnock Brick Works, Inc., and Sutton & Suderley Brick Co. Production of miscellaneous clay totaled 180,000 short tons.

Allegany.—Building and paving sand and gravel and fill sand were produced at Alfred, Belmont, and Wellsville.

Bronx.—National Gypsum Co. calcined crude gypsum by the kettle process at its Bronx plant. The company also expanded perlite shipped from outside the State at the plant.

Broome.—Sand and gravel was produced near Binghamton and Vestal and consisted principally of building and paving material. Sandstone used as riprap and concrete aggregate was quarried near Binghamton by Corbisello Quarries. Dimension bluestone (sandstone) was quarried at unspecified locations in the county and shipped to fabricating yards in Delaware County. Stone used as veneer and flagstone was quarried near Lakeside, Pa. Miscellaneous clay used in manufacturing building brick was produced by Binghamton Brick Co., Inc. (Binghamton).

Cattaraugus.—Production of sand and gravel totaling 751,000 tons was reported from eight operations. Output, consisting mainly of building and paving material, came from pits near Allegany, Gowanda, Onoville, and Red House.

Cayuga.—General Crushed Stone Co. quarried and crushed limestone near Auburn for use as concrete aggregate, roadstone, railroad ballast, and asphalt filler. The company improved plant facilities by installing a new stone crusher. Building and paving sand and gravel were recovered from two pits near Auburn.

Chautauqua.—Sand and gravel used mainly for paving and building material was produced at pits near Jamestown, Bemus Point, and Dunkirk.

Chemung.—Building and paving sand and gravel was produced at Elmira and Horseheads. Miscellaneous clay was mined from an open pit near Horseheads by Consolidated Brick Co. Output was used exclusively for manufacturing building brick.

Chenango.—Sand and gravel was produced by Bundy Concrete Co. (Sherburne) and B&B Builders Supplies (Greene). Output consisted mainly of building and paving material.

Clinton.—Magnetite iron ore was mined by the Republic Steel Corp. at its Chateaugay open-pit and underground mine at Lyon Mountain. Output was curtailed due to idleness in the first 8 months of the year. The open-pit portion of the mine was single face, with an average face height of 35 feet. Underground mining operations were carried on entirely by sublevel stoping. Development consisted of 106 feet of raising and 380 feet of tunneling. Large quantities of water were taken from surface reservoirs, chlorinated, and used at the mine and preparation plants. Ore treatment consisted of washing, screening, crushing, grinding, and burning (sintering), and a quantity of old tailings were re-treated. Treatment included concentrations and processing through a Dwight-Lloyd sintering plant. Production (sinter) was consumed in making pig iron and steel. Republic Steel Corp. also recovered gneiss (miscellaneous stone) from waste mine material for use as concrete aggregate, railroad ballast, and stone sand.

International Lime & Stone Corp. produced limestone near Chazy for use as riprap, blast-furnace and open-hearth flux, concrete aggregate, and agstone and for manufacturing lime at its nearby plant. Quicklime and hydrated lime were produced at the Chazy plant in two shaft kilns and a batch hydrator. Output was sold for use in the construction, chemical, and other industries and as agricultural lime. The lime was shipped for consumption in New York, Canada, Maine, Rhode Island, and New Hampshire. Limestone for riprap and concrete aggregate was also produced near Plattsburg by Lancaster Development, Inc. Bero Construction Co. (Morrisonville), producers of sand and gravel, did not operate in 1958.

Columbia.—Columbia was the leading cement-producing county. Producers were Universal Atlas Cement Division of United States Steel Corp. (Hudson) and Lone Star Cement Corp. (Greenport). These companies quarried limestone nearby for use in manufacturing cement. Shale and gypsum were also used as raw materials. The bulk of cement was consumed in New York; quantities were also shipped to New Jersey and New England. Lone Star Cement Corp. increased plant capacity by adding an additional kiln. Facilities were also improved by adding a new primary crusher and electrostatic dust-collection system and by rehabilitating the grinding departments. Sand and gravel used mainly as building and paving material was recovered from three operations. The Stuyvesant sand and gravel operation of Whitehead Brothers Co. was idle.

Cortland.—Building, paving, and other sand and gravel were produced at Cortland by Cortland Ready Mix Concrete Co.

Delaware.—In terms of value, Delaware continued as the leading sandstone (bluestone)-producing county. Output totaled 21,000 tons valued at $756,000 and consisted entirely of dimension stone used for construction and architectural purposes and as curbing and flagging. Stone quarried in Delaware and surrounding New York counties and Wayne County, Pa., was dressed at yards near Deposit, East Branch,

Hancock, and Masonville. Dimension stone produced in the county was used in constructing hospitals, churches, and other buildings in New York and Connecticut.

Dutchess.—Dutchess County continued to rank second in value of limestone. Producers were New York Trap Rock Corp. (New Hamburg) and Dutchess Quarry & Supply Co., Inc. (Pleasant Valley). Commercial sand and gravel totaling 376,000 tons was recovered at 13 operations throughout the county. Output consisted of material used for building, paving, fill, and other purposes. Miscellaneous shale was mined near Beacon by Dennings Point Brick Works, Inc., and used for manufacturing building brick. Quartz specimens were recovered near Rhinebeck by an amateur gem and mineral collector.

Erie.—Erie County ranked second in total mineral value and third in cement production. Portland and masonry cements were produced at plants near Buffalo by Lehigh Portland Cement Co. and Penn-Dixie Cement Corp. Masonry cement was produced near Akron by Louisville Cement Co. Raw materials used included limestone, shale, clay, sand, gypsum, and iron ore. Most of the cement produced was consumed in New York and Pennsylvania; some was shipped to New England. Erie County ranked third in valuation of commercial sand and gravel, as production totaling 2 million tons was reported. Eleven operations were active during the year and produced mostly prepared material used mainly for building and paving purposes. Quantities of filter sand and fill and other sand and gravel also were produced.

Crude gypsum was mined near Clarence by Bestwall Gypsum Co. The output was shipped to the company-owned plant at Akron, where the material was calcined and made into finished building material. Crude perlite from outside the State was also expanded at the Akron plant. Expanded perlite was used exclusively for plaster aggregate. National Gypsum Co. mined and calcined gypsum and processed crude perlite at Clarence Center. Expanded perlite was also produced by Buffalo Perlite Corp. (Cheektowaga) from crude material from Western States. Limestone used chiefly for concrete aggregate, roadstone, and riprap was produced at quarries near Cheektowaga, Bowmansville, and Lancaster.

Quicklime and hydrated lime used principally for metallurgical purposes were produced at the Buffalo plant of Kelly Island New York Corp. Lime was produced in rotary kilns and a continuous hydrator. Bituminous coal was used for fuel. Early in 1958 Anchor Concrete Products, Inc., acquired the property of John H. Black Co., Inc. (Jewettsville). The company mined and processed miscellaneous clay for lightweight aggregate. Miscellaneous clay used principally for manufacturing building brick was also mined and processed near Lakeview and Orchard Park. Limited quantities of clay used for manufacturing flower pots were mined near Buffalo.

Essex.—Republic Steel Corp. New Bed-Harmony-Old Bed open-pit mine at Mineville and National Lead Co. MacIntyre underground mine at Tahawus produced magnetite. The Republic Steel Corp. Fisher Hill mine was idle in 1958. Shipments of direct-shipping ore, concentrate, and sinter were consumed largely in making pig iron and

steel, with smaller quantities for paint, cement, and unspecified uses. The second largest mine in New York was in Essex County. National Lead Co. also mined titaniferous magnetite at Tahawus.

Building and paving sand and gravel was recovered from operations near Saranac Lake. Cabot Carbon Co. recovered wollastonite and byproduct abrasive garnet (andradite) at its Willsboro mine. The wollastonite was crushed and ground for use as a filter in ceramics, paints, and plastics. Specimens of garnet and wollastonite were collected near Willsboro.

Franklin.—Sand and gravel consisting mainly of bank-run material was produced at Brighton, Brushton, Malone, and St. Regis Falls. Rough construction sandstone used on the St. Lawrence Seaway near Massena was quarried near Burke by Adirondack Stone Quarries, Inc. Franklin-Clinton Sandstone Co., Inc. (Burke), quarried and fabricated dressed architectural sandstone.

Fulton.—Six commercial pits near Ephrata, Gloversville, Johnstown, and Northville yielded 46,000 tons of sand and gravel. Art Stone Co. (Gloversville) installed new material-handling equipment to facilitate processing building sand used for manufacturing concrete products.

Genesee.—Crude and calcined gypsum were produced near Oakfield by United States Gypsum Co. The company also expanded perlite. Sand and gravel used mainly for building and paving purposes was produced at two stationary plants near Batavia. Crushed limestone was produced at quarries near Leroy and Stafford. Output was used mainly for concrete aggregate, roadstone, and railroad ballast.

Greene.—The county dropped from first in valuation of cement in 1957 to second in 1958. Producers of cement were Alpha Portland Cement Co. (Cementon), Lehigh Portland Cement Co., and North American Cement Corp., both near Alsen. These companies also quarried limestone for their own use in manufacturing cement. In addition to limestone, quantities of clay, gypsum, and iron ore were used as cement raw materials. Most of the cement output was consumed in New York and New England; some was exported. Production at the Alsen plant of Lehigh Portland Cement Co. was curtailed from June 10 to September 22, owing to a labor dispute. Crushed sandstone for concrete aggregate and roadstone was quarried near Cairo. Prepared molding sand was produced at Catskill and Coxsackie. Unprepared sand for icy highways was recovered at Windham.

Herkimer.—General Crushed Stone Co. produced limestone used for concrete aggregate, agstone, and asphalt filler at its quarry near Jordanville. Newport Quarries, Inc. (Newport), resumed production of limestone used for concrete aggregate and roadstone. Building sand and fill gravel were produced near Poland. A limited quantity of quartz specimens was recovered near Middleville.

Jefferson.—Limestone was quarried near Watertown by General Crushed Stone Co. for use as agstone and for highway and railroad construction and maintenance. The highway departments of the towns of Cape Vincent and Lynn, produced limestone for concrete

aggregate and roadstone. Output totaling 147,000 tons of sand and gravel came from six operations throughout the county in 1958. Fifty pounds of hematite was collected near Antwerp by an amateur gem and mineral collector.

Lewis.—Carbola Chemical Co., Inc. (Natural Bridge) quarried and crushed low-magnesium limestone used at paper mills, as a filler in soap and insecticides, and as a whiting compound.

Livingston.—The county continued to rank first in value of salt output. Rock salt used mainly in chemicals and for highway ice removal was recovered from the Retsof underground mine of International Salt Co. Most of the salt was consumed in New York and other Northeastern States. Some was exported to Canada. Building sand and gravel and filter sand were produced at the Avon and Scottsville plants of Valley Sand and Gravel Corp. Bank-run sand was recovered near Conesus.

Madison.—Limestone used mainly for highway construction and maintenance and agstone was quarried near Munnsville and Perryville. Building sand and gravel was produced near Hamilton by Cossitt Concrete Products. Celestite specimens were recovered in the county near Chittenango and Cazenovia by mineral collectors.

Monroe.—Dolomite Products Co. operated two quarries at Penfield and Gates and produced limestone used chiefly for concrete aggregate. Limestone for concrete aggregate was also quarried near Sweden by Central Materials Corp. Commercial production of sand and gravel totaled 629,000 tons. Output was reported from six producers with operations near Irondequoit, Ogden, Penfield and Spencerport. Most of the output was used for structural purposes. Crude gypsum recovered from the nearby Wheatland mine was calcined and processed into building materials at the Caledonia plant of the Ruberoid Co. A mineral collector recovered dolomite specimens near Rochester.

Montgomery.—Crushed Rock Products, Inc., quarried limestone near Amsterdam. Commercial production of sand and gravel in the county came from the St. Johnsville operation of St. Johnsville Supply Co., Inc. Most of the output was prepared and sold for paving material.

Nassau.—Nassau County dropped to second among the State's sand-and-gravel-producing counties. Output totaled 4.8 million tons, 21-percent decrease compared with 1957. Ninety-eight percent of the output was washed, screened, or otherwise prepared. Nassau Brick Co., Inc., mined miscellaneous clay from a pit near Farmingdale for use in manufacturing building brick.

Niagara.—Limestone used chiefly for concrete aggregate and roadstone was produced at quarries near Niagara Falls, Lockport, and Gasport. Niagara Stone Corp. changed its name to Niagara Stone Division, Olsker-McLain Industries, Inc. Sand and gravel used mainly for building and paving material was produced at Lockport by Gasport Sand & Gravel Co., Inc. Twenty pounds of calcite was collected near Lockport. Artificial graphite was manufactured at plants near Niagara Falls by National Carbon Co., Division of Union Carbide Corp., and Great Lake Carbon Corp. E. I. duPont de Nemours & Co., Inc., and Olin-Mathieson Chemical Corp. recovered atmospheric nitrogen used to make anhydrous ammonia at plants near Niagara Falls.

Oneida.—Eastern Rock Products, Inc., operated the Prospect No. 6 and Oriskany Falls No. 5 quarries and produced limestone used as riprap, agstone, and concrete aggregate. Commercial output totaling 432,000 tons of sand and gravel was reported from seven operations in the county. Output consisted mainly of prepared material used for building and paving purposes, as well as molding and filter applications. Clinton Metallic Paint Co. recovered crude iron oxide pigment from the Brimfield underground mine near Clinton. The Utica plant of Zonolite Co. continued to be the only producer of exfoliated vermiculite in the State. The company processed crude vermiculite, mainly from company-owned mines in Lincoln County, Mont., and Spartansburg County, S.C., and partly imported from the Union of South Africa.

Onondaga.—The county ranked first in value of limestone production. Limestone was produced at two quarries near Jamesville. Portland and masonry cement was produced at Jamesville by Alpha Portland Cement Co. Limestone, shale, sand, and iron ore were used as cement raw materials. The output of portland cement was consumed primarily in New York and New Jersey. The entire output of masonry cement was consumed in New York. Solvay Process Division, Allied Chemical Corp., operated wells at Tully and a plant at Syracuse for producing evaporated salt and brine. The brine was used in manufacturing chemicals. The evaporated salt was produced in vacuum pans and used mainly in chemicals.

Commercial production of sand and gravel totaled 613,000 tons, a 36-percent drop from 1957. Output was reported from nine operations and consisted mainly of building and paving material. Onondaga Brick Corp., Warners, mined and processed miscellaneous shale used for lightweight aggregate. Syracuse Pottery Co., Inc., Syracuse, mined miscellaneous clay used for manufacturing flowerpots; during the year the company scrapped three periodic kilns and enlarged its plant. The Cicero clay pit and brick plant of Syracuse Brick Corp. was inactive during the year. Mineral Processing Corp. expanded crude perlite from California at its Syracuse plant.

Ontario.—Limestone used for highway and railroad construction and maintenance was produced at the Oaks Corners quarry of General Crushed Stone Co. Sand and gravel production was reported from five commercial operations and totaled 305,000 tons. Output was centered mainly near Manchester, Phelps, and Victor.

Orange.—Eight commercial sand and gravel producers were active. The output totaled 565,000 tons and was mainly prepared material used for structural and paving purposes. The Jova Brick Works (Newburgh) produced miscellaneous clay for manufacturing building brick. Limestone was quarried near Goshen by Dutchess Quarry & Supply Co., Inc. The output was used as concrete aggregate and riprap. Reed-sedge peat was recovered from a bog near Tuxedo Park by Sterling Forest Peat Humus Co. Specimens of quartz were collected near Ellenville during the year.

Orleans.—Clarendon Stone Co., Inc., quarried limestone near Clarendon for use as concrete aggregate, roadstone, and asphalt filler. Gravel for fill and building and paving sand and gravel were recovered near Albion.

Oswego.—Sand and gravel was recovered from operations near Lacona, Pulaski, and Scriba. The output consisted of molding sand and building and paving material.

Otsego.—Prepared building and paving sand and gravel was produced near Milford by Seward Gravel. Building sand and gravel was recovered at Unadilla by Unadilla Concrete Products Co.

Putnam.—Specimens of magnetite, opal, and serpentine were recovered from the Tilley Foster mine by gem and mineral specimen collectors. The Patterson quarry of Eastern Mineral Company, Inc., did not produce.

Rensselaer.—Crushed and broken basalt used entirely for concrete aggregate and roadstone was recovered from the Campbell Mountain Quarry (Brunswick) of Fitzgerald Bros. Construction Co. Nine sand and gravel operations were active, mainly in the western section of the county. The output consisted mainly of bank-run gravel used chiefly as building and paving material. Albany Gravel Co., the leading producer, opened a new gravel pit near East Nassau. Bleau Brick Works, Inc. (Troy), and Champlain Brick Co., Mechanicville, were both idle.

Richmond.—United States Gypsum Co. processed crude gypsum at its New Brighton plant.

Rockland.—Rockland County continued to lead in total output and value of stone among the State's 36 stone-producing counties. Limestone used exclusively for concrete aggregate was produced by New York Trap Rock Corp. at Tompkins Cove. Obsolete loading equipment was replaced at the operation. The company also was the major producer of basalt in the State; output from its Haverstraw and West Nyack quarries was crushed and broken for use as riprap, concrete aggregate, roadstone, railroad ballast, and stone sand. The bulk of the output from the Haverstraw quarry was shipped by barge and from the West Nyack quarry by truck to markets in the metropolitan New York area. The company constructed a new crushing plant at the West Nyack quarry. Basalt for railroad ballast and concrete aggregate was also quarried at Suffern.

Output of sand and gravel totaled 548,000 tons and came from operations near Hillburn, Mount Ivy, Sparkill, Stony Point, and Thiells. Output consisted mainly of building and paving material. Amateur mineral collectors recovered specimens of graphite and sphene near Suffern. Crude gypsum was calcined and processed into building materials by United States Gypsum Co. at Stoney Point.

St. Lawrence.—Iron ore (magnetite) was mined by Jones & Laughlin Steel Corp. at its Benson open-pit mine 2 miles east of Star Lake in the southern part of the county. The ore, which averaged 24.26 percent iron, was sintered and shipped for use in manufacturing pig iron and steel. The mine comprised three benches, averaging 50 feet high and 200 feet wide. Ammonium nitrate and fuel oil were used in blasting. Diesel trucks were employed in haulage. Treatment of the ore consisted of screening, crushing, grinding, burning, sintering, pulping, flotation, and jugging.

Lead, zinc, and silver were recovered by St. Joseph Lead Co. from lead-zinc ore (Edwards mine) and zinc ore (Balmat mine). Open stoping was used at both mines. The Balmat No. 2 shaft reached a

depth of 73 feet below the 2,500-foot level. Inclined at 40° from the horizontal, this shaft is 3,878 feet long. Development at the Balmat mine included 547 feet of shaft sinking, 5,801 feet of raising, 7,905 feet of drifting, underground diamond drilling totaling 27,002 feet, and 88,204 feet of long-hole drilling. Some 2,000 gallons of water a minute obtained from nearby lakes was chlorinated for use in the plant. Treatment before flotation consisted of screening, crushing, grinding, and drying. Mine haulage was by rail and skip, powered by storage battery and diesel.

Edwards mine-development included 1,551 feet of raising, 3,406 feet of drifting, 6,407 feet of underground diamond drilling, and 2,000 feet of long-hole drilling. Water was used at a rate of over 700 feet a minute and consisted of both stream and ground water. Virtually all the water was returned to surface flow. Mine haulage consisted of rail and skip hoist. Over 3,000 roof bolts were used in 1958 in both mines to improve safety and reduce dilution of the ore.

The zinc-lead ore was treated at the 1,800-ton flotation mill at Balmat and the zinc ore at a 600-ton flotation mill at Edwards. New mechanical flotation machines treated half of the Balmat tonnage and resulted in savings in power and reagents and an increase in zinc recovery. Zinc concentrate was shipped to the company smelter at Josephtown, Pa. Lead concentrate from Balmat and lead residue from Josephtown were shipped to the Herculaneum, Mo., smelter of St. Joseph Lead Co. for recovery of lead and silver.

Crude talc was mined and ground at company-owned plants at Gouverneur by International Talc Co., Inc., and Gouverneur Talc Co., Inc. During the year Gouverneur Talc Co., Inc., improved its plant facilities by installing new storage bins at the grinding mill. Crushed marble used as agstone and concrete aggregate was quarried near Gouverneur by Balducci Crushed Stone Co. Limestone, used chiefly for concrete aggregate and roadstone, was quarried near Norwood and Ogdensburg. Commercial production of sand and gravel in the county totaled 271,000 tons and was reported from seven operations throughout the county. The output consisted mainly of bank-run material for use in the construction industry.

Various mineral specimens were recovered near Balmat, Fowler, and Gouverneur. The output included asbestos, calcite, hexagonite, pyrite, sphalerite, serpentine, talc and tremolite.

Saratoga.—Commercial sand and gravel, consisting chiefly of molding sand, was recovered from seven operations mainly near Clifton Park, Gansevoort, and Ushers. Output totaled 125,000 tons, a 15-percent drop from 1957. Glens Falls Portland Cement Co. quarried limestone near Glens Falls for its own use in manufacturing cement at the company plant in Warren County. Limestone used for riprap, concrete aggregate, railroad ballast, and lime manufacture was quarried near Saratoga Springs by Pallette Stone Corp. Beryl specimens were recovered near Batchelorville.

Schenectady.—Sand and gravel output by commercial producers was reported from four operations—three near Schenectady and one near Scotia. Output was used mainly as building and paving material.

Quantities of bank-run sand and gravel for fill material also were produced.

Schoharie.—North American Cement Co. quarried and crushed limestone near Howes Cave for its own use in manufacturing cement at its nearby plant. The company began initial production of masonry cement. In addition to limestone, shale, gypsum, and iron ore were used as cement raw materials. Shipments of finished cement were chiefly to consumers in New York, Massachusetts, and other New England States. Limestone used principally for concrete aggregate and agstone was also produced by Cobleskill Stone Products Division, Allied Materials Corp. (Cobleskill) and Masick Soil Conservation Co. (Schoharie).

Schuyler.—International Salt Co., Inc., and Watkins Salt Co., both near Watkins Glen, produced evaporated salt. Building sand and paving gravel was also produced near Watkins Glen.

Seneca.—Finger Lakes Peat Moss Co. produced moss peat near Junius.

Steuben.—Sand and gravel used chiefly in construction was produced near Bath, Cohocton, and Corning.

Suffolk.—Suffolk County replaced Nassau County as the leading sand-and-gravel-producing county. Commercial output of sand and gravel increased from 4,861,000 tons in 1957 to 5,081,000 in 1958. Eighty-one percent of the total county commercial output was washed, screened, or otherwise prepared. Output was reported from 14 operations throughout the county and was used principally for building and paving material.

Sullivan.—Paving sand and gravel was recovered mainly from three operations near Liberty, Mongaup Valley, and Summitville. Dimension sandstone (bluestone) was quarried at unspecified locations and prepared in Delaware County for use as architectural stone, rubble, curbing, and flagging.

Tioga.—Building and paving sand and gravel was recovered from pits near Barton and Oswego.

Tompkins.—Cayuga Rock Salt Co. recovered rock salt from its underground mine near Myers. The output was used largely for ice removal on highways, mainly in New York. Evaporated salt was produced in vacuum pans at the Ludlowville refinery of International Salt Co., Inc. Sand and gravel, consisting mainly of prepared building material, was produced at two stationary plants near Ithaca. Dimension sandstone was quarried at the University quarry of Finger Lakes Stone Co., Inc. Output consisted of rubble, sawed and dressed architectural stone, and flagging and was used in constructing the Civil Engineering Building, Cornell University (Ithaca), and other buildings in the State.

Ulster.—Limestone used chiefly for concrete aggregate and roadstone was produced at plant No. 3 of Callanan Road Improvement Co. near Esopus. The company replaced two gyratory crushers at the plant with a cone crusher. The Jockey Hill quarry of Richard F. Dunn Estate (Elizabeth M. Dunn, executrix) was idle. Century Cement Mfg. Co., Inc., produced natural and masonry cements at Rosendale. Masonry cement output was shipped for con-

sumption principally in New York, New Jersey, and Pennsylvania. Some was exported to Canada.

The Hutton Co., Kingston, produced miscellaneous clay for building brick. Miscellaneous clay used for manufacturing common brick was also mined near Kingston by Hammond Saginaw Corp. (formerly Star Brick Corp.). The Saugerties clay pit and brick plant of Elva S. Staples was idle. Prepared paving sand and gravel was produced at the Wawarsing operation of the Dutchess Quarry & Supply Co. An amateur gem and mineral collector recovered quartz specimens near Ellenville.

Warren.—Portland and masonry cement was produced by Glens Falls Portland Cement Co., mainly from limestone quarried in Saratoga County. Gypsum, iron ore, slag, and sand were also used as cement raw materials. Destinations of the finished cements were markets in New York and New England. Barton Mines Corp. mined and processed abrasive garnet at North Creek. The refined garnet was used in manufacturing sandpaper and for grinding and polishing glass. Limestone used exclusively for concrete aggregate and roadstone was quarried near Glens Falls. The county led in gem and mineral specimen valuation with crude and finished garnet, hornblende, and labradorite recovered in the County.

Washington.—Slate was quarried by 10 producers near Granville, Middle Granville, and Whitehall. Dimension slate consisted mainly of roofing slate and flagging material. Ground slate was used mainly for manufacturing natural and artificially colored roofing granules. The Middle Falls quarry of Hudson Valley Sand & Stone Co. was sold on May 1 to Batten Kill Stone, Inc. No production was reported in 1958. Bank-run sand and gravel used mainly for paving was produced at pits near Argyle, Clemons, Fort Ann, and Hebron.

Wayne.—Limestone used as agstone and for highway and railroad construction and maintenance was quarried near Sodus by General Crushed Stone Co. Commercial production of sand and gravel was reported from operations near Galen and Palmyra.

Westchester.—White dolomitic marble was quarried and crushed at Thornwood by Universal Marble Products Corp. The marble was used as a filler in asphalt, hand soap, adhesive, sweeping compound, asbestos, and roofing. Quantities were also used as terrazzo, cast stone, agricultural lime, and for chemical purposes. Quantities of the terrazzo and cast stone marble were used in constructing floors for storing ammunition on battleships.

Emery was recovered from the DeLuca No. 1 (Peekskill) and DeLuca No. 2 (Croton) mines of DeLuca Emery Mine and the Kingston mine of DiRubbo & Ellis. Colbate Emery Co. (Peekskill) operated the Kingston mine for DiRubbo & Ellis. Output from the mine was shipped to plants in Massachusetts for general abrasive purposes. Output from both DeLuca mines was shipped to a plant at Peekskill for use as aggregate in heavy-duty, nonslip floors. Sand and gravel was produced at pits near Bedford, Carmel, and Peekskill. A new conveyor system was installed at the Peekskill plant of Peekskill Masons Supply Co. Humus peat was recovered from bogs near Armonk by Stone Age Humus Co. Beryl, rose quartz, and other mineral specimens were recovered near Bedford.

Wyoming.—Morton Salt Co. produced evaporated salt by the open-pan and vacuum-pan processes at its Silver Springs plant. Dimension sandstone (bluestone) as rough construction and sawed and dressed architectural stone was quarried at the Ambluco quarry (Portageville) of American Bluestone Co. Part of the stone was used in constructing interiors of public schools in New York City.

Yates.—Paving sand and gravel was produced by road-maintenance crews of the town of Jerusalem.

The Mineral Industry of North Carolina

This chapter has been prepared under a cooperative agreement for collecting mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of North Carolina.

By James L. Vallely,[1] Jasper L. Stuckey,[2] and Mildred E. Rivers [3]

NONMETALLICS comprised more than 90 percent of North Carolina's 1958 mineral production; stone and sand and gravel supplied 63 percent of the total. In order of value, stone, sand and gravel, lithium minerals, mica, clays and talc were the principal nonmetallics mined. Including lithium minerals in the State total for the first time since 1954 contributed to the increase in value.

TABLE 1.—Mineral production in North Carolina [1]

Mineral	1957		1958	
	Thousand short tons (unless otherwise stated)	Value (thousand)	Thousand short tons (unless otherwise stated)	Value (thousand)
Abrasive stone (millstones)	(2)	$5	(2)	$2
Beryllium concentrate—short tons	1	1	(3)	(3)
Clays [4]	2,392	1,407	2,047	1,187
Feldspar—thousand long tons	233	2,728	(3)	(3)
Gem stones	(2)	(5)	(2)	1
Gold (recoverable content of ores, etc.)—troy ounces	1,373	48	876	31
Lead (recoverable content of ores, etc.)—short tons	9	3		
Mica:				
Scrap	53	1,173	51	1,041
Sheet—pounds	577,607	1,575	521,701	1,722
Sand and gravel	6,829	5,724	7,044	5,880
Silver (recoverable content of ores, etc.)—troy ounces	12,347	11	15,157	14
Stone	[6] 9,455	[6] 12,839	12,385	19,132
Talc and pyrophyllite	121	558	126	614
Tungsten concentrate (60 percent WO_3 basis)	2	(3)	(3)	(3)
Zinc	2	(5)		
Value of items that cannot be disclosed: Abrasive stone (grinding pebbles and tubemill liners), asbestos, copper, kaolin, lithium minerals (1958), olivine, slate (1957), stone (1957, crushed limestone, marble, sandstone, basalt and dimension granite and marble), and values indicated by footnote 3		11,498		10,267
Total North Carolina		37,570		39,891

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Incomplete total, excludes kaolin.
[5] Less than $1,000.
[6] Excludes certain stone; value included with "Items that cannot be disclosed."

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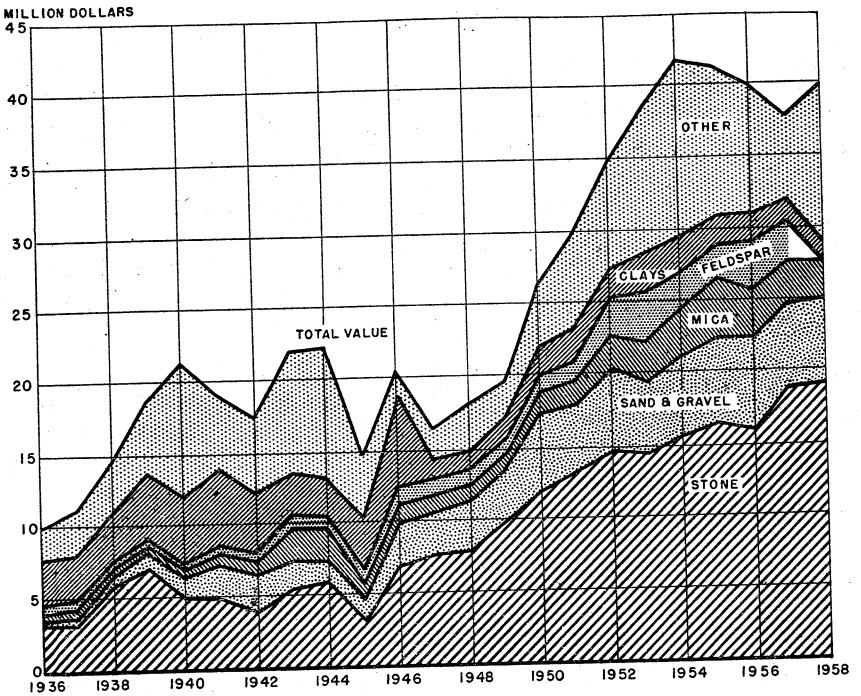

FIGURE 1.—Value of stone, sand and gravel, mica, feldspar, clays, and total value of mineral production in North Carolina, 1936–58.

Copper production increased substantially; tungsten was much lower than in 1957 because of the closing of the Hamme mine, the only producer, in the middle of the year. North Carolina led all States in producing feldspar, sheet and scrap mica, olivine, spodumene, and tungsten and was third in talc and pyrophyllite combined and fifth in kaolin. It was the only State producing millstones.

Employment and Injuries.—The increased employment resulted in part from more complete coverage of the mica mining industry and sand and gravel operations. Metal-mine employment dropped primarily as a result of closing the Hamme mine of Tungsten Mining Co.

Five fatal accidents occurred, compared with 4 in 1957; and nonfatal accidents rose from 287 to 358. The frequency rate (injuries per million man-days) was 218, an 18 percent increase over the 184 rate of 1957. Nonmetal mines showed considerable improvement over 1957, sand and gravel mines were virtually unchanged, but metal mines and quarries and mills had less satisfactory frequency rates than in the previous year.

Legislation and Government Programs.—The Office of Minerals Exploration (OME) was established to continue the program of Defense Minerals Exploration Administration (DMEA), which expired June 30, 1958. Under the DMEA program, 19 contracts totaling $414,924 were in force during 1958—16 contracts for mica, 2 for copper-lead-zinc, and 1 for tungsten. A total of $77,656 was spent on these projects

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-days worked	Fatal injuries	Nonfatal injuries	Injuries per million man-days
	1957						
Nonmetal mines	192	2,200	229	504,317	3	89	182
Quarries and mills	61	2,177	216	469,600		108	230
Metal mines [1]	5	1,437	330	474,054		74	156
Sand and gravel mines	90	607	218	132,566	1	16	128
Total	348	6,421	246	1,580,537	4	287	184
	1958 [2]						
Nonmetal mines	350	2,891	227	657,138	2	93	145
Quarries and mills	70	1,978	241	477,370	2	167	354
Metal mines [1]	4	1,258	286	360,025		77	214
Sand and gravel mines	110	770	225	173,625	1	21	127
Total	534	6,897	242	1,668,158	5	358	218

[1] Includes aluminum smelters.
[2] Preliminary figures.

during the year. The Government share was 75 pecent of mica contracts and 50 percent of the others. In 1957, $208,120 was spent on 41 contracts, which totaled $498,606. Only five contracts were in force at the end of 1958.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Grinding pebbles, millstones, and tube-mill liners were produced in Rowan County. Tonnage and value of grinding pebbles and tube-mill liners were considerably higher than in 1957; millstones declined.

Asbestos.—Amphibole asbestos production from Transylvania County, although small, was higher than in 1957.

Clays.—Production of clays declined for the second year after reaching a record in 1956. Kaolin declined about 25 percent in tonnage and value, and miscellaneous clay dropped 14 percent in tonnage and 16 percent in value. Kaolin production came from Avery County and a small quantity from Mitchell County. Twenty-five operators mined miscellaneous clay in 19 counties from 30 pits for manufacturing brick and other clay products. Leading producer of kaolin was Harris Clay Co. Leading producers of miscellaneous clay were Sanford Brick & Tile Co. and Southern Lightweight Aggregate Corp.

Feldspar.—Crude feldspar again decreased in tonnage and value. Three companies produced 87 percent of the tonnage, including flotation concentrate; the remaining 13 percent was mined by many small individual producers. Mitchell County furnished 89 percent of the tonnage, and the remainder came from Avery, Madison, Yancey, and other counties, origin unknown. Ground feldspar production decreased 2 percent in tonnage and 3 percent in value. The new mill of Lawson-United Feldspar & Minerals Co. was described.[4]

[4] Pit and Quarry, vol. 51, No. 2, August 1958, pp. 112–117.

TABLE 3.—DMEA mica contracts in force during 1958

Operator	Property	County	Contract	
			Date	Total amount [1]
Carolina Mining Co	Moody	Macon	November 1957	$4,492
Do	Ray-Liner	do	April 1958	6,016
DeGroat, Buchanan, et al	Twiggs	Mitchell	May 1958	5,512
Empire Mica Co	Cloudland	do	June 1958	6,684
Grindstaff & Greene	Johnson	do	September 1957	6,624
Huskins, Huskins, et al	Big Ridge	do	October 1957	4,208
Huskins, Petty, et al	W. C. Geouge	do	February 1958	4,764
McKinney, Howard	McKinney	do	May 1957	5,652
McMahan, Young & Pitman	Lick Ridge	do	June 1958	3,764
Mitchell Lumber Co., Inc	Banner	do	June 1958	9,864
Phillips, et al	Avery	do	October 1957	6,080
Ward, Buchanan & Medford	Spencer	Stokes	June 1958	3,260
Grassy Woods Mining Corp	Grassy Woods	Yancey	April 1957	6,584
Hector Mining Co	Ed. Sparks (Cox)	do	June 1958	5,536
Moody Rock Mining Co	Moody Rock	do	April 1957	11,590
Phillips, Grindstaff & Fox	Weld	do	February 1958	6,424

[1] Government participation, 75 percent.

TABLE 4.—Sheet mica sold or used by producers, by counties

County	1957		1958	
	Pounds	Value	Pounds	Value
Ashe	23,989	$88,938	(1)	(1)
Avery	13,715	135,916	19,667	$186,176
Buncombe	2,309	8,086	(1)	(1)
Burke	747	2,571	(1)	(1)
Caldwell	168	1,973	(1)	(1)
Cleveland	7,640	26,134	2,673	18,390
Davie	25	378		
Gaston	19,956	33,048	7,836	24,680
Jackson	2,564	6,043	462	5,225
Lincoln	4,286	21,910	383	3,048
Macon	18,958	183,469	7,707	70,332
Mitchell	123,615	785,728	220,242	1,113,319
Rutherford	(1)	(1)	2,643	3,170
Stokes	(1)	(1)	15,843	68,048
Watauga	228	2,415		
Wilkes	(1)	(1)	1,123	1,926
Yancey	32,935	113,693	50,237	153,246
Undistributed	326,472	164,797	192,885	74,389
Total	577,607	1,575,099	521,701	1,721,949

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Gem Stones.—Gem stones and gem materials were collected in Clay, Haywood, Macon, Mitchell, and other counties. Among the gem stones reported was a black sapphire of 500 carats, origin unknown. Other gem material included corundum, emerald, ruby, sapphire, samarskite, and miscellaneous rock specimens.

Lithium.—North Carolina was the principal domestic producer of lithium minerals. Foote Mineral Co. mined and processed spodumene at Kings Mountain, and Lithium Corp. of America processed foreign ore at its Bessemer City plant. Value of spodumene is included in the State total for the first time since 1954. Operations of Foote Mineral Co. at Kings Mountain were described.[5]

[5] Mining Congress Journal, vol. 44, No. 1, January 1958, pp. 52–56.

Mica.—Sheet-and-scrap mica production was reported from 296 mines in 19 counties compared with 403 mines in 21 counties in 1957. Considerable tonnage could not be identified as to county and mine origin. The five leading mica-producing counties supplied 98 percent of the tonnage and 92 percent of the value. The number of mines (in parentheses) and value of production of each follows: Mitchell (87) $1,319,141, Yancey (61) $520,673, Avery (38) $357,187, Cleveland (26) $250,708, and Macon (21) $107,923. Most sheet-mica production was sold to the Government through the General Services Administration (GSA). Leading producers of sheet-mica were Sink Hole Mining Co. (Sink Hole mine), Abernathy Mining Co. (Abernathy mine), and Mitchell Lumber Co. (Banner mine). Sixteen DMEA mica contracts were in force during 1958, compared with 40 in 1957. Four mica contracts were in force at the end of the year.

Olivine.—Production of olivine decreased more than 50 percent in tonnage and value. Two companies were active in Jackson County and one in Yancey County.

TABLE 5.—Mica sold or used by producers

Kind	1957		1958	
	Quantity	Value	Quantity	Value
Sheet mica:				
Uncut punch and circle---pounds	418,306	$32,998	366,643	$30,070
Larger uncut mica---do	12,045	9,055	3,834	3,248
Full-trim purchased by GSA [1]---do	147,256	1,533,046	151,224	1,688,631
Total sheet mica---do	577,607	1,575,099	521,701	1,721,949
Scrap mica: Total---short tons	53,452	1,173,215	50,897	1,041,036
Grand total (sheet and scrap)---do	53,741	2,748,314	51,157	2,762,985

[1] Includes full-trimmed mica equivalent of hand-cobbed mica.

Perlite.—Only one plant produced expanded perlite at Salisbury from crude material shipped into North Carolina. Production was somewhat higher than in 1957.

Quartz.—Byproduct quartz was recovered from the four feldspar-flotation plants in Mitchell County. Production data is included under stone—sandstone, quartz, and quartzite. Although tonnage was 19 percent higher than in 1957, its value declined 23 percent.

Sand and Gravel.—Production of sand and gravel ranked second in the State in tonnage and value. Commercial sand and gravel supplied 59 percent of the tonnage and 72 percent of the value, compared with 63 percent and 77 percent, respectively, in 1957. Commercial sand increased 4 percent in tonnage and 3 percent in value.

Commercial gravel increased 7 percent in tonnage and 6 percent in value. Government-and-contractor sand production was up 5 percent and 7 percent, respectively, in tonnage and value. Government-and-contractor gravel increased 70 percent in tonnage and 89 percent in value. Commercial sand and gravel was produced in 12 counties, gravel only in 1, and sand only in 8 others. Twenty-seven companies operated 32 pits in these counties, compared with 22 companies and 29 pits in 1957. Government-and-contractors produced sand in 58

counties, gravel in 8, and both sand and gravel in 9 others. Leading producers were the State highway commission, Becker County Sand & Gravel Co., and Lessees of B. V. Headrick.

TABLE 6.—Ground mica sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Roofing	18,174	$615,352	$33.86	18,000	$575,341	$31.96
Paint	5,706	849,591	148.89	5,528	801,392	144.97
Rubber	2,717	401,143	147.64	2,776	393,683	141.82
Plastics	790	110,410	139.76	778	97,457	125.27
Wallpaper	244	35,489	145.45	245	33,821	138.04
Textile coating and electronics	68	11,214	164.91	(1)	(1)	(1)
Other [2]	15,174	847,515	55.85	14,013	722,785	51.58
Total	42,873	2,870,714	66.96	41,340	2,624,479	63.49

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes pipeline enamel, welding rods, textile coating and electronics, joint cement, well drilling and other uses.

TABLE 7.—Sand and gravel sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Alamance	8,000	$2,800	52,300	$17,830
Alexander	44,017	14,682	9,500	9,500
Ashe	60,800	43,600	4,880	4,880
Avery	(1)	(1)	78,633	38,100
Beaufort	77,000	48,600	22,000	13,200
Bertie	4,000	1,000	106,000	63,600
Bladen	119,291	70,600	18,000	18,000
Brunswick	27,800	13,300	197,223	92,378
Burke	181,034	73,409		
Cabarrus	8,000	4,000	19,638	19,638
Caldwell	7,750	4,350	6,000	1,500
Camden	15,000	3,750	3,000	1,050
Carteret			20,000	8,000
Caswell	28,000	9,800	69,935	24,372
Catawba	46,000	14,950		
Chowan	34,000	8,500	24,400	24,400
Clay			38,500	15,400
Cleveland	40,806	13,622	79,000	47,400
Columbus	71,167	34,160	(1)	(1)
Craven	3,000	2,000	7,000	1,750
Currituck	20,000	5,000	3,000	750
Dare	56,000	16,000	184,000	92,000
Davidson	174,000	87,000	79,000	39,500
Davie	67,000	33,500	8,000	8,000
Duplin	24,300	12,000	121,000	60,500
Forsyth	116,148	95,150	6,000	3,000
Franklin	6,000	3,000	36,717	14,686
Gaston	27,000	8,775	6,000	1,500
Gates	25,000	6,250	23,200	23,200
Graham			4,835	3,142
Granville	4,000	3,000	54,800	15,897
Greene	45,000	30,000	3,925	1,962
Guilford	5,900	2,950	4,030	2,400
Halifax	6,968	2,090	25,800	28,200
Henderson			17,000	4,250
Hertford			1,600	400
Hyde	4,400	1,100	81,328	27,506
Iredell	75,667	25,317	43,800	48,500
Jackson	(1)	(1)	35,000	35,000
Johnston	31,500	31,500	40,556	21,822
Jones	30,000	20,000		
Lee	2,650	654		

See footnote at end of table.

TABLE 7.—Sand and gravel sold or used by producers, by counties—Continued

County	1957		1958	
	Short tons	Value	Short tons	Value
Lenoir	166,506	$131,697	200,953	$154,330
Lincoln	28,500	9,263	32,000	12,800
Martin	8,000	2,000	30,000	7,500
Montgomery	6,027	2,900	10,000	6,000
Moore	(1)	(1)	307,015	147,197
Nash	33,000	15,800	41,136	24,700
Onslow	6,100	2,900	5,000	5,000
Pamlico			3,000	1,050
Pasquotank	25,000	6,250	19,000	4,750
Pender	8,800	4,200	4,000	4,000
Perquimans	14,000	3,500	2,000	500
Person	11,150	8,363	8,550	5,557
Pitt	94,000	63,000	(1)	(1)
Polk	25,000	25,000	61,800	47,300
Randolph	4,000	1,200	5,000	1,250
Richmond	12,203	6,300	13,875	17,500
Robeson	87,700	42,100	(1)	(1)
Rockingham	3,821	1,911		
Rowan	40,000	20,000	38,000	19,000
Rutherford	(1)	(1)	150,000	75,000
Sampson	18,090	9,100	9,000	9,000
Scotland	3,770	3,770		
Stokes	82,000	41,000	99,000	49,500
Surry	15,045	30,090	17,945	10,800
Transylvania	(1)	(1)	10,034	13,390
Tyrrell	2,200	550	1,600	400
Vance			4,000	2,000
Wake	1,900	1,140	2,200	1,320
Washington	32,000	8,000	70,000	17,500
Watauga	2,900	3,725	82,738	62,674
Wilkes	(1)	(1)	22,485	13,500
Wilson	30,000	14,400	25,765	15,500
Yadkin	31,635	47,453	33,515	20,000
Undistributed	4,538,806	4,472,182	4,198,641	4,297,712
Total	6,829,351	5,724,203	7,043,852	5,879,943

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 8.—Sand and gravel sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Paving	3,958,432	$2,885,571	$0.73	4,012,672	$2,810,371	$0.70
Structural	2,521,906	2,489,264	.99	2,732,124	2,746,115	1.01
Railroad ballast	(1)	(1)	(1)	96,963	52,246	.54
Other [2]	349,013	349,368	1.00	202,093	271,211	1.34
Total	6,829,351	5,724,203	.84	7,043,852	5,879,943	.83

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes filter sand, railroad ballast, and other sand and gravel.

Stone.—Total tonnage and value of stone, the principal mineral product of the State, was virtually unchanged from 1957. Figures for crushed granite are not comparable for the 2 years, because certain stone classified as granite in 1957 was changed to traprock (basalt) in 1958. Total crushed stone, granite, limestone, marble, byproduct

quartz, and traprock decreased 2 percent in tonnage and increased 1 percent in value. Total dimension stone, granite, marble, sandstone, and slate increased 38 percent in quantity but decreased 13 percent in value. Stone was quarried in 39 counties, including granite in 28, limestone in 6, marble in Cherokee, quartz in Mitchell, slate in Davidson and Montgomery, and traprock in 7. Excluding quartz, 20 operators produced commercial stone from 38 quarries—23 granite, 7 limestone, 3 slate, 4 traprock, and 1 marble. North Carolina State Highway & Public Works Commission crushed stone from 19 granite, 1 limestone, and 4 traprock quarries; and the Federal Bureau of Public Roads quarried building stone in 4 counties. Leading producers of crushed granite were Superior Stone Co., Bryan Rock & Sand Co., and W. E. Graham & Sons. Leading producer of dimension granite was North Carolina Granite Corp. Leading crushed-limestone producer was Superior Stone Co. Leading crushed-traprock producer was Nello L. Teer Co. Columbia Marble Co. was the only producer of marble.

Talc and Pyrophyllite.—Although crude production of both talc and pyrophyllite increased, total products sold were lower in quantity and value than in 1957. Ground talc increased in tonnage and value; ground pyrophyllite was down in tonnage but higher in value. Sawed talc and crude pyrophyllite sold to consumers also decreased in quantity and value. Leading producer of talc was Hitchcock Corp., and the leading pyrophyllite producer was Standard Mineral Co., Inc.

Vermiculite.—Exfoliated vermiculite was produced from crude shipped into North Carolina by Zonolite Co., High Point.

TABLE 9.—Crushed granite sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Alamance	39,293	$49,091	55,068	$79,302
Anson	46,500	58,650		
Buncombe	28,300	55,478	45,191	68,296
Cabarrus			40,000	20,000
Caldwell	100,000	130,000		
Chatham	57,755	62,546		
Cherokee			24,720	57,000
Forsyth	751,274	999,437	(1)	(1)
Graham			11,000	22,000
Granville	6,500	13,000		
Guilford	1,898,991	2,763,704	1,747,847	2,767,399
Jackson			16,100	32,200
Macon			9,400	18,800
Orange	24,425	30,521	18,938	28,407
Polk			5,000	10,000
Randolph	212,840	236,760	136,850	206,987
Rockingham	75,909	87,295	53,166	26,582
Swain	58,500	72,819	5,200	10,400
Transylvania	(1)	(1)	19,000	38,000
Union	102,505	128,131		
Watauga	83,100	61,660		
Other counties	5,968,418	8,086,606	5,996,801	8,554,030
Total	9,454,310	12,835,698	8,184,281	11,939,403

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

TABLE 10.—Crushed granite sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roads	8,910,827	$12,208,913	$1.37	7,740,367	$11,373,061	$1.47
Other [1]	543,483	626,785	1.15	443,914	566,342	1.28
Total	9,454,310	12,835,698	1.36	8,184,281	11,939,403	1.46

[1] Includes riprap, railroad ballast, and other uses.

TABLE 11.—Talc and pyrophyllite production

Year	Crude mined		Sales (crude, sawed, and ground)	
	Short tons	Value	Short tons	Value
1949–53 (average)	111,183	(1)	110,229	$1,772,680
1954	112,704	$388,428	105,384	1,771,778
1955	125,206	571,689	120,885	1,999,560
1956	125,487	529,205	121,782	1,921,834
1957	120,905	557,850	98,185	2,003,189
1958	126,158	613,779	110,528	2,078,176

[1] Data not available.

METALS

Beryllium.—The Bledsoe mine in Davie County was the only producer of beryl. Output was sold to the Government (GSA) Depot at Spruce Pine.

Gold, Silver, Copper, Lead and Zinc.—Appalachian Sulfides, Inc., was the only producer. The Ore Knob mine operated at capacity and increased copper output 26 percent above 1957; value, however, was only 10 percent higher. Gold and silver also were recovered from the ore. The company continued exploration and development, including deepening of the Ore Knob shaft, drilling under a DMEA contract and further mill expansion. Roland F. Beers, Inc. explored the Denton property in Davidson County for copper-lead-zinc under a DMEA contract. The two DMEA contracts (Ore Knob and Denton) totaled $71,270, Government participation was 50 percent.

Iron Ore.—Plans have been made to reopen the old Cranberry Magnetite mine. Shipments of iron ore in North Carolina from earliest records to date are shown in table 12.

Tungsten.—Tungsten Mining Co. stopped production at its Hamme mine in Vance County near the end of June but continued shipments of tungsten concentrate from stocks after that date. A DMEA contract totaling $246,660 was completed in June; Government participation was 50 percent.

TABLE 12.—Shipments of iron ore in North Carolina, 1730–1958

Year	Long tons	Value	Year	Long tons	Value
1730–1870	20,000	$10,000	1904	64,347	$80,434
1871	1,000	1,000	1905	56,282	81,046
1872	2,000	2,000	1906	56,057	75,677
1873	3,000	2,800	1907	50,439	113,488
1874	2,700	2,500	1908	48,522	76,877
1875	1,600	1,500	1909	61,150	107,103
1876	800	800	1910	65,278	114,237
1877	650	700	1911	84,782	148,368
1878–80			1912	68,322	103,849
1881	1,700	1,200	1913	69,235	143,316
1882	2,500	2,000	1914	57,667	137,824
1883			1915	66,453	165,601
1884	1,000	800	1916	64,306	237,900
1885	4,000	3,600	1917	90,957	445,898
1886	4,900	5,000	1918	108,332	604,592
1887	8,100	8,000	1919	58,778	231,530
1888	5,300	7,500	1920	71,810	293,382
1889	10,125	20,000	1921	383	1,259
1890	22,873	45,000	1922	19,279	49,415
1891	19,210	19,600	1923	59,684	161,603
1892	25,379	25,000	1924	12,525	32,512
1893	9,782	9,000	1925	22,011	49,511
1894	6,500	5,980	1926	14,798	31,645
1895	3,191	2,936	1927	32,528	81,753
1896	7,069	6,079	1928		
1897			1929	30,575	106,411
1898	2,089	1,692	1930–34		
1899	36,828	56,347	1935	54	170
1900	20,479	27,237	1936	57	225
1901	2,020	2,424	1937–58		
1902	30,836	42,862	Total	1,665,000	4,088,000
1903	75,252	99,885			

REVIEW BY COUNTIES

Ninety-five of the 100 counties in North Carolina reported mineral production, compared with 96 in 1957; Cleveland, Mitchell, Guilford, Vance, and Ashe were the leaders. In addition to the detailed county production listed in table 13 a considerable quantity of crude feldspar, 180,00 pounds of sheet mica, 800 tons of scrap mica, 35,000 tons of sand and gravel, 400 tons of dimension granite, and a small quantity of gem stones were produced—all of undetermined county origin.

Alamance.—Boren & Harvey (Snow Camp mine) mined pyrophyllite for refractory purposes. North Carolina State Highway & Public Works Commission crushed 55,000 tons of granite for concrete aggregate and roadstone. Hanford Brick Co., Inc., mined miscellaneous clay for heavy clay products.

Alexander.—The State highway commission mined 52,000 tons of paving sand.

Anson.—Three operators mined structural, paving, and railroad-ballast sand and gravel; the leading producers were Lessees of B. V. Hedrick and W. R. Bonsal Co. The State highway commission (Sugartown and Lee quarries) crushed 40,000 tons of traprock for concrete aggregate and roadstone.

TABLE 13.—Value of mineral production in North Carolina, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Alamance	$138,563	(2)	Granite, talc, miscellaneous clay.
Alexander	14,682	$17,830	Sand and gravel.
Anson	(2)	(2)	Sand and gravel, traprock.
Ashe	(2)	(2)	Copper, mica, gold, silver, sand and gravel.
Avery	(2)	(2)	Mica, kaolin, sand and gravel, feldspar.
Beaufort	48,600	38,100	Sand and gravel.
Bertie	1,000	13,200	Do.
Bladen	70,600	63,600	Do.
Brunswick	13,300	18,000	Do.
Buncombe	(2)	(2)	Sand and gravel, granite, mica.
Burke	76,139	(2)	Sand and gravel, mica.
Cabarrus	4,000	20,000	Granite.
Caldwell	139,823	(2)	Sand and gravel, mica.
Camden	3,750	1,500	Sand and gravel.
Carteret		1,050	Do.
Caswell	(2)	(2)	Granite, sand and gravel.
Catawba	(2)	(2)	Granite, miscellaneous clay, sand and gravel.
Chatham	210,446	268,420	Traprock, miscellaneous clay.
Cherokee	(2)	(2)	Marble, talc, granite, mica.
Chowan	8,500		
Clay		24,500	Sand and gravel, gem stones.
Cleveland	(2)	(2)	Lithium minerals, limestone, mica, sand and gravel, miscellaneous clay, granite.
Columbus	34,160	47,400	Sand and gravel.
Craven	(2)	(2)	Limestone, sand and gravel.
Cumberland	222,156	214,295	Sand and gravel, miscellaneous clay.
Currituck	5,000	1,750	Sand and gravel.
Dare	16,000	750	Do.
Davidson	(2)	(2)	Slate, sand and gravel, miscellaneous clay.
Davie	40,592	39,500	Sand and gravel.
Duplin	12,000	(2)	Do.
Durham	(2)	(2)	Traprock.
Forsyth	1,094,742	(2)	Granite, sand and gravel.
Franklin	3,000	3,000	Sand and gravel.
Gaston	51,631	57,223	Mica, miscellaneous clay, sand and gravel, granite.
Gates	6,250	1,500	Sand and gravel.
Graham		45,000	Sand and gravel, granite.
Granville	16,000	3,142	Sand and gravel.
Greene	30,000	15,897	Do.
Guilford	2,810,154	2,814,261	Granite, miscellaneous clay, sand and gravel.
Halifax	44,735	26,600	Miscellaneous clay, sand and gravel.
Harnett	(2)	(2)	Sand and gravel.
Haywood	(2)	(2)	Sand and gravel, granite, gem stones.
Henderson	272,402	523,812	Limestone, granite, sand and gravel, miscellaneous clay.
Hertford		4,250	Sand and gravel.
Hoke	(2)	(2)	Do.
Hyde	1,100	400	Do.
Iredell	25,317	27,506	Do.
Jackson	(2)	(2)	Olivine, sand and gravel, granite, mica.
Johnston	(2)	(2)	Traprock, sand and gravel.
Jones	20,000	21,822	Sand and gravel.
Lee	(2)	215,500	Miscellaneous clay.
Lenoir	131,697	154,330	Sand and gravel.
Lincoln	31,552	15,870	Sand and gravel, mica
Macon	260,797	154,503	Mica, sand and gravel, granite, gem stones.
Madison	(2)	(2)	Feldspar.
Martin	2,000	7,500	Sand and gravel.
McDowell	310,854	(2)	Sand and gravel, limestone, mica.
Mecklenberg	(2)	(2)	Granite.
Mitchell	(2)	(2)	Feldspar, mica, sandstone, kaolin, gem stones.
Montgomery	(2)	(2)	Miscellaneous clay, slate, sand and gravel.
Moore	(2)	(2)	Talc, sand and gravel, miscellaneous clay.
Nash	(2)	(2)	Sand and gravel, granite.
New Hanover	(2)	(2)	Sand and gravel.
Northampton	(2)	(2)	Do.
Onslow	(2)	(2)	Limestone, sand and gravel.
Orange	(2)	(2)	Talc, granite.
Pamlico		1,050	Sand and gravel.
Pasquotank	6,250	4,750	Do.
Pender	4,200	4,000	Do.
Perquimans	3,500	500	Do.
Person	8,363	5,557	Do.
Pitt	63,000	(2)	Do.
Polk	26,000	60,100	Sand and gravel, granite.
Randolph	(2)	(2)	Granite, talc, sand and gravel.
Richmond	6,300	17,500	Sand and gravel.
Robeson	42,100	(2)	Do.
Rockingham	(2)	(2)	Miscellaneous clay, granite, traprock.

See footnotes at end of table.

TABLE 13.—Value of mineral production in North Carolina, by counties [1]—Con.

County	1957	1958	Minerals produced in 1958 in order of value
Rowan	$1,553,598	$1,403,971	Granite, miscellaneous clay, sand and gravel, abrasive stones.
Rutherford	(2)	78,511	Sand and gravel, mica.
Sampson	127,074	25,880	Miscellaneous clay, sand and gravel.
Scotland	3,770		
Stanly	181,600	173,200	Miscellaneous clay.
Stokes	(2)	(2)	Mica, sand and gravel, miscellaneous clay.
Surry	(2)	(2)	Granite, sand and gravel.
Swain	265,447	151,325	Limestone, granite.
Transylvania	(2)	(2)	Granite, sand and gravel, asbestos, mica.
Tyrrell	550	400	Sand and gravel.
Union	(2)	(2)	Traprock, miscellaneous clay.
Vance	(2)	(2)	Tungsten, granite, sand and gravel.
Wake	(2)	(2)	Granite, sand and gravel.
Washington	8,000	17,500	Sand and gravel.
Watauga	67,800	62,674	Do.
Wayne	54,453	(2)	Do.
Wilkes	(2)	15,536	Sand and gravel, mica.
Wilson	(2)	(2)	Granite, sand and gravel.
Yadkin	(2)	(2)	Do.
Yancey	660,448	570,573	Mica, feldspar, sand and gravel, olivine.
Undistributed [3]	28,317,000	32,435,762	
Total	37,570,000	39,891,000	

[1] The following counties are not listed because no production was reported: Edgecombe and Warren.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Includes value of feldspar, mica, sand and gravel, dimension granite and gem stones hat cannot be assigned to specific counties, and values indicated by footnote 2.

Ashe.—Ashe County ranked fifth in value of mineral production. Appalachian Sulfides, Inc. (Ore Knob mine), recovered copper, gold and silver. Eight mica mines were operated; the leading producers were Duncan Mining Co. (Duncan mine) and Lewie Aldridge (Tucker, Littleton, and Jackson mines). The State highway commission mined 9,500 tons of paving sand and gravel.

Avery.—Harris Clay Co. (Kaolin and Gusher Knob mines) mined kaolin for whiteware, floor and wall tile, refractories, plastics, and artificial abrasives. Mica was produced at 38 mines; the leading producers of sheet mica were Birch Mining Co. (Birch mine), J. E. Wilson (Charlie Ridge mine), and Elk Mica Miners (Elk mine). The leading producer of scrap mica was Harris Clay Co. (Gusher Knob mine).

Ray Watson (Cliff mine) and Charlie Silver (Silver mine) produced a small quantity of crude feldspar. The State highway commission mined 4,800 tons of paving gravel.

Beaufort.—J. S. Hill Construction Company and the State highway commission mined paving sand.

Bertie.—The State highway commission mined 22,000 tons of paving sand.

Bladen.—The State highway commission mined 106,000 tons of paving sand.

Brunswick.—The State highway commission mined 18,000 tons of paving sand.

Buncombe.—Five operators mined structural and paving sands and structural, paving, railroad ballast, and other gravel; the leading producers were Grove Stone & Sand Branch, of B. V. Hedrick Gravel & Sand Co., and J. J. Rogers, Jr. Four mica mines were operated in 1958; the leading producers were Steele Mining Co. (Watkins mine) and Phillips Mica Co. (Black Mountain mine). The State highway

commission (Weaverville quarry) crushed 45,000 tons of granite for concrete aggregate and roadstone.

Burke.—The State highway commission mined 197,000 tons of paving sand and gravel. Sheet mica was produced at five mines; the leading producers were Stokes Buchanan (Stilwell mine) and Aldridge & Jess Callahan (Greybeal mine). Great Lakes Carbon Corp. produced artificial graphite at its plant in Morganton.

Cabarrus.—The State highway commission crushed 40,000 tons of granite for concrete aggregate and roadstone.

Caldwell.—R. L. Auton (McGee mine) and Cub Holtzclaw (Talbott mine) mined a small quantity of sheet mica. The State highway commission mined 20,000 tons of paving sand and gravel.

Camden.—The State highway commission mined 6,000 tons of paving sand.

Carteret.—The State highway commission mined 3,000 tons of paving sand.

Caswell.—Lambert Bros. (Danville quarry) and the State highway commission (Ivy Bluff quarry) crushed granite for concrete aggregate and roadstone. The State highway commission mined 20,000 tons of paving sand.

Catawba.—Statesville Brick Co. (Statesville mine) mined miscellaneous clay for heavy clay products. Superior Stone Co. (Hickory quarry) crushed granite for concrete aggregate and roadstone. The State highway commission mined 70,000 tons of paving sand.

Chatham.—Pomona Terra Cotta Co., Boren Clay Products Co., and Chatham Brick & Tile Co., Inc., mined miscellaneous clay for use in heavy clay products. The State highway commission (Goldston quarry) crushed 109,000 tons of traprock for concrete aggregate and roadstone.

Cherokee.—Columbia Marble Co. (Pleasant Valley quarry) quarried dimension marble for exterior stone, dressed interior stone, cut and dressed monumental stone, and crushed marble for terrazzo and other uses. Hitchcock Corp. (Nancy Jordan mine) and Minerals & Metals Corp. (Mulberry Gap mine) mined talc for crayons, textiles, toilet preparations, and other uses. H. M. Morrow (H. S. Matheson mine) mined a small quantity of sheet mica. The State highway commission (McDonald quarry) crushed 25,000 tons of granite for concrete aggregate and roadstone.

Clay.—Fred O. Scruggs collected a small quantity of gem stones (ruby and sapphire). The State highway commission mined 24,000 tons of paving sand.

Cleveland.—Cleveland County ranked first in value of mineral production. Twenty-two mines produced sheet mica; the leading producers were Robert Y. Moffatt and Paul Hoppas. The leading producers of scrap mica were Kings Mountain Mica, Inc. (Moss and Patterson mines) and Foote Mineral Co. (Kings Mountain mine); three other companies produced a small tonnage of scrap mica.

Superior Stone Co. (Kings Mountain quarry) crushed limestone for concrete aggregate, roadstone, and agstone. The State highway commission mined 39,000 tons of paving sand and 400 tons of granite for building stone. Bennett Brick & Tile Co. mined 18,000 tons of

miscellaneous clay for heavy clay products. Foote Mineral Co. mined and processed lithium minerals at Kings Mountain.

Columbus.—The State highway commission mined 79,000 tons of paving sand.

Craven.—Nello L. Teer Co. (Shell quarry) and Superior Stone Co. (New Bern quarry) crushed limestone for concrete aggregate, roadstone, and agstone. Southern Sand Co., Inc., and the State highway commission mined structural and paving sand.

Cumberland.—Becker County Sand & Gravel Co. (Fayetteville mine) and the State highway commission mined structural, paving, railroad-ballast sands, and structural and paving gravels. Ideal Brick Co. (Linden mine) mined miscellaneous clay for heavy clay products.

Currituck.—The State highway commission mined 7,000 tons of paving sand.

Dare.—The State highway commission mined 3,000 tons of paving sand.

Davidson.—Jacob's Creek Flagstone Co., Inc., and Denton Flagstone Quarry quarried dimension slate for structural millstock and flagging. The State highway commission mined 184,000 tons of paving sand and gravel. Cunningham Brick Co. (Thomasville mine) mined miscellaneous clay for heavy clay products.

Davie.—The State highway commission mined 79,000 tons of paving sand.

Durham.—Nello L. Teer Co. crushed traprock for concrete aggregate and roadstone.

Forsyth.—W. E. Graham & Sons (Graham quarry) and Piedmont Quarry Co. (Salem quarry) crushed granite for concrete aggregate and roadstone. The State highway commission mined 121,000 tons of paving sand.

Franklin.—The State highway commission mined 6,000 tons of paving sand.

Gaston.—Self Huskins Mining Co. produced full-trim and hand-cobbed mica from the Self and Huskins mines; 4 other operators produced small quantities of full-trim mica. Kendrick Brick & Tile Co. (Mt. Holly mine) mined 27,000 tons of miscellaneous clay for heavy clay products. The State highway commission crushed 3,100 tons of granite for concrete aggregate and roadstone and mined 37,000 tons of paving sand. Lithium Corp. of America processed lithium ore at its Bessemer City plant.

Gates.—The State highway commission mined 6,000 tons of paving sand.

Graham.—The State highway commission crushed 11,000 tons of granite for concrete aggregate and roadstone; also mined 23,000 tons of paving sand.

Granville.—The State highway commission mined 4,900 tons of paving sand.

Greene.—The State highway commission mined 55,000 tons of paving sand.

Guilford.—Guilford County ranked third in value of mineral production. Five quarries produced crushed granite for concrete aggregate, roadstone, and stone sand; the leading producers were Superior Stone Co. (McLeansville, Jamestown, and Pomona quarries) and Bu-

chanan Stone Co. (Buchanan quarry). Boren Clay Products Co. (Pleasant Garden mine) mined miscellaneous clay for heavy clay products. The State highway commission mined 4,000 tons of paving sand. Zonolite Co. exfoliated vermiculite in its plant at High Point.

Halifax.—Nash Brick Co. (Ita mine) mined 41,000 tons of miscellaneous clay for heavy clay products. The State highway commission mined 4,000 tons of paving sand.

Harnett.—Becker County Sand & Gravel Co. (Senter mine) and the State highway commission mined sand for structural, paving, filler, and railroad-ballast purposes and gravel for structural, paving, and railroad-ballast uses.

Haywood.—Sale & Alexander (Waynesville mine) and the State highway commission mined structural and paving sands and structural, paving, and other gravels. The Bureau of Public Roads quarried dimension granite for building use. Fred O. Scruggs collected a small quantity of gem stones (blue corundum).

Henderson.—Fletcher Limestone Co. (Fletcher quarry) and Cogdill Limestone Co., Inc. (Cogdill quarry), crushed 214,000 tons of limestone for concrete aggregate, roadstone, and other uses. W. E. Graham & Sons and the State highway commission crushed granite for concrete aggregate and roadstone. The Fletcher Brick Co., Inc. (Fletcher mine), mined 47,000 tons of miscellaneous clay for heavy clay products. The State highway commission mined 26,000 tons of paving sand and gravel.

Hertford.—The State highway commission mined 17,000 tons of paving sand.

Hoke.—Cumberland Gravel & Sand Co. (Vass mine) mined structural, paving, and other sands and structural and paving gravels.

Hyde.—The State highway commission mined 1,600 tons of paving sand.

Iredell.—The State highway commission mined 81,000 tons of paving sand.

Jackson.—Harbison-Walker Refractories Co. (Addie mine) and Balsam Gap Co. (Balsam Gap mine) mined olivine. Eight mines produced sheet mica; the leading producers were Shawnee Mica Mines (Bowers mine) and Milton Buchanan (Shirley Wilson mine). The Bureau of Public Roads quarried dimension granite for building purposes. The State highway commission crushed granite for concrete aggregate and roadstone, and mined paving gravel. Alabama Vermiculite Co. abandoned its exfoliating plant at Sylva and moved the equipment to Atlanta, Ga.

Johnston.—Nello L. Teer Co. crushed traprock for concrete aggregate and roadstone. The State highway commission mined paving sand.

Jones.—Simmons Marl & Lime Co. (Simmons mine) and the State highway commission mined paving and other sands and other gravel.

Lee.—Sanford Brick & Tile Co. (Colon mine), Borden Brick & Tile Co. (Sanford mine), and Hanford Brick Co. (Hanford mine) mined miscellaneous clay for heavy clay products.

Lenoir.—Barrus Construction Co. (Kinston mine) and the State highway commission mined structural and paving sands and structural gravel.

Lincoln.—Eight mines produced sheet mica. The leading producers were Roe Woody (Brown mine) and Pat Buchanan (Warlick mine). The State highway commission mined 32,000 tons of paving sand.

Macon.—Twenty-one mines produced sheet mica; the leading producers were Harris Mining Co. (Harris mine) and Glenn Holt (Lyle Knob mine). The leading producer of scrap mica was Macon Mica Co. (Shepherd Knob mine). Hayes Block Co. and the State highway commission mined structural sand and paving gravel. The State highway commission crushed granite for concrete aggregate and roadstone. A small quantity of gem stones (samarskite and corundum) was collected. Roy M. Biddle exfoliated vermiculite at the Franklin plant. Two DMEA mica contracts were in force.

Madison.—The Feldspar Corp. (Robinson mine) and Conway Construction Co. (Weaverville mine) mined small quantities of crude feldspar.

Martin.—The State highway commission mined 30,000 tons of paving sand.

McDowell.—Becker County Sand & Gravel Co. (Marion mine) mined structural and paving sands and structural, paving, and other gravels. James T. Burnett (R. L. Swafford mine) produced a small quantity of sheet mica. The State highway commission (Woodlawn quarry) crushed 82,000 tons of limestone for concrete aggregate and roadstone.

Mecklenberg.—Superior Stone Co. (Charlotte quarry) and the State highway commission (Mecklenberg quarry) crushed granite for concrete aggregate and roadstone.

Mitchell.—Mitchell County ranked second in value of mineral production. Eleven companies mined crude feldspar; the leading producers were International Minerals & Chemical Corp. (Kona and Hawkins mines), Feldspar Corp. (Glenn, Bennett, Dogwood Flats, Poteat, Wiseman, Vance, Sullins, and Burleson mines), and Lawson-United Feldspar & Minerals Co. (Minpro mine). Eighty-seven mines produced mica, 70 produced sheet only (full-trim and/or hand-cobbed), 5 scrap only and 12 both sheet and scrap. The leading producers of sheet mica were Abernathy Mining Co. (Abernathy mine), Mountain Mining Co. (Jimmy Cut mine), Mitchell Lumber Co. (Banner mine), R & B Mining Co. (R. B. Phillips mine) and Sink Hole Mining Co. (Sink Hole & Sink Hole #2). The leading producers of scrap mica were the Feldspar Corp. (Poteat and Wiseman mines), International Minerals & Chemicals Corp. (Kona and Hawkins mines), and Southern Mica Co. of North Carolina, Inc. (Sullins mine).

International Minerals & Chemicals Corp., the Feldspar Corp., and Lawson-United Feldspar & Minerals Co. recovered crushed sandstone (quartz) from feldspar milling. Roy Grindstaff (Fluking Ridge mine) mined a small quantity of kaolin. Fred O. Scruggs collected a small quantity of gem stones (emerald matrix). Nine DMEA mica contracts were in force.

Montgomery.—Jacob's Creek Flagstone Co. quarried slate for structural millstock and flagging. Mt. Gilead Brick Co. (Mt. Gilead mine)

mined miscellaneous clay for heavy clay products. The State highway commission (Candor mine) mined 10,000 tons of paving sand.

Moore.—Standard Mineral Co., Inc., Glendon Pyrophyllite Co., and T & H Clay Co. mined pyrophyllite for asphalt filler, ceramic, insecticide, paint, refractory, rubber, and other uses. Four mines produced structural and paving sands; the leading producers were Pleasant Sand & Supply Co. (Pleasant mine) and Bryan Rock & Sand Co. (Montrose mine). T & H Clay Co. mined miscellaneous clay for heavy clay products.

Nash.—Nello L. Teer Co. abandoned the Castalia quarry after producing a small quantity of crushed granite for concrete aggregate and roadstone. The State highway commission mined paving sand.

New Hanover.—E. B. Towles Construction Co., Mrs. E. L. Robbins, and the State highway commission mined sand for fertilizer filler and paving uses.

Northampton.—Bryan Rock & Sand Co., Inc. (Garysburg mine), and the State highway commission mined structural and paving sands and structural and paving gravels.

Onslow.—Superior Stone Co. (Belgrade quarry) crushed limestone for concrete aggregate and roadstone. The State highway commission mined paving sand.

Orange.—Boren & Harvey (Hillsboro mine) mined pyrophyllite for refractory uses. The State highway commission crushed granite for concrete aggregate and roadstone. Duke University (Hillsboro quarry) quarried granite for rough construction.

Pamlico.—The State highway commission mined 3,000 tons of paving sand.

Pasquotank.—The State highway commission mined 19,000 tons of paving sand.

Pender.—The State highway commission mined 4,000 tons of paving sand.

Perquimans.—The State highway commission mined 2,000 tons of paving sand.

Person.—The State highway commission mined 8,600 tons of paving sand.

Pitt.—White Concrete Co. and the State highway commission mined structural and paving sands.

Polk.—The State highway commission mined 62,000 tons of paving sand and gravel and also crushed 5,000 tons of granite for concrete aggregate and roadstone. J. C. Williams (Williams quarry) quarried 560 tons of granite for rough construction.

Randolph.—The State highway commission (Parks Cross Road and Glenola quarries) crushed granite for concrete aggregate and roadstone and also mined paving sand. Carolina Pyrophyllite Co., Inc. (Gerhardt mine), mined pyrophyllite for ceramic uses.

Richmond.—The State highway commission mined 14,000 tons of paving gravel.

Robeson.—Southern Sand & Gravel Co. and the State highway commission mined structural, paving, and other sands and structural gravel.

Rockingham.—Pine Hall Brick & Pipe Co. (Madison mine) and Roanoke-Webster Brick Co., Inc. (Draper mine), mined miscellaneous

clay for heavy clay products. The State highway commission (Newman quarry) crushed granite for concrete aggregate and roadstone. Garland W. and Morris Hall crushed traprock for concrete aggregate and roadstone.

Rowan.—Superior Stone Co. (Woodleaf and Kanapolis quarries) crushed granite for concrete aggregate and roadstone. Six quarries produced dimension granite; the leading producers were Harris Granite Quarries Co. (Collins, Balfour, and Shuping quarries) and H. P. Stirewalt. Oglethorpe Granite Co. began quarrying granite for rough construction.

Carolina Tufflite Co. and Isenhour Brick & Tile Co. (East Spencer mine) mined miscellaneous clay for lightweight aggregates and heavy clay products. Gardner Granite Works produced millstones. Harris Granite Quarries Co. produced tube-mill liners and grinding pebbles. The State highway commission mined 38,000 tons of paving sand. Carolina Perlite Co. expanded perlite at its mill.

Rutherford.—A. R. Thompson, contractor, mined paving gravel. Eight mines produced full-trim mica, two of which also sold a small tonnage of scrap mica. The leading producer was Mace & Son.

Sampson.—Crumpler Brick Co., Inc., Sampson Brick Co., Inc., and Patterson Brick Co. mined miscellaneous clay for heavy clay products. The State highway commission mined 9,000 tons of paving sand.

Stanley.—Southern Lightweight Aggregate Corp. (Aquadale mine) Stanly Shale Products, Inc. (Norwood mine), and Yadkin Brick Yards, Inc. mined miscellaneous clay for lightweight aggregates and heavy clay products. Carolina Aluminum Co. produced aluminum metal at Badin.

Stokes.—Seven companies produced sheet mica, two of which also marketed a small tonnage of scrap mica. The leading producers of sheet and scrap mica were Stokes County Mining Co. (Sandy Ridge and Spencer mines) and Lemmie and Curtis Mabe (Mabe mine). The State highway commission mined paving sand. Pine Hall Brick & Pipe Co. (Nos. 1 and 2 mines) mined miscellaneous clay for heavy clay products.

One DMEA mica contract was in force.

Surry.—North Carolina Granite Corp. quarried dimension granite for rough and dressed construction stone, rough and dressed architectural stone, rubble, dressed monumental stone, and curbing and flagging. North Carolina Granite Corp. (Mount Airy quarry) and W. E. Graham & Sons produced granite for riprap, concrete aggregate, roadstone, poultry grit, and other uses. The State highway commission mined paving sand.

Swain.—Nantahala Talc & Limestone Co. (Hewitt quarry) crushed 123,000 tons of limestone for concrete aggregate, roadstone, and agstone. The State highway commission crushed 5,200 tons of granite for concrete aggregate and roadstone. The Bureau of Public Roads quarried 4,100 tons of dimension granite for rough construction.

Transylvania.—The State highway commission crushed granite for concrete aggregate and roadstone. Four mines produced paving sand and gravel; the leading producers were the State highway commission and Seniard Bros. Powhattan Mining Co. (Kilpatrick mine) mined asbestos. James E. Moore (Fred Hall mine) mined a small quantity

of sheet mica. The Bureau of Public Roads quarried dimension granite for rough construction.

Tyrell.—The State highway commission mined 1,600 tons of paving sand.

Union.—Superior Stone Co. (Bakers quarry) crushed traprock for concrete aggregate and roadstone. Kendrick Brick & Tile Co. (Monroe mine) mined miscellaneous clay for heavy clay products.

Vance.—Vance County ranked fourth in value of mineral production. Tungsten Mining Corp. (Hamme mine) shipped tungsten concentrates. Greystone Granite Quarries crushed granite for concrete aggregate, and roadstone. The State highway commission mined paving sand.

Wake.—Bryan Rock & Sand Co. (Crabtree and Rolesville quarries) and Nello L. Teer Co. (Raleigh quarry) crushed granite for concrete aggregate, and roadstone. The State highway commission mined paving sand.

Washington.—The State highway commission mined 70,000 tons of paving sand.

Watauga.—The State highway commission mined 83,000 tons of paving gravel.

Wayne.—Bryan Rock & Sand Co. (Goldsboro mine) and the State highway commission mined structural and paving sands.

Wilkes.—Three mines produced sheet mica, the leading producer was Tracy Higgins (Tracy mine). The State highway commission mined paving sand.

Wilson.—Bryan Rock & Sand Co. (Neverson and Elm City quarries) crushed granite for concrete aggregate, roadstone, and other uses. The State highway commission mined paving sand.

Yadkin.—Stone Mining Co. (Cycle quarry) crushed granite for concrete aggregate and roadstone. The State highway commission mined paving sand.

Yancey.—Sixty-one mines produced mica, 53 produced sheet only (full-trimmed and/or hand-cobbed), 4 produced scrap only and 4 both sheet and scrap. The leading producers of sheet mica were Burleson & Thomas Mining Co. (Mud Hole mine), S. M. Edge (Poll Hill and Chrisawn mines) and Gouge & Allen (Barger, Barger No. 2 and Barger No. 3 mines). The leading producers of scrap mica were Deweld Mica Corp. and Hassett Mining Co.

The Feldspar Corp. (Mud Hole, Webb, Laws, and McCurry mines) and Terry Mica Miners (Nannie Water Hole mine) mined crude feldspar. C. R. Wiseman (Wray mine) mined olivine. Fox Bros. mined paving sand and structural gravel.

Four DMEA mica contracts were in force.

The Mineral Industry of North Dakota

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of North Dakota.

By D. H. Mullen [1]

MINERAL production in North Dakota in 1958 was valued at a new record of $59.1 million, an increase of 4 percent over the preceding high of 1957. The gain of $2.4 million resulted principally from the steady expansion in output of petroleum, natural gas, and natural-gas products, and a marked rise in output of sand and gravel. The latter increase reflected an expanded program of road construction during the year. The moderate gain in petroleum production (7 percent in quantity and 2 percent in value) resulted from increasing industrialization and the steadily advancing economy of the area. Production was controlled by the State Industrial Commission by establishing monthly allowable production schedules based on estimated demand. Declines were recorded in the production and value of clays, coal (lignite), and crushed stone.

Exploratory drilling was of particular significance in 1958 because of the excellent success ratio. Of 104 completions 18 were discoveries, a success ratio of 17 percent. Exploratory drilling totaled 618,793 feet, second highest in the history of the State, and total drilling was 2.8 million feet, the highest ever recorded.

The decline in lignite production continued as additional power from hydroelectric plants on the Missouri River became available. However, the anticipated increase in demand for electric power and the approaching completion of planned hydroelectric generating facilities on the Missouri River indicated that the additional power needed will come from thermal powerplants, using North Dakota lignite. Considerable attention was given to increased use of lignite and, at the lignite forum held at the University of North Dakota at Grand Forks on May 27, the various uses of lignite were extensively discussed. A nine-man committee was appointed by Governor Davis to study methods of using the vast reserves of North Dakota lignite.

EMPLOYMENT

Employment in the mineral industries averaged 2,078 workers, an increase of 24 percent over 1957. Construction, which included contractors engaged in heavy construction such as road building involving the production of a major part of the sand and gravel used,

[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

averaged 9,484 workers. Total nonagricultural employment averaged 118,617 workers, less than 1 percent above the average employment of 118,367 workers in 1957.

TABLE 1.—Mineral production in North Dakota [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays [2] thousand short tons	54	$67	54	$66
Coal (lignite) do	2,561	5,947	2,314	5,409
Gem stones	(4)		(4)	1
Natural gas million cubic feet	[5] 15,450	[5] 1,468	[3] 17,325	[3] 1,672
Petroleum (crude) thousand 42-gallon barrels	[5] 13,259	[5] 41,501	[3] 14,141	[3] 42,282
Pumice thousand short tons	2	2	11	11
Sand and gravel do	7,048	4,967	11,464	6,605
Stone do	29	52	23	35
Value of items that cannot be disclosed: Clays (bentonite) and natural-gas liquids		2,698		3,012
Total North Dakota		[5] 56,702		59,093

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite; value included with "Items that cannot be disclosed."
[3] Preliminary figure.
[4] Weight not recorded.
[5] Revised figure.

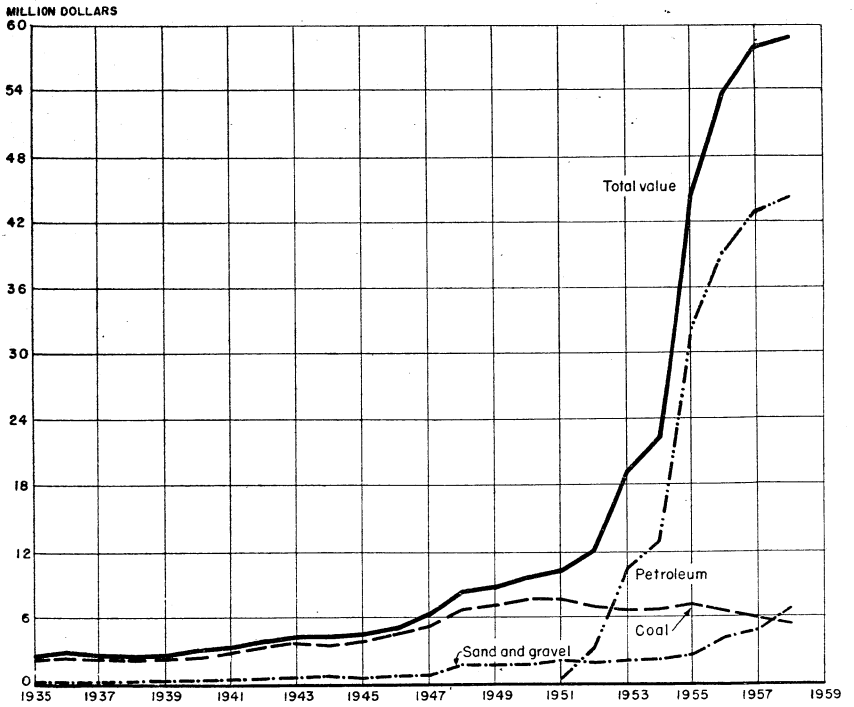

FIGURE 1.—Value of sand and gravel, petroleum, and coal, and total value of mineral production in North Dakota, 1935–58.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Lignite).—Output of lignite from 37 mines (1 underground, 36 strip) in 15 counties, producing 1,000 tons or more, declined 10 percent in quantity and 9 percent in value compared with 1957 and continued the gradual downward trend that began in 1956.

Employment and injury data collected by the Federal Bureau of Mines for all coal mines in the State (5 underground and 43 strip) show 336 employees worked a total of 66,186 man shifts and 17 lost-time injuries. There were no fatal accidents. Three underground mines and 37 strip mines worked the entire year without a lost-time injury.

Additions to the generating capacity of Missouri River dams and the increased supply of natural gas for heating and industrial use in the eastern part of the State helped decrease the use of coal. During the spring runoff, all water released from the four main-stem Missouri River dams passed through hydrogenerators. In October the 80-ton steel turbine for the fourth 80,000-kw. generator at the Garrison Dam powerplant was delivered.

North Dakota lignite was selected to heat the Grand Forks Air Force Base for the 1958–59 heating season. This decision was based on the comparative costs between lignite and heavy fuel oil; fuel costs were to be restudied annually.

TABLE 2.—Production of coal (lignite) in North Dakota, by counties

(Exclusive of mines producing less than 1,000 tons)

County	1957		1958	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Adams	26,325	$2.65	29,269	$3.50
Bowman	195,217	1.77	182,575	1.72
Burke	441,684	2.27	381,536	2.25
Burleigh	13,627	3.28	13,844	3.30
Divide	243,012	2.45	207,370	2.52
Dunn	11,029	2.92	9,682	2.97
Grant	21,338	2.82	26,469	3.15
Hettinger	8,655	2.93	7,270	2.91
McLean	114,939	2.90	97,485	3.00
Mercer	912,668	2.26	824,166	2.25
Morton	28,396	2.48	25,314	2.52
Oliver	9,521	2.50	9,119	2.49
Stark	67,734	2.29	56,944	2.62
Ward	463,671	2.41	439,766	2.36
Williams	2,836	4.47	3,049	4.73
Total	2,560,652	2.32	2,313,858	2.34

[1] Value received or charged 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 as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

Considerable attention was given to possible uses for the 2.5-million-ton stockpile of lignite at Riverdale accumulated during construction of the Garrison Dam. The U.S. Army Corps of Engineers was authorized to negotiate the sale of the lignite. North Dakota Nitrogen,

Inc., of Delaware, affiliated with Chemical & Industrial Corp. of Cincinnati, proposed to construct a $1.5 million plant at Riverdale to use the surplus lignite. It was negotiating with the U.S. Army Corps of Engineers for the purchase of the lignite stockpile, lease on a long-term basis of 1,000 acres of land below the dam for plant and farm demonstration sites, use of the access railroad from Riverdale Junction to the damsite, the Riverdale City steamplant and other facilities. The corporation would use lignite in manufacturing nitrogen fertilizer. The stockpile would be adequate for 8 to 10 years of operation and thereafter the plant would probably use lignite from commercial producers.

The Federal Bureau of Mines continued research work on lignite at its Charles R. Robertson Lignite Laboratory at Grand Forks. Major activities included installing equipment for an extensive investigation of pressure-gasification of lignite, evaluating the various constituents of tars, studying size reduction, and investigating methods to freezeproof lignites. A report [2] concerning one phase of the work was published.

Natural Gas.—Dry natural gas was produced from 28 wells in 2 fields in Bowman County and 1 well in Bottineau County. Gas from the fields in Bowman County and residual gas from the Tioga gasoline plant was marketed through Montana-Dakota Utilities Co. pipelines to consumers in North Dakota, Montana, South Dakota, and Wyoming. Gas from the field in Bottineau County was marketed locally. The quantity marketed was 12 percent more than in 1957.

Natural-Gas Liquids.—Natural gasoline, butane, and propane were recovered at the Tioga gasoline plant in Williams County. Throughput of wet gas, principally from the Beaver Lodge and Tioga fields, was 14.4 billion cubic feet; 7.6 billion cubic feet of residual gas was marketed through natural-gas pipelines. The quantity of natural gasoline and liquid-petroleum gas recovered gained 3 and 9 percent, respectively, over 1957. The plant also recovered elemental sulfur.

Petroleum.—Petroleum production continued to increase for the seventh year since the discovery at Beaver Lodge field in Williams County in 1951. Production came from 10 counties and 67 fields with 1,218 wells producing at yearend; output was 7 percent greater than in 1957. Older fields, such as Beaver Lodge, Capa, and Tioga, showed substantial declines in annual production; however, these decreases were offset by increased production in the Antelope, Blue Buttes, Lignite, Newburg, and Rival fields. Smaller gains were recorded for other fields.

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[2] Oppelt, W. H., Cooney, J. P., Golob, E. F., and Kube, W. R., Thermal Pretreatment and Pelletizing of North Dakota Lignite: Bureau of Mines Rept. of Investigations 5382, 1958, 55 pp.

TABLE 3.—Production of crude petroleum, by counties [1]

(Thousand barrels)

County	1957	1958 (preliminary)	Principal fields in 1958 (in order of production)
Billings	234	368	Fryburg, Rocky Ridge, Scoria.
Bottineau	412	1,139	Newburg, Westhope-S, Westhope-N, Landa-N, Souris-N.
Bowman		15	Little Missouri.
Burke	306	1,252	Lignite, Tioga, Rival, Tioga-N, Flaxton.
Divide	22	130	Noonan, Baukol-Noonan, Tioga-N.
McKenzie	3,291	4,156	Blue Buttes, Antelope, Charlson.
Mountrail	2,095	1,588	Tioga, White Earth, Tioga-E.
Renville	3	32	Glenburn, Sherwood.
Stark	3	33	Dickinson.
Ward	3		
Williams	6,890	5,428	Capa, Beaver Lodge, Tioga.
Total	13,259	14,141	

[1] Based on North Dakota Geological Survey county data adjusted to Bureau of Mines total.

TABLE 4.—Wildcat- and development-well completions in 1958, by counties

[Oil and Gas Journal]

County	Crude	Dry	Total	Footage
WILDCAT				
Billings	1	1	2	17,700
Bottineau	4	42	46	174,700
Bowman	1		1	9,000
Burke	6	16	22	147,800
Cavalier		1	1	3,400
Divide	1	4	5	46,600
Dunn		1	1	8,900
Golden Valley		2	2	18,600
Hettinger		1	1	8,000
Logan		2	2	6,000
McHenry		12	12	45,000
McKenzie	8	4	12	125,600
Morton		1	1	11,200
Mountrail		2	2	15,800
Nelson		2	2	5,200
Renville	2	8	10	52,000
Stark		3	3	28,600
Walsh		1	1	1,800
Ward		8	8	48,380
Williams		1	1	13,000
Total wildcat	23	112	135	787,700
DEVELOPMENT				
Billings	5	2	7	62,000
Bottineau	80	24	104	364,600
Burke	57	27	84	571,200
Divide	9	3	12	87,300
McKenzie	70	16	86	820,100
Renville	1		1	4,600
Stark	1		1	9,000
Williams	8	4	12	133,500
Total development	231	76	307	2,052,300
Total drilling	254	188	442	2,840,000

The exploratory drilling success ratio ranked second in the State's history. Records of the State Geological Survey [3] show 104 completions and 18 discoveries, compared with 126 completions and 17 dis-

[3] Laird, Wilson M., Oil in North Dakota First Half 1958: North Dakota Geol. Survey Bull., August 1958.
Laird, Wilson M., Oil in North Dakota Second Half 1958: North Dakota Geol. Survey Bull., April 1959.

coveries in 1957; success ratios were 17 and 13 percent, respectively. Development, outpost, extension, and stratigraphic test drilling furnished 350 completions, of which 240 were successful. Of 454 wells completed, 258 were successful; an overall success ratio of 57 percent.

Unit operation of the Beaver Lodge-Tioga fields, largest in the State, in Williams, Burke, and Mountrail Counties, was approved by the State Industrial Commission in March. More than 85 percent of the owners in the 2 fields agreed to unit operating, repressuring, and waterflooding the Madison pool, which was expected to increase primary recovery by 130 million barrels. It was estimated that total recovery would be 258 million barrels, or 72 percent of 358 million barrels in place. Amerada Petroleum Corp. was to be the unit operator for 21 companies in the 2 fields. Waterflooding began in November with the injection of 24,000 barrels of water a day in 7 wells of the Tioga field and 6 wells of the Beaver Lodge field; water was injected at the edges of the fields, forcing the oil toward the center. Peak injection, expected in several years, will reach an estimated 93,000 barrels a day into 40 wells.

NONMETALS

Clays.—Miscellaneous clay, produced in Adams and Morton Counties, was used to manufacture building brick, draintile, and other heavy clay products. Shale produced in Divide and Morton Counties was used in lightweight aggregate. A small quantity of bentonite produced in Morton County was used in foundries and in prepared mortar.

Gem Stones.—Gem material, such as petrified wood, chalcedony, and jasper, was collected by individuals in Billings, Morton, and Stark Counties.

Pumice.—Shale, partly fused by fires in underlying coal beds and locally termed "scoria," was mined in Bowman, McKenzie, and Mercer Counties for road construction. Production increased nearly fivefold over 1957.

Sand and Gravel.—Sand and gravel for building, road construction, fill material, and bedding material for stockcars was produced in 44 of 53 counties. The 71 percent of commercial sand and gravel used for road construction was produced at 41 places in 23 counties and represented 25 percent of the total production. Government-and-contractor noncommercial production came from 44 counties. Contractors for the State highway department produced in 44 counties, and county and municipal highway departments, in 42 counties. Material for repairs and maintenance was produced by county and municipal crews in 14 counties. Of the total production, 92 percent was used for road construction. Major production came from Ward County (1,011,700 tons), followed by Pembina (500,200), Barnes (492,000), Williams (484,600), Mountrail (424,600), and Nelson (413,900) counties.

Progress of construction of the National System of Interstate and Defense Highways in North Dakota, according to a report by the U.S. Department of Commerce, Bureau of Public Roads, showed that 119.5 miles of highway construction was completed in 1958. Con-

struction at yearend was in progress on 37.4 miles of highway. Total highway mileage completed under the program through 1958 was 173.8 miles.

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Building	551	$403	313	$302
Paving	127	91	339	245
Filter	(1)	(1)		
Other	5	3	62	33
Total	683	497	714	580
Gravel:				
Building	229	388	290	558
Paving	1,881	1,303	1,649	998
Railroad ballast	232	177	104	44
Other	172	86	57	24
Total	2,514	1,954	2,100	1,624
Total sand and gravel	3,197	2,451	2,814	2,204
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building			70	70
Paving	83	34	212	106
Total	83	34	282	176
Gravel:				
Building	41	35		
Paving	3,727	2,447	8,368	4,225
Total	2,768	2,482	8,368	4,225
Total sand and gravel	3,851	2,516	8,650	4,401
ALL OPERATIONS				
Sand	766	531	996	756
Gravel	6,282	4,436	10,468	5,849
Grand total	7,048	4,967	11,464	6,605

[1] Less than 1,000.

Stone.—Crushed granite for highway construction was produced by contractors in various places throughout the State for the State department of highways. The quantity produced was 21 percent below 1957.

Sulfur.—Elemental sulfur was recovered at the natural-gasoline plant at Tioga, Williams County. Shipments were 18 percent greater than in 1957. Because of the difficulty of assigning the State or country of origin to sulfur recovered from natural gas and crude petroleum at some plants, the value of sulfur so recovered was not included in the total value of mineral production in 1958. Adjustments also were made for previous years to make value data comparable.

Vermiculite.—Crude vermiculite from deposits in Montana was processed at a plant in Ward County. The processed material (ex-

foliated) was used chiefly for insulation; small quantities were used as a lightweight aggregate and as a soil conditioner.

METALS

Uranium.—No activity was reported in development of uraniferous lignite deposits during the year. In April 1958 the Atomic Energy Commission (AEC) completed a study, begun in late 1957, of the adequacy of milling facilities for treating uraniferous materials in certain areas. This study resulted in the recommendation that a 600-ton-a-day plant be authorized for processing uraniferous lignites; none of the 1958 active or proposed plants were equipped to treat the material. A proposal to construct such a plant submitted by International Resources Corp. was considered, and a contract to purchase the uranium oxide to be recovered was recommended. Difficulty in obtaining the necessary capital for constructing the mill was apparently the only remaining obstacle to approving the contract at the end of the year.

REVIEW BY COUNTIES

Barnes.—Output of sand and gravel was more than double that of 1957 and was produced by contractors for the State highway department and by the county highway department for construction, repair, and maintenance of highways. The county ranked third (sixth in 1957) in the State in producing sand and gravel.

TABLE 6.—Value of mineral production in North Dakota, by counties [1]

County	1957	1958 [2]	Minerals produced in 1958 in order of value
Adams	$70,607	$103,185	Coal, clays.
Barnes	159,800	215,000	Sand and gravel.
Benson	80,600	177,300	Do.
Billings	[3] 732,420	1,100,420	Petroleum, gem stones.
Bottineau	[3] 1,289,560	3,405,610	Petroleum.
Bowman [4]	348,276	361,611	Coal, petroleum, pumice.
Burke	[3] 1,993,585	4,632,950	Petroleum, coal, sand and gravel.
Burleigh	119,660	179,827	Sand and gravel, coal.
Cass	246,400	138,700	Sand and gravel.
Cavalier		102,000	Do.
Dickey		199,900	Do.
Divide	[3] 703,142	1,048,005	Coal, petroleum, sand and gravel, clays.
Dunn	32,235	149,350	Sand and gravel, coal.
Eddy	([5])	307,800	Sand and gravel.
Emmons		38,000	Do.
Grand Forks	304,700	208,100	Do.
Grant	60,116	131,934	Coal, sand and gravel.
Griggs		151,900	Sand and gravel.
Hettinger	25,359	27,656	Coal, sand and gravel.
Kidder		3,100	Sand and gravel.
La Moure		46,300	Do.
Logan		71,800	Do.
McHenry	([5])	26,700	Do.
McIntosh	94,100	201,700	Do.
McKenzie	[3] 10,358,460	12,438,049	Petroleum, pumice, sand and gravel.
McLean	640,890	398,273	Coal, sand and gravel.
Mercer	2,061,782	1,854,476	Coal, pumice.
Morton	199,604	220,926	Sand and gravel, coal, clays, gem stones.
Mountrail	[3] 6,673,350	4,960,420	Petroleum, sand and gravel.
Nelson	18,000	212,800	Sand and gravel.
Oliver	23,802	49,903	Sand and gravel, coal.
Pembina		249,900	Sand and gravel.

See footnotes at end of table.

TABLE 6.—Value of mineral production in North Dakota, by counties [1]—Con.

County	1957	1958 [2]	Minerals produced in 1958 in order of value
Pierce		$6,200	Sand and gravel.
Ramsey	$16,900	53,100	Do.
Ransom	21,500	7,200	Do.
Renville	[3] 9,390	106,280	Petroleum, sand and gravel.
Richland	23,200	169,400	Sand and gravel.
Rolette	30,600	61,200	Do.
Sargent	([5])	192,000	Do.
Sheridan	76,700	168,600	Do.
Sioux		39,200	Sand and gravel.
Stark	[3] 253,575	378,021	Coal, sand and gravel, petroleum, gem stones.
Steele	1,800	23,100	Sand and gravel.
Stutsman	([5])	149,000	Do.
Towner		140,900	Do.
Traill	101,400	129,800	Do.
Walsh	64,700	181,200	Do.
Ward	[3] 1,422,640	1,765,312	Coal, sand and gravel.
Wells	21,900	14,300	Sand and gravel.
Williams [6]	[3] 21,825,973	16,523,553	Petroleum, sand and gravel, coal.
Undistributed [7]	[3] 6,595,200	5,570,000	
Total	[3] 56,702,000	59,093,000	

[1] The following counties are not listed because no production was reported: Foster, Golden Valley, Slope.
[2] Values of natural gas, natural-gas liquids, and petroleum are preliminary.
[3] Revised figure.
[4] Excludes natural gas.
[5] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[6] Excludes natural-gas liquids and recovered elemental sulfur.
[7] Includes all natural-gas liquids, natural gas, stones, gem stones (1957), some sand and gravel, and values indicated by footnote 5.

Billings.—Petroleum production from five fields was 57 percent greater than in 1957. It came from Heath sandstone at three fields and Madison limestone at two fields. Total production of petroleum since the first discovery in 1953 has exceeded 1 million barrels.

Bottineau.—Petroleum production from 13 fields was nearly 3 times greater than in 1957, coming from the Madison limestone and the Spearfish and Charles formations. Two fields, Roth and Wiley, were discovered during the year; production from both came from Madison limestone. Total output of petroleum since the first discovery in 1953 has exceeded 2 million barrels. Construction of an oil-gathering system in the Newburg field by International Refineries of Minneapolis neared completion. The main-line terminal was the railhead at Newburg with lateral lines to well sites. Natural gas from the Max Bass field was consumed locally. A geologic and engineering report [4] of the Newburg and Westhope fields was published.

Bowman.—Bowman County became a petroleum producer when Carter Oil Co. completed the Lewis & Ellen Johnson No. 1 well in the Red River formation at a depth of 8,980 feet on January 6. This discovery, designated the Little Missouri field, at first produced 195 barrels a day on pump. In 1958 production exceeded 15,000 barrels. Natural gas from 28 wells in the Cedar Creek and Little Missouri gasfields was marketed through pipelines by Montana-Dakota Utilities Co. Production came from the Eagle sandstone. The Knife River Coal Mining Co. Peerless strip mine at Gascoyne produced partly fused shale, locally termed "scoria," for road construction.

[4] North Dakota Geological Society, Preliminary Study of the Newburg and South Westhope Fields: 1958.

Burke.—Burke County ranked third in the State in the value of coal (lignite) produced and fourth in the value of petroleum. Traux-Traer Coal Co. produced coal from its Kincaid strip mine and at the Bonsness strip mine. Petroleum was produced from the Madison limestone at 111 wells in 16 fields. Five new fields—Bowbells, Foot Hills, South Rival, Stony Run, and Viking—were discovered during the year. Production of petroleum since the first discovery in 1953 has totaled nearly 2 million barrels.

Divide.—Petroleum was produced from Madison limestone at 15 wells in 3 fields, increasing nearly sixfold compared with 1957. The Tioga field was extended into the county, and in August a new field, North Tioga, was established in Divide and Burke Counties. One new field, Writing Rock, was discovered in February. Baukol-Noonan, Inc., produced coal (lignite) at its Baukol-Noonan strip mine in Noonan; it also produced shale for lightweight aggregate.

McKenzie.—McKenzie County ranked second in the State in the production of petroleum, which came from 294 wells in 14 fields. Five new fields were discovered during the year. Discovery wells in the Camel Butte, Clear Creek, and Pershing fields were completed in the Madison limestone; the North Fork field, in Silurain formations; and the Sand Creek field, in Devonian formations. Major production came from the Blue Buttes field (Madison limestone), and the Antelope and Charleston fields (Madison limestone and Spanish sandstone). Production since the first discovery in 1952 has totaled nearly 11 million barrels. Sand and gravel was produced by the county highway department for road repair.

McLean.—Coal (lignite) production declined 15 percent compared with 1957. The major producers were Truax-Traer Coal Co. (Custer strip mine) and the Underwood Coal Co. (Underwood strip). Sand and gravel was produced by contractors for the State highway department.

Mercer.—Mercer County led the State in producing coal (lignite). Output from 5 mines declined 10 percent compared with the preceding year. Major producers were Knife River Coal Mining Co. at the Beulah mine, Truax-Traer Coal Co. at the Dakota Star strip mine, and Dakota Collieries Co. Division, North American Coal Corp., at the Indian Head mine. The last company also mined partly fused shale for road construction.

Morton.—Coal (lignite) production from 4 mines declined 11 percent below that of 1957. Miscellaneous clay was produced for building brick, draintile, and other heavy clay products. A small quantity of bentonite was produced for use in foundries and for manufacturing prepared mortar. The Mandan refinery of Standard Oil Co. of Indiana produced the entire year except during a 30-day strike in September and October. A 1,630-barrel-a-day alkylation unit was completed and began producing in November; butane for this unit was obtained by pipeline from the Signal Oil & Gas Co. natural-gasoline plant at Tioga. Crude oil was delivered largely by pipeline from fields in Williams, McKenzie, and Mountrail Counties. An increasing quantity of crude having a high wax content and from Devonian formations also was processed. Rated capacity of the refinery was 34,700

barrels a day; however, the plant had been producing at a daily capacity of 41,000 barrels on an experimental basis.

Mountrail.—Petroleum production in 1958, 24 percent below that of 1957, came from 141 wells in 3 fields, mostly from that part of the Tioga field lying within the county. The normal depletion of the field, the month-long strike at the Mandan refinery, and the beginning of unit operation of the Tioga field contributed to this decline in production. The county ranked third in the State in output of petroleum. Total oil production of the county since the first discovery in 1953 has been in excess of 10.6 million barrels.

The county ranked fifth in the State in the production of sand and gravel, entirely produced by contractors for the State highway department and used for road construction.

Renville.—Petroleum production, increased substantially over the preceding year, came entirely from two fields, Glenburn and Sherwood, discovered during the year.

Stark.—Coal (lignite) output from three strip mines declined 16 percent compared with 1957; it was produced mostly by the Dickinson Coal Mining Co. from the Lehigh and Dickinson strip mines. Output from the Lehigh mine was used for briquets. Petroleum production from two horizons in the Dickinson field increased substantially over the preceding year. Previous output had come entirely from the Madison limestone. In February a new pool in the Heath sandstone was discovered, furnishing 84 percent of production. The Queen City Oil Co. at Dickinson filed a petition for bankruptcy; its 4,500 barrel-a-day plant had been idle for nearly 2 years because of financial difficulties. The purpose of the bankruptcy proceedings was to permit refinancing and resumption of production.

Construction of a half-million-dollar clay-products-manufacturing plant at Dickinson was begun in August by the Dic-Kota Clay Products Co. Operations were scheduled to begin in the spring of 1959. The plant was designed to manufacture sewer pipe and other heavy clay products. Sand and gravel was produced for the State highway department for road construction.

Ward.—Ward County led the State in output of sand and gravel and ranked second in production of coal (lignite). Sand and gravel (658,500 tons) for road construction was produced by contractors for the State highway department. The county highway department produced sand and gravel for maintenance and repairs. Commercial sand and gravel (268,300 tons) was used for building, paving, and railroad ballast, and as fill material. Major producers were the Minot Sand & Gravel Co. and the Atlas Sand & Gravel Co.

Coal (lignite) production from 4 mines was 5 percent below that of 1957; the principal producer was the Truax-Traer Coal Co. at the Velva strip mine.

Williams.—Williams County continued to lead the State in petroleum production. In 1958 output from the 480 wells in 10 fields was 21 percent below that of 1957. Normal depletion, a month-long strike at the Mandan refinery, and the beginning of unit operation at the Beaver Lodge and Tioga fields contributed to the decline. Successful unit operation required that certain wells be shut in until well pressures were equalized and waterflooding permitted resumption of efficient pro-

duction. A new horizon, Devonian, was discovered in the McGregor field in December and became the second field in the county to produce from more than one formation. Beaver Lodge field has produced chiefly from the Madison limestone. Production has also been obtained from the Red River sandstone and Devonian and Silurian formations. Total petroleum production in the county since the first discovery of oil in the State in 1951 (Beaver Lodge field) has exceeded 37 million barrels, 58 percent of the total production in the State.

Westland Oil Co. operated its 2,000-barrel-a-day refinery at Williston the entire year. Oil for processing was high-gravity sweet crude from fields in northeastern Montana and from Burke County transported to the plant by tank. Construction of a platformer begun in 1957 was completed early in the year. No further improvements were planned; the total cost of this program (begun in 1955 with acquisition of the plant) has been $1.2 million.

The Signal Oil & Gas Co. No. 12 natural-gasoline plant at Tioga processed natural gas from fields in Williams, Burke, Mountrail, and McKenzie Counties; the natural gas was delivered to the plant through a gas-gathering pipeline system. Because of unitizing and repressuring begun in the Beaver Lodge and Tioga fields, some wells that contained a high percentage of gas for use at the Tioga plant, were shut in. However, gas from other wells was available to the pipeline system, and the company began a half-million-dollar expansion to link 736 producing wells to the plant.

The plant has a rated capacity of 65 million cubic feet of gas a day, and it processed about 42 million cubic feet a day at yearend. Products recovered at the plant were natural gasoline, butane, propane, sulfur, and residue gas. Natural gasoline and some butane for use as blending stock were delivered by pipeline to the refinery at Mandan. Residue gas was marketed through pipelines of the Montana-Dakota Utilities Co. to consumers in North Dakota and adjoining States.

Coal (lignite) produced came from the Black Diamond mine, the only underground mine in the State, producing more than 1,000 tons.

Sand and gravel was produced by contractors for the State and county highway departments for road construction, maintenance, and repair. Commercial sand and gravel used for building, paving, railroad ballast, and fill material was produced by three operators. The county ranked fourth in the State in output of sand and gravel.

The Mineral Industry of Ohio

By Joseph Krickich,[1] Stanley A. Feitler,[1] and Roy H. Davis [2]

OWING primarily to slackened pig iron and steel production and less business activity output from the main segments of Ohio mineral industry declined in 1958. Cutbacks in the pig iron and steel industry affected output of fire clay, sandstone, lime, and quartzite (all used in various refractory applications) as well as coal and fluxing stone (limestone). Compared with the preceding year, decreases were reported for most of the other minerals produced, but the State continued to rank high nationally in output of minerals, leading in lime and clay, and ranking fifth in coal and salt.

TABLE 1.—Mineral production in Ohio [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stones	1,505	$132	852	$83
Cement:				
Portland—376-pound barrels	15,454,422	49,115	14,960,087	50,092
Masonry—do	784,443	3,069	739,728	2,951
Clays	6,136,024	16,073	5,219,551	13,082
Coal	36,861,607	146,134	32,028,396	126,241
Gem stones			(2)	(2)
Lime	2,763,128	38,383	2,410,504	32,471
Natural gas—million cubic feet	30,384	7,201	31,786	6,802
Peat	5,478	102	5,660	104
Petroleum (crude)—thousand 42-gallon barrels	5,478	17,694	[4] 6,260	[4] 18,091
Salt (common)	2,824,878	16,936	2,443,123	17,443
Sand and gravel	30,595,877	37,503	29,623,943	36,619
Stone	[5] 37,451,161	[5] 61,847	29,122,138	49,782
Value of items that cannot be disclosed: Gypsum, dimension limestone (1957), marl (calcareous) (1957), and natural gasoline		[6] 2,452		1,905
Total Ohio [7]		[6] 383,000		344,856

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Quantity not recorded.
[3] Less than $500.
[4] Preliminary figure.
[5] Excludes certain stone, value for which is included with "Value of items that cannot be disclosed."
[6] Revised figure.
[7] Totals have been adjusted to avoid duplicating the value of limestone, clays, and calcareous marl used for manufacturing cement and lime.

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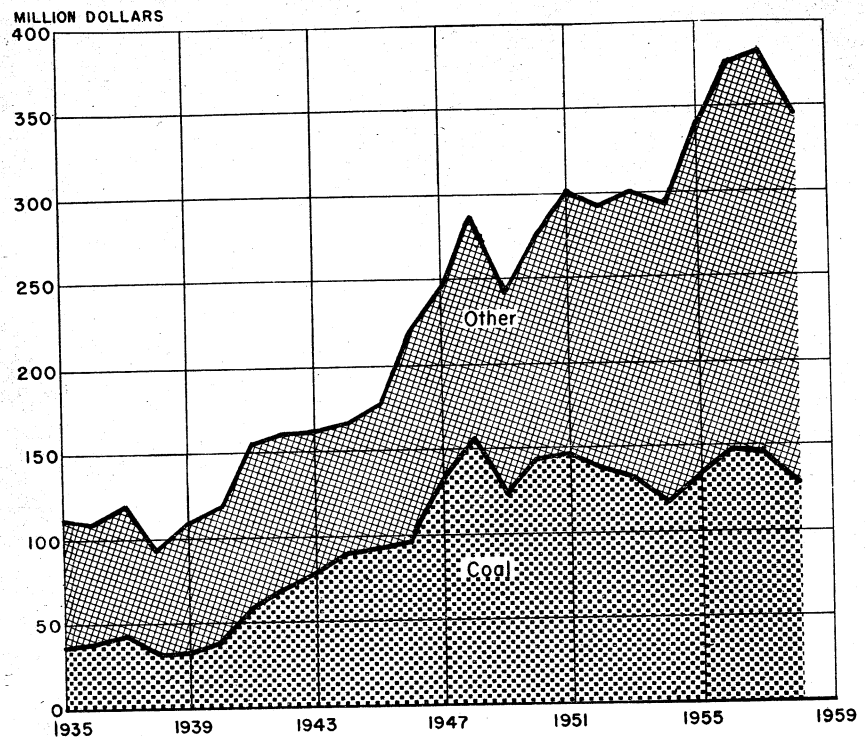

FIGURE 1.—Value of coal and total value of mineral production in Ohio, 1935–58.

Trends and Developments.—Construction of a new cement plant at Barberton and expansion of existing cement plants were reported during the year. The salt industry continued to grow. Production of aluminum at a newly constructed plant near Clarington was started in mid-1958. Interest in offshore drilling on Lake Erie by petroleum and natural gas producers continued as the first test well was begun on the lake 6 miles east of Conneaut.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Grindstones were produced at three quarries—two in Washington County and one in Lorain County.

Cement.—Production and shipment of portland and masonry cements dropped; plants operated at 71 percent of capacity compared with 90 percent in 1957. Total value of portland cement, however, increased owing to a $0.17 increase in the value per barrel. Cement production was reported in eight counties; Greene County led. Annual capacity at producing plants, December 31, 1958, totaled 21.4 million barrels, increased 19 percent over the preceding year. Of the total capacity, 70 percent was wet process and 30 percent, dry process. The industry consumed 377.7 million kilowatt hours of

electrical energy, of which 195.7 million kilowatt-hours were purchased from public utilities.

Most cement companies mined limestone and clay for use at nearby cement plants. Gypsum, sand, calcareous marl, slag, and iron ore also were used as raw materials. Most finished cement was consumed in Ohio; sizable quantities were shipped to Indiana, Kentucky, West Virginia, Michigan, and Pennsylvania. Late in 1958 construction began on the new cement plant of Columbia Southern Chemical Corp. at Barberton. The plant was designed to produce 1.5 million barrels of cement, annually, and would include a 450- by 13-foot rotary kiln. The plant was scheduled for completion late in 1959. Nine silos (capacity, 180,000 barrels of cement) were constructed. A $5 billion expansion program at the Diamond Portland Cement Co. Middlebranch plant was completed.

TABLE 2.—Finished portland cement produced, shipped, and in stock

Year	Number of active plants	Production (thousand barrels)	Shipments from mills		Stocks at mills on December 31 (thousand barrels)
			Barrels (thousands)	Value (thousands)	
1949-53 (average)	9	11,321	11,290	$27,469	794
1954	9	13,307	13,077	35,929	985
1955	9	13,966	13,982	39,643	839
1956	10	15,722	15,151	46,342	1,293
1957	10	16,291	15,454	49,115	1,974
1958	10	15,191	14,960	50,092	2,115

Clays.—Ohio continued to lead the Nation in clay production. A decrease in output was due chiefly to less demand for building brick, refractory material, clay used in manufacturing cement, and lightweight aggregate and was caused largely by a 43-percent drop in demand for refractory materials by the steel, glass, and foundry industries. Clay was produced in 40 counties—1 more than in 1957. Of the 17 fire-clay producing counties, Tuscarawas and Stark Counties led. Cuyahoga and Tuscarawas Counties led in production of miscellaneous clays in the State.

Plans were announced for increasing capacity and modernizing the Perrysburg plant of Perrysburg Tile & Brick Co. The $500,000 expansion program included a new tunnel kiln, new drying kilns, and new buildings, which included laboratory and office buildings.

In May, the Newcomerstown plant of Goshen Brick Co. was destroyed by a $350,000 fire. The plant was rebuilt, and full production was restored by the end of the year.

Gem Stones.—Materials gathered by amateur gem and mineral collectors included barite, calcite, celestite, flint, fossils, jasper, petrified wood, and other mineral specimens, mainly in Wood, Licking, Coshocton, and Ottawa Counties.

Gypsum.—Output and value of crude gypsum decreased compared with 1957. Production was centered in Ottawa County, where two companies mined and calcined crude gypsum for manufacturing finished building products.

Iron Oxide Pigment.—Red iron oxide pigment was manufactured in Summit County from purchased pyrite cinders.

TABLE 3.—Clays sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Carroll	150,005	(1)	(1)	(1)
Columbiana	391,427	(1)	(1)	(1)
Cuyahoga	479,067	$378,263	317,716	$269,816
Highland	8,919	(1)	(1)	(1)
Hocking	141,869	618,915	(1)	(1)
Holmes	(1)	(1)	95,661	213,253
Jackson	189,245	724,453	99,676	604,979
Jefferson	142,872	979,371	90,318	(1)
Lawrence	166,948	963,434	(1)	885,696
Madison	990	(1)	(1)	(1)
Paulding	23,200	(1)	(1)	(1)
Perry	301,060	744,775	298,049	(1)
Putnam	29,192	35,955	21,524	24,330
Scioto	74,157	580,161	9,770	112,605
Seneca	7,500	(1)	7,500	7,500
Stark	630,697	1,523,049	639,690	(1)
Summit	64,954	119,465	(1)	(1)
Tuscarawas	1,259,220	3,787,210	1,018,055	2,989,428
Van Wert	(1)	(1)	6,277	8,436
Vinton	(1)	(1)	40,963	81,926
Washington	40,674	40,674	518	829
Wood	3,190	(1)	1,351	1,351
Undistributed [2]	2,030,838	5,577,158	2,572,483	7,881,869
Total	6,136,024	16,072,883	5,219,551	13,082,018

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes data for the following counties: Ashland, Athens (1958), Belmont (1957), Darke, Delaware, Franklin, Hancock, Harrison, Henry, Mahoning, Marion, Medina, Muskingum, Noble, Portage (1958), Richland, Wayne, Williams, and Wyandot; clays used in cement manufacturing not apportioned by counties; and data indicated by footnote 1.

Lime.—The State continued to lead nationally in production and value of lime. Output declined because of decreased demand for refractory lime used in steel mills; demand for chemical and industrial lime was greater. Seventy-seven percent of the lime was produced for quicklime; the remainder was hydrated. Eighteen plants in 10 counties were active. Sandusky County continued to lead in lime production, furnishing 33 and 38 percent of total lime production and value, respectively, in the State. Shaft-type kilns and batch-type hydrators predominated at the reporting lime plants. The lime was consumed mostly in Ohio and nearby States.

In mid-1957 the Clay Center lime plant of Basic, Inc., was closed, and the manufacture of lime products was transferred to the Gibsonburg plant, where a $400,000 expansion had been completed. An extensive expansion program was also reported at the Sandusky County plant of Woodville Lime Products Co. The Luckey (Wood County) lime plant of National Gypsum Co. was closed.

TABLE 4.—Lime (quick and hydrated) sold or used by producers, in thousands

Year	Agricultural (burned)		Building		Chemical and other industrial		Refractory		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	51	$595	583	$8,004	497	$4,625	1,128	$14,645	2,259	$27,869
1954	68	889	517	8,134	1,040	9,135	924	13,286	2,549	31,444
1955	44	544	639	10,353	1,087	9,828	1,269	18,669	3,039	39,394
1956	37	542	577	9,575	968	8,612	1,413	22,076	2,995	40,805
1957	35	482	510	9,049	918	8,411	1,300	20,441	2,763	38,383
1958	34	481	474	7,539	1,007	9,977	896	14,474	2,411	32,471

Perlite (Expanded).—Tonnage and valuation of expanded perlite produced in Ohio decreased. Plants in Cuyahoga, Montgomery, and Summit Counties expanded crude perlite from Western States; the output was used for plaster and concrete aggregate, loose fill insulation, soil conditioning, and other applications.

Salt.—Ohio continued to rank fifth as a salt-producing State. Most of the salt was consumed as brine for manufacturing chlorine and soda ash, and the remainder was sold as evaporated salt for a wide variety of uses. The vacuum-pan process for evaporating salt predominated. The salt industry operated at 73 percent capacity compared with 85 percent capacity in 1957. Summit County led in value of salt production. Five producers were active in four counties; three producing counties were Lake, Wayne, and Meigs.

Development of the International Salt Co. underground salt mine near Cleveland continued and included sinking production and service shafts, installing dock facilities for boat shipments, and completing test drilling. The inside diameter of each shaft is 16 feet, and the depth will reach 1,850 feet.

Morton Salt Co. purchased 103 acres of land southwest of Rittman as a source of underground salt; recovery by well was expected to begin in 1959.

Sand and Gravel.—The sand and gravel industry was characterized by less demand for structural material and larger demand for paving material, reflecting increased highway and road construction and maintenance. Output of molding sand was less principally because of decreased activity in the iron and steel industry of the State. Output of sand also decreased for glass, grinding and polishing, blast, and engine sand. Ninety-three percent of the State total output was washed, screened, or otherwise prepared, compared with 91 percent in 1957. Less than 1 percent of the total was produced by Government-and-contractor operations. Production was recorded in 78 counties compared with 71 in 1957. Hamilton, Franklin, Butler, and Montgomery Counties, in order of decreasing value, led in sand and gravel output.

A total of 286 commercial operations were active, of which 247 produced gravel and 241, sand. Two operations produced more than 1 million tons of gravel; 8 operations, from 250,000 to 1,000,000 tons; 35 operations, from 100,000 to 250,000 tons; 99 operations, from 25,000 to 100,000 tons; and 60 operations, from 10,000 tons to 25,000 tons. Of the 241 sand operations, 1 plant produced over 500,000 tons, 4 operations from 250,000 to 500,000 tons, 29 operations from 100,000 to 250,000 tons, 90 operations from 25,000 to 100,000 tons, and 51 operations from 10,000 to 25,000 tons. Eighty-seven percent of the total commercial sand and gravel tonnage was shipped by truck; the remainder was transported by rail (7 percent), waterways (5 percent), and other means.

American Aggregates Corp. purchased the Newark plant of Vanatta Gravel Co. and planned to expand; it also acquired 150 acres near Fairborn for a planned $500,000 sand and gravel plant (capacity, 250,000 tons a year).

TABLE 5.—Sand and gravel sold or used by producers, by uses, in thousands

Use	1957		1958	
	Short tons	Value	Short tons	Value
Sand:				
Molding	546	$1,845	305	$1,041
Structural	5,792	6,377	5,030	5,836
Paving	5,472	5,556	5,703	5,891
Filter	79	115	72	118
Railroad ballast	(1)	(1)	17	13
Fill			445	276
Other [2]	989	2,590	609	2,182
Gravel:				
Structural	5,435	6,430	5,172	6,434
Paving	9,832	11,526	9,946	11,861
Railroad ballast	345	340	328	271
Fill			564	567
Other	2,106	2,724	1,433	2,129
Total sand and gravel	30,596	37,503	29,624	36,619

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other" sand.
[2] Includes the following sands: Glass, grinding and polishing, blast, fire or furnace, engine and ground; contains data indicated by footnote 1.

Slag (Iron-Blast-Furnace).—Ohio ranked second after Pennsylvania in output of processed iron blast furnace slag. The quantity of all types of slag decreased from 8.1 million tons in 1957 to 5.8 million tons in 1958, and value also declined from $14.2 million to $10.8 million, chiefly because of slackened pig iron and steel production in the State. Screened air-cooled blast-furnace slag was processed at 18 plants; granulated slag, at 5 plants; and lightweight (expanded) slag, at 5 plants. Seventy-five percent of the total processed slag was screened air-cooled material.

Stone.—Output and value of stone decreased primarily because of less demand for sandstone used in refractory applications and limestone used for aggregate, roadstone, and metallurgical purposes. Output of calcareous marl used in manufacturing cement in Erie County also declined. Stone was produced in 55 counties, compared with 59 counties in 1957.

Limestone furnished 97 and 82 percent of stone output and value, respectively. Of 48 limestone-producing counties, Sandusky, Franklin, and Summit, in order of decreasing value, were the leading counties.

Sandstone was marketed as both dimension and crushed stone. Output of dimension sandstone mainly for sawed stone declined. Quantities of sawed and rough architectural stone were used also

TABLE 6.—Crushed and broken limestone sold or used by producers, by uses

Use	1957		1958	
	Short tons	Value	Short tons	Value
Riprap	410,868	$275,000	48,863	$50,172
Concrete aggregate and roadstone	16,852,044	21,436,743	13,332,065	17,462,523
Fluxing stone	5,629,422	8,090,051	3,845,022	5,411,753
Agriculture	2,125,569	3,414,108	1,678,488	2,650,683
Railroad ballast	1,451,842	1,684,424	668,752	751,672
Miscellaneous uses	10,112,701	15,699,171	8,703,898	14,665,781
Total	36,582,446	50,599,497	28,277,088	40,992,584

as refractories in lining furnaces. Crushed sandstone output declined 35 percent principally because of lessened demand for refractories. Loraine County led the 11 producing counties in output of sandstone.

Vermiculite (Exfoliated).—Exfoliated vermiculite was produced at a plant in Cuyahoga County from crude materials shipped from Montana. Output was used principally for loose-fill insulation and concrete and plaster aggregate.

MINERAL FUELS

Coal.—Bituminous coal production dropped 14 percent in tonnage, 4.8 million tons less than in 1957. Sixty-nine percent of the coal output was strip mined and 28 and 3 percent, recovered by underground and auger mining, respectively. There were 493 active mines producing 1,000 tons or more, 23 more mines than in 1957. At 278 active strip mines (251 in 1957), 614 power shovels and drag lines, 47 carryall scrapers, 499 bulldozers, and 166 power drills were used to recover the coal. Although the dipper capacities of most of the power shovels averaged less than 3 cubic yards, the capacities of 15 shovels were over 12 cubic yards. Most of the power shovels and drag lines were diesel powered. There were 165 active underground mines producing 1,000 tons or more, 12 fewer than in 1957. Virtually the entire underground output (over 99 percent) was cut by machine, including 32 percent mined by continuous miners; the remainder was cut by hand or shot from solid. Eighty-nine percent of the underground output was mechanically loaded. Of the total mechanically loaded, 63 percent was by mobile loaders (mainly into shuttle cars), and 36 percent by continuous miners. The remaining 1 percent was hand-loaded onto conveyors. The number (34) of continuous mining machines was the same as in 1957, but output declined from 3.3 million tons in 1957 to 2.9 million tons in 1958. Fifty auger mines were active in 15 counties in 1958, 8 more than in 1957; the largest production came from 8 mines in Jefferson County. Output totaled 1,070,000 short tons, which averaged $3.65 a ton, $0.06 less than in 1957. Strip mines were active in 15 counties. The value of strip- and underground-mine coal in 1958 averaged $3.61 and $4.68 a ton, compared with $3.64 and $4.65 in 1957, respectively. Harrison, Belmont, and Jefferson Counties led in coal production. Harrison County led in output of strip mine coal; Belmont County led in production of coal from underground mines. Twenty-four preparation plants (two fewer than in 1957) were in operation. Over 14.1 million tons of coal was cleaned, principally by wet-washing methods. Twelve percent was treated to prevent dust or for antifreeze purposes, using either oil or calcium chloride or a combination of both. Eleven percent of the State total output was captive coal. More than half Ohio coal (58 percent) was shipped by rail or water; 33 percent was transported by truck, and the remainder reached markets by other means, mainly pipeline.

The safety record in the coal industry was less favorable—10 fatalities compared with 7 in 1957. Fatalities per million short tons were 0.39 compared with 0.19 the preceding year. Of the five underground fatalities, two were from falls of roofs, and one each caused

by explosives, machinery, and other causes. Four fatalities were recorded at strip mines mainly because of haulage accidents.

TABLE 7.—Bituminous coal production, in thousands

Year	Short tons	Value	Year	Short tons	Value
1949-53 (average)	35,523	$136,630	1956	38,934	$148,650
1954	32,469	117,520	1957	36,862	146,134
1955	37,870	133,814	1958	32,028	126,241

Coke and Coal Chemicals.—Ohio production of coke dropped from second to third after Pennsylvania and Indiana in 1958. The quantity and value of coke, over 6.4 million tons at $110.2 million, declined 43 percent and 45 percent, respectively, compared with 1957. Decreased production of pig-iron during most of 1958 affected the output of coke. On December 31, 1958, there were 15 plants operating 2,515 ovens (all slot type), 76 more ovens than in 1957. The yield of coke from 9.2 million tons of carbonized coal was 69.87 percent. Of the 9,312,000 tons of coal shipped to Ohio for consumption at coke plants, West Virginia supplied 48 percent; Pennsylvania, 35 percent; Kentucky, 10 percent; and Virginia, 7 percent. Nearly all the coke (91 percent) was consumed by producing companies, largely in blast furnaces. The remainder was sold by producers to blast-furnace plants, foundries, and other industrial and residential uses. Byproducts recovered at coke plants included 430,000 tons of coke breeze, 93,638 million cubic feet of coke-oven gas, 69,265 tons of ammonium sulfate, 2,600 tons of NH_3 content of ammonia liquor, 75,705,000 gallons of coke-oven tar, and 25,652,000 gallons of crude light oil (from which 13,519,000 gallons of benzene, 3,171,000 gallons of toluene, 1,185,000 gallons xylene, and 508,000 gallons of solvent-naphtha were derived).

Peat.—Peat from eight operations in six counties was used mostly for soil improvement. Of the output 76 percent was sold in bulk form and the remainder, in packages. Summit County continued as the leading peat-producing area.

Petroleum and Natural Gas.—Output of crude petroleum and natural gas increased, in the face of declining national production. The year was highlighted by increased wildcat activity and continued interest in offshore drilling on Lake Erie. Total well completions decreased from 1,115 in 1957 to 1,049 (including 502 oil, 249 gas, 233 dry, and 65 service) in 1958. Footage for completed wells totaled 2,708,000; the average footage increased from 2,412 in 1957 to 2,582. Twenty-three wildcat completions (4 oil, 7 gas, 12 dry) were reported in 1958 compared with 15 in 1957. The four oil and seven gas discoveries were made at depths between 2,500 feet and 5,000 feet. The remaining completions (1,026) were extensions of known fields. Of the wildcat completions, Holmes County led with seven (three oil, one gas, and three dry). Coshocton County led in development completions with 138 (92 oil, 21 gas, and 25 dry).[3] Proved reserves, January 1959 (according to the American Petroleum Institute and the American Gas Association), were: Crude petroleum, 70.8 million barrels;

[3] Oil and Gas Journal, Annual Review and Forecast Number: Vol. 57, No. 4, Jan. 26, 1959.

natural-gas liquids, 1.6 million barrels; and natural gas, 818,052 million cubic feet (14.65 p.s.i.a., at 60° F.). The reserve of crude petroleum was increased 2.6 million barrels; natural-gas liquids and natural gas reserves decreased.

Eleven petroleum refineries were active with a total operating capacity of 447,787 barrels a day and 479,800 a stream day. Refineries were at Canton, Cincinnati (2), Cleveland, Lima, Newark, Toledo (4), and Weston.

METALS

Aluminum.—Production of aluminum began at the new $110 million reduction plant of Ormet Corp. near Clarington. Bauxite from Surinam was processed into alumina at Burnside, La., and shipped by way of the Mississippi and Ohio Rivers in specially designed barges to the plant. The first of five reduction potlines began producing in May; by the end of the year, four potlines were producing. The fifth and last potline was scheduled for operation early in 1959. Two-thirds of the output from the 180,000-ton-capacity plants was for Olin Mathieson Chemical Corp. and one-third for Revere Copper & Brass, Inc., joint owners of the plant. Construction of a new aluminum rolling mill of Olin Mathieson Chemical Corp. adjacent to the reduction plant continued, and production was scheduled to begin in mid-1959. Work on an electric generating plant across the Ohio River at Cresap, W. Va., also continued and was expected to be completed during the first quarter of 1959.

Beryllium.—The Brush Beryllium Co., Elmore, produced beryllium metal, alloys, and compounds for nuclear and other applications. By terms of the 5-year contract awarded in 1956, the company agreed to annual delivery (beginning in 1958) of 100,000 pounds of beryllium ingots to the Atomic Energy Commission (AEC). This contract was amended to set new production at 37,500 pounds of ingots, annually.

Ferroalloys.—Twelve major categories of ferroalloys totaling 378,000 tons were produced. Shipments totaled 407,000 tons valued at $92,698,000 included 36,000 tons silicomanganese, 103,000 tons ferrosilicon, 57,000 tons ferrochromium and chrome briquets, and 6,000 tons ferrochromium silicon as well as quantities of ferromanganese, silvery pig iron, ferrosilicon boron, ferrotitanium, ferrovanadium, and other ferroalloys.

Ohio Ferro-Alloys Corp. began producing ferrosilicon and silicon metal at its new electric furnace plant in Powhatan Point (Belmont County).

Iron and Steel.—Pig iron production decreased sharply, owing chiefly to the general business decline. Output totaled 9,563,000 tons, 5.4 million tons less than 1957. Seventy-seven percent of the total pig iron output was used in basic open hearths, 19 percent went to Bessemer converters, and the remainder was used for malleable, low-phosphorus, foundry, and direct castings. Metalliferous materials consumed in the State's blast furnaces included 8.9 million tons of iron ore (22 percent foreign), 3.3 million tons of sinter, 486,000 tons of mill cinder and roll scale, and 181,000 tons of flue dust. In addition, 279,000 tons of home scrap, 90,000 tons of slag scrap, 257,000 tons of purchased scrap, 761,000 tons of open hearth and Bessemer slag,

7.7 million tons of coke, and 2.9 million tons of limestone and dolomite were consumed. Slag production totaled 4.2 million tons. Recovered materials included 806,000 tons of flue dust and 132,000 tons of scrap.

The blast furnace capacity of 52 stacks at 22 plants totaled 18,209,000 tons on January 1, 1959, decreasing by 1 stack and 54,000 tons from January 1, 1958. The 281,000-ton-capacity stack of United States Steel Corp., Central Operations, (Youngstown) was abandoned. The total capacity of 20 steel plants (179 open hearths, 9 Bessemers, and 35 electric furnaces) was 28,861,680 short tons, January 1, 1959—two Bessemers less and a 745,000 tons more than in the preceding year.

According to the American Iron & Steel Institute, steel (ingots and steel for castings) production totaled 13.8 million tons compared with 19.8 million tons in 1957. Of the 1958 total, 85 percent was produced in open hearths, 8 percent in Bessemer converters, and 7 percent in electric furnaces.

In mid-1958 the $10 million iron ore sintering plant of United States Steel Corp. Youngstown works began producing.

TABLE 8.—Annual capacity of blast furnaces, January 1, 1959, in short tons

[American Iron and Steel Institute]

Company	Location of plant	Number of stacks	Total annual capacity (short tons)
Louis Berkman Co	Belmont County: Martins Ferry	1	136,800
	Butler County:		
Armco Steel Corp	Middletown	1	691,000
Do	New Miami	2	604,000
	Cuyahoga County:		
American Steel & Wire Division	Cleveland	2	752,000
Jones & Laughlin Steel Corp	do	2	866,000
Republic Steel Corp	do	6	2,586,000
	Jackson County:		
Interlake Iron Corp	Jackson	1	75,000
Jackson Iron & Steel Corp	do	1	95,000
	Jefferson County:		
Wheeling Steel Corp	Steubenville	5	1,708,000
National Tube Division	Lorain County: Lorain	5	2,073,000
Interlake Iron Corp	Lucas County: Toledo	2	551,000
Youngstown Sheet & Tube Co	Mahoning County: Campbell	4	1,452,000
Sharon Steel Corp	Lowellville	1	149,000
Pittsburgh Coke & Chemical Co	Struthers	1	182,500
Republic Steel Corp	Youngstown	5	1,773,000
United States Steel Corp. (central operations)	do	5	1,937,200
Youngstown Sheet & Tube Co	do	2	504,000
Detroit Steel Corp	Scioto County: Portsmouth	2	768,700
	Stark County:		
Republic Steel Corp	Canton	1	266,000
Do	Massillon	1	266,000
	Trumbull County:		
Youngstown Sheet & Tube Co	Hubbard	1	204,000
Republic Steel Corp	Warren	1	569,000

Titanium.—Titanium-sponge was produced at Ashtabula by Union Carbide Metals Co. and Mallory-Sharon Metals Corp.; in mid-1958 this latter company purchased the Ashtabula titanium tetrachloride plant of Stauffer Chemical Co., shipping titanium tetrachloride by pipeline to the sponge plant. Mallory-Sharon also rolled and fabricated titanium at its plant in Niles. Several new titanium alloys were developed with aluminum, columbium, and vanadium, and having high temperature applicability, and improved workability and tensile strength. Titanium metal also was rolled and forged at the Toronto plant of Titanium Metals Corp. of America.

Zirconium.—The newly formed Mallory-Sharon Metals Corp. was in full production by the end of 1958 at its plant near Ashtabula. Zirconium sponge, "chunklets," and byproduct hafnium oxide were produced. Half of the output (1 million pounds a year) of zirconium will be supplied at reactor grade to the Atomic Energy Commission (AEC) under a 5-year contract. The other half of the output will be available to industry for nuclear work and for high corrosion resistance applications. The plant utilized a sodium-reduction process, which yielded hafnium-free zirconium sponge. Sodium used at the plant was supplied from the nearby sodium and chlorine plant of United States Industrial Chemical Corp.

REVIEW BY COUNTIES

Value of mineral output were lower in 57 of the 86 mineral producing counties. The largest decline was in Tuscarawas County, owing chiefly to decreased output of coal, the county's predominant mineral. The State of Ohio Highway Department reported production of sand and gravel either by its own crew or by contractors in Athens, Jackson, Meigs, Morgan, and Washington Counties. The highway departments of Ashland, Brown, Greene, Hocking, Knox, Lake, and Morrow Counties also reported Government-and-contractor production of sand and gravel. In addition, Government-and-contractor output of sand and gravel was reported by the cities of Hamilton (Butler County) and Mansfield (Richland County).

TABLE 9.—Value of mineral production in Ohio, by counties[1 2]

County	1957	1958	Minerals produced in 1958 in order of value
Adams	$617,032	$561,774	Stone.
Allen	1,208,653	984,283	Stone, sand and gravel.
Ashland	(3)	(3)	Sand and gravel, clays.
Ashtabula	217,340	(3)	Lime, sand and gravel.
Athens	(3)	2,249,545	Coal, stone, clays, sand and gravel.
Auglaize	(3)	(3)	Sand and gravel, stone.
Belmont	28,607,849	27,440,870	Coal, stone.
Brown	45,467	70,994	Stone, sand and gravel.
Butler	1,912,291	2,156,372	Sand and gravel, stone.
Carroll	2,827,424	2,082,502	Coal, stone, clays, sand and gravel.
Champaign	443,251	(3)	Sand and gravel.
Clark	(3)	(3)	Sand and gravel, lime, stone, peat.
Clermont	635,933	(3)	Sand and gravel.
Clinton	882,482	565,680	Stone, sand and gravel.
Columbiana	(3)	(3)	Coal, clays, sand and gravel.
Coshocton	5,163,762	6,232,693	Coal, stone, sand and gravel, gem stones.
Crawford	(3)	(3)	Stone, sand and gravel.
Cuyahoga	1,341,364	877,892	Sand and gravel, clays.
Darke	(3)	(3)	Do.
Delaware	(3)	(3)	Lime, stone, clays.
Erie	5,543,313	4,092,210	Cement, stone, sand and gravel.
Fairfield	(3)	263,721	Sand and gravel.
Fayette	1,169,244	782,619	Stone.
Franklin	8,293,635	8,664,132	Sand and gravel, stone, lime, clays, gem stones.
Gallia	(3)	(3)	Coal, sand and gravel, gem stones.
Geauga	(3)	(3)	Stone, sand and gravel.
Greene	(3)	(3)	Cement, sand and gravel.
Guernsey	2,797,056	1,184,867	Coal, stone.
Hamilton	4,315,168	4,201,780	Sand and gravel.
Hancock	(3)	(3)	Stone, clays.
Hardin	(3)	(3)	Stone.
Harrison	42,433,097	30,707,511	Coal, stone, clays.
Henry	(3)	(3)	Sand and gravel, clays.
Highland	(3)	(3)	Stone, sand and gravel, clays.
Hocking	1,024,543	508,489	Coal, clays, sand and gravel.
Holmes	558,740	661,734	Stone, clays, sand and gravel, coal.
Huron	(3)	80,025	Sand and gravel.
Jackson	2,679,086	1,771,306	Coal, clays, sand and gravel.
Jefferson	(3)	14,115,599	Coal, sand and gravel, clays, stone.
Knox	(3)	(3)	Sand and gravel, stone.
Lake	(3)	(3)	Cement, salt, sand and gravel.

See footnotes at end of table.

TABLE 9.—Value of mineral production in Ohio, by counties [1] [2]—Continued

County	1957	1958	Minerals produced in 1958 in order of value
Lawrence	$8,535,121	$8,250,641	Cement, clays, coal, sand and gravel, stone.
Licking	480 569	612, 656	Sand and gravel, gem stones.
Logan	297, 515	(3)	Stone, sand and gravel.
Lorain	(3)	(3)	Stone, sand and gravel, grindstones.
Lucas	(3)	(3)	Cement, stone, sand and gravel, gem stones.
Madison	(3)	(3)	Sand and gravel, clays.
Mahoning	6, 527, 179	(3)	Coal, clays, sand and gravel.
Marion	(3)	(3)	Stone, clays, sand and gravel.
Medina	(3)	(3)	Sand and gravel, clays.
Meigs	(3)	(3)	Coal, sand and gravel, salt.
Mercer	(3)	(3)	Stone.
Miami	1, 911, 373	1, 885, 019	Stone, sand and gravel.
Monroe	(3)	57, 641	Do.
Montgomery	(3)	(3)	Sand and gravel, stone, gem stones.
Morgan	7, 059, 134	(3)	Coal, sand and gravel.
Morrow	43, 000	88, 570	Sand and gravel.
Muskingum	(3)	(3)	Cement, coal, stone, sand and gravel, clays, gem stones.
Noble	(3)	(3)	Coal, stone, clays.
Ottawa	9, 322, 288	7, 760, 347	Lime, gypsum, stone, gem stones.
Paulding	(3)	(3)	Cement, stone, clays.
Perry	(3)	(3)	Coal, sand and gravel, clays.
Pickaway	(3)	(3)	Sand and gravel.
Pike	(3)	(3)	Sand and gravel, stone.
Portage	4, 850, 588	3, 668, 482	Sand and gravel, stone, coal, clays, peat.
Preble	(3)	(3)	Lime, sand and gravel, stone.
Putnam	382, 851	(3)	Stone, clays.
Richland	(3)	(3)	Sand and gravel, clays, peat, stone.
Ross	(3)	746, 268	Sand and gravel.
Sandusky	18, 640, 914	14, 299, 633	Lime, stone, sand and gravel.
Scioto	2, 415, 014	(3)	Stone, clays.
Seneca	(3)	(3)	Lime, stone, clays.
Shelby	387, 566	(3)	Sand and gravel, stone.
Stark	10, 872, 078	10, 418, 661	Cement, coal, clays, sand and gravel, stone, peat.
Summit	13, 009, 790	14, 438, 002	Salt, stone, lime, sand and gravel, clays, peat.
Trumbull	177, 901	185, 241	Sand and gravel.
Tuscarawas	(3)	12, 837, 309	Coal, clays, sand and gravel.
Union	(3)	(3)	Stone.
Van Wert	(3)	(3)	Stone, clays.
Vinton	(3)	(3)	Coal, clays, stone.
Warren	449, 273	437, 066	Sand and gravel.
Washington	(3)	(3)	Coal, sand and gravel, stone, grindstones, clays.
Wayne	(3)	(3)	Salt, coal, sand and gravel, clays.
Williams	(3)	(3)	Sand and gravel, clays.
Wood	(3)	530, 402	Stone, clays, gem stones.
Wyandot	(3)	(3)	Stone, lime, sand and gravel, peat, clays.
Undistributed	[4] 184, 921, 123	158, 382, 970	
Total	[4] 383, 000, 000	344, 856, 000	

[1] Defiance and Fulton Counties were not listed, as no production was reported.
[2] Fuels, including natural gas, petroleum, and natural-gas liquids, not listed by counties, as data are not available; included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Revised figure.

Adams.—Davon, Inc., quarried and crushed limestone at Peebles for use mainly as concrete aggregate and roadstone. Quantities also were used for coal-mine rock dust, agstone, cement, and railroad ballast. The county highway department produced more than 50,000 tons of limestone for use in road building and maintenance.

Allen.—Limestone was produced at four quarries near Bluffton, Delphos, and Lima (2). More than 80 percent of the limestone was used as roadstone and concrete aggregate and the remainder, as railroad ballast, agstone, and riprap. Output decreased for the second consecutive year. Paving sand and gravel was produced by C. E. Duff & Son near Lima.

Ashland.—Commercial production of sand and gravel from plants near Loudonville and Mifflin consisted mainly of prepared building and paving material. Heavy clay products were produced from miscellaneous clay mined from an open pit near New London.

Ashtabula.—Sand and gravel used mainly for building and paving purposes was produced near Kingsville, Ashtabula, and Conneaut. Molding sand was produced near Conneaut. Gleason Sand & Gravel, Inc. (Conneaut), installed a new washing plant during the year.

Athens.—Fifteen underground, three auger, and three strip coal mines were active. Gem Coal Co. cleaned coal by wet washing at its No. 255 plant. Two companies at Albany and one at Amesville mined and prepared limestone for use in concrete and highway construction. Vaughn Coal & Clay Co. mined plastic and silica fire clay near Nelsonville. Output was shipped to plants in Hocking County for building brick and other heavy clay products. Commercial sand and gravel was produced near Athens and The Plains, mainly for paving and structural material.

Auglaize.—Sand and gravel pits mostly near Wapakoneta produced structural and paving material. Near Wapakoneta and Buckland National Lime & Stone Co. of Findlay quarried limestone that was crushed and sized for use in concrete, roadstone, and agstone.

Belmont.—Belmont County continued to rank second in output of coal; 6.2 million tons were recovered chiefly from underground mines. There were 19 underground, 27 strip, and 4 auger mines active. Over 3.7 million tons of coal was cleaned at seven cleaning plants. Thirty continuous mining machines were used underground.

George & C. H. McCort mined limestone for use as roadstone and concrete aggregate near Temperanceville. Limestone was crushed and screened for agricultural, road, and concrete applications by W. J. Plumly at Somerton.

Brown.—The county highway department and Howard S. Watson produced limestone at Georgetown for concrete aggregate, roadstone, and agricultural purposes. Howard S. Watson also produced gravel.

Butler.—Sand and gravel used mainly for building and paving purposes was produced at 13 commercial operations, mostly at plants near Hamilton and Middletown. North Cincinnati Sand & Gravel Co. discontinued output of limestone at Hamilton in July.

Carroll.—Twelve coal mines (eight strip, two underground, and two auger) were active. Coal was crushed at four county mines. Hanna Coal Co., Division, Consolidation Coal Co., mined and sized limestone at its Ames Plant at Carrollton mainly for aggregate and agstone. Fire clay was recovered from pits near Magnolia and Minerva. Miscellaneous clay was produced near Magnolia and used for building brick and other heavy clay products. Molding sand was produced near Mineral City.

Champaigne.—Paving sand and gravel and railroad ballast gravel was produced near Urbana. Building gravel was produced at a portable plant near Springhill.

Clark.—Nine sand and gravel plants, mainly near Springfield, New Carlisle, and Enon, were active, and output consisted principally of prepared structural and paving material. The Moores Lime Co. crushed and screened high magnesium limestone at its Durbin operation for use as aggregate, agstone, blast-furnace flux, filler, and raw material for manufacturing lime and dead-burned dolomite. The lime was used in construction, agriculture, sewage treatment, water purification, and papermaking. Reedsedge and humus peat were produced by Harold A. Skinner near Carlisle.

Clermont.—Structural and paving sand and gravel was produced at a stationary plant near Miamiville.

Clinton.—Melvin Stone Co. (Melvin) quarried high-magnesium limestone for use as concrete aggregate, roadstone, agstone, riprap, and flux. The company also produced sand and gravel.

Columbiana.—Although the number of active coal mines increased from 42 in 1957 to 62, output increased only 4 percent. The county ranked second in value of clay production, of which 57 percent was fire clay, and the remainder, miscellaneous clay. The output was reported from eight pits in the eastern part of the county. Miscellaneous clay was used for building brick, vitrified sewer pipe, floor and wall tile, and other heavy clay products. County fire clay was used chiefly for firebrick and block and other refractories. On July 1, Summitville Face Brick Co., Summitville, announced the change of its company name to Summitville Tiles, Inc. Mainly building and paving sand and gravel was produced near Leetonia, East Liverpool, and Salem.

Coshocton.—Production of coal (mainly strip-mined) increased slightly over 1957. Twenty mines (12 strip, 8 underground) were active. Briar Hill Stone Co. of Glenmont quarried sandstone at Cavallo, Walhonding, Layland, and New Castle. The sandstone was sawed for architectural applications and dressed for use in steel mills. Variegated Quarries Division, Nicholl Stone Co., produced sandstone in quarry blocks that were sawed at its mill at Killbuck, Holmes County. Sand and gravel was produced throughout the county, mainly for building and paving material. Four hundred pounds of selenite crystals and flint was collected near Nellie by amateur gem collectors. Reconstituted mica was produced by General Electric Co. at Coshocton. This sheet material was formed from specially delaminated mica scrap and used as a substitute for built-up mica in many applications.

Crawford.—At its Spore Quarry near Bucyrus National Lime & Stone Co., Findlay, quarried limestone, which was crushed and sized for concrete aggregate, roadstone, sinter stone, agstone, blast-furnace flux, and railroad ballast. Crawford County Highway Department quarried and crushed limestone for improvement and maintenance of roads. Building and fill sand and gravel, paving sand, and filter sand was produced by Galion Gravel Co., Galion.

Cuyahoga.—Five sand and gravel producers, mostly near Cleveland, recovered material, the bulk of which was used for building and paving purposes. Miscellaneous clay and shale were produced at seven operations throughout the county and used mostly for building brick, as well as for draintile, lightweight aggregate, and flowerpots. Crude perlite from Colorado, Nevada, and New Mexico was expanded at the Cleveland plant of Cleveland Gypsum Co. Archer Daniels Midland Co., Division, Federal Foundry Supply Co. (formerly Wyodak Chemical Division) exfoliated vermiculite from purchased material at its Cleveland plant.

Darke.—Seven sand and gravel producers were active. The output was used mainly for paving, building, and fill purposes and was produced near Fort Jefferson, Greenville, New Madison, and Versailles. Draintile was manufactured from miscellaneous clay mined near Greenville.

Delaware.—Scioto Lime & Stone Co. (Delaware), produced limestone for concrete aggregate, roadstone, railroad ballast, agstone, and manufacturing lime in its rotary kiln. Lime was sold for use as flux in open-hearth and electric furnaces, bleach in papermills, neutralizer for waste treatment, and reagent in water treatment plants. Marble Cliff Quarries Co. at Powell produced limestone for concrete aggregate, roadstone, agstone, and riprap. Penry Stone Co. (Radnor) and the Owens Stone Co. (Ostrander) mined and prepared high-calcium limestone for concrete aggregate, roadstone, and agstone. Total stone production for Delaware County was 7 percent less than in 1957. Building brick was made from miscellaneous clay mined near Westerville and Galena.

Erie.—Medusa Portland Cement Co. mined calcareous marl and clay for manufacturing cement at its Bay Bridge plant, which used other raw materials including limestone, fly ash, air-entraining compounds, and grinding aids. It produced Types I and II portland cement for general use, Type III high-early-strength, waterproof portland, and mortar cement. Sandusky Crushed Stone Co., Inc., Parkertown, quarried limestone for use as concrete aggregate, roadstone, agstone, railroad ballast, riprap, filter medium, and stone sand. The company installed two 6- by 16-foot three-deck screens at its crushing plant during 1958. Molding sand was produced at stationary plants near Huron and Shinrock.

Fairfield.—Sand and gravel consisting mainly of building and paving material was mined near Lancaster.

Fayette.—Three companies produced limestone for concrete aggregate and roadstone, railroad ballast, agstone, and riprap. Two quarries were near Washington Court House and the other, near Greenfield.

Franklin.—Franklin County led in output of sand and gravel. Eight operations mainly near Columbus were active. American Aggregates Corp. was the leading producer. Marble Cliff Quarries Co. of Columbus prepared limestone for blast-furnace and open-hearth flux, roadstone, railroad ballast, agstone, and concrete aggregate. The company used part of its production in manufacturing lime which was utilized in open-hearth steel furnaces, papermaking, water treatment plants, masonry, and agriculture. Most of the lime produced was marketed in Ohio. The Claycraft Co. mined plastic fire clay and miscellaneous shale from the Taylor mine near Blacklick. It constructed a new laboratory and glaze area and added a preheater operation. The Columbus Clay Manufacturing Co., Blacklick, mined miscellaneous shale for use in manufacturing draintile. Specimens of petrified wood were gathered near Columbus by mineral specimen collectors.

Gallia.—Coal production decreased slightly despite the increased number of active mines, 21 compared with 15 mines in 1957. Peacock Coal Co. cleaned run-of-mine coal at its Cheshire plant. Prepared molding sand was produced at a stationary plant near Kerrs. Prepared building and paving sand and gravel was produced near Gallipolis. Petrified wood specimens were collected in the county by amateurs.

Geauga.—Quartzite, mined at Thomson by Harbison-Walker Refractories Co., was used in silica brick. Seven operators produced

sand and gravel for building and paving. Jefferson Materials Co. produced filter sand and gravel at its County Line plant. It also produced structural sand and gravel and other gravel at its Boyer plant near Newburgh.

Greene.—Limestone and clay were mined by two cement producers near Fairborn. Southwestern Portland Cement Co. used gypsum, flue dust, and scrap iron products in addition to limestone and clay. Types I and II portland cement for general use, high-early-strength, waterproof, and mortar cements were made. Universal Atlas Cement Division of United States Steel Corp. purchased sand, gypsum, and iron dust for manufacturing Types I and II portland cement for general use, high early strength, and masonry cements. Eight sand and gravel producers were active, mainly processing gravel for building and paving purposes. Phillips Sand & Gravel Co. constructed a new washing plant at Alpha.

Guernsey.—Coal output (mainly strip-mined) dropped from 811,000 tons in 1957 to 273,000 in 1958. Fifteen mines (10 strip, 4 underground, and 1 auger), were active. John Gress Co. produced roadstone from dolomite quarried near New Concord.

Hamilton.—Hamilton County in 1958 ranked second after Franklin County as the leading sand- and gravel-producing area in the State. Output, mainly prepared material, was produced at ten places.

Hancock.—National Lime & Stone Co., Tarbox-McCall Stone Co., both of Findlay, and Pifer Stone Co., Inc., Williamstown, produced limestone for concrete aggregate, roadstone, railroad ballast, and agstone. The Herzog Lime & Stone Co. (Forest) and the Hardin Quarry Co. (Blanchard) produced limestone for concrete aggregate, roadstone, metallurgical flux, agstone, railroad ballast, and riprap. Miscellaneous clay, mined near Findlay, was used in heavy clay products.

Hardin.—Limestone, mainly for concrete aggregate, metallurgical purposes, and agstone, was quarried near Forest and Blanchard.

Harrison.—The county continued to lead as a coal-producing area despite a 2.5-million-ton drop in coal output. Sixty-eight percent of the coal was strip-mined; 30 percent was mined underground; and 2 percent came from auger mines. Most of the coal was cleaned at the Georgetown plant of Hanna Coal Co., Division, Consolidation Coal Co., and the Nelms plant of Youghiogheny and Ohio Coal Co. Over 2.5 million tons of coal was crushed and over 2 million tons was treated for dust preventative or antifreezing.

The Hanna Coal Co., Division, Consolidation Coal Co. (Cadiz) produced limestone at its Georgetown No. 12 plant for use as aggregate in concrete, roadstone, and agstone.

The Bowerston Shale Co. (Bowerston) mined miscellaneous shale for use in farm draintile.

Henry.—Sand and gravel was dredged at two places on the Maumee River. Turkey Foot Sand & Gravel Co. installed a conveyor system for unloading barges at its Napoleon operation. Napoleon Sand & Gravel Co., Napoleon, also dredged. Farm draintile was manufactured from miscellaneous clay from open pits near Malinta and Napoleon.

Highland.—Highland Stone Division, Davon, Inc. (Hillsboro), and Ohio Asphaltic Limestone Co., Inc. (New Vienna), quarried lime-

stone for concrete aggregate, roadstone, and agstone. New conveyors and a new trommel screen were installed by Ohio Asphaltic Limestone Co., Inc., during the year. Uhrig and Collins at a portable plant near Hillsboro and Greenfield Sand & Gravel Corp. at a stationary plant near Greenfield produced sand and gravel. Miscellaneous shale was produced near Mowrystown for building brick and draintile.

Hocking.—Seven underground, six strip, and one auger coal mines were active.

Plastic fire clay and miscellaneous shale used entirely for building brick was recovered from the Mohler pit near Logan of General Hocking Brick Co. Heavy clay products were produced at the Haydenville plant of Natco Corp. from plastic fire clay mined nearby and in Athens County.

Sand and gravel was produced near Enterprise and Logan.

Holmes.—Holmes Clay Division, Holmes Limestone Co., Berlin, quarried limestone for agricultural purposes. Briar Hill Stone Co. Glenmont, produced sawed sandstone for architectural applications at its No. 5 and No. 8 quarries near Killbuck and at quarry No. 31 near Glenmont.

Miscellaneous clay and plastic fire clay was produced from a pit near Baltic by General Clay Products Co. Plastic fire clay, produced near Berlin by Belden Brick Co. and Holmes Clay Division of Holmes Limestone Co., was used in refractories, rotary drilling mud, flux filler, and building brick manufacture.

Mostly paving gravel was produced at two plants near Millersburg and one plant near Holmesville.

Three mines (two strip and one underground) produced 34,000 tons of coal.

Huron.—Building and filter sand and gravel and paving and fill gravel were produced at the Willard operation of Huron Sand & Gravel Co. Greenwich Sand & Gravel Co., Greenwich, was inactive.

Jackson.—Coal production (mostly strip-mined) totaled 270,000 tons. The Waterloo plant of Waterloo Coal Co. was the only active coal-cleaning plant.

Fire clay, produced at four places near Oak Hill, was used mostly for firebrick and block and other refractory uses.

Glass sand and other sand was produced near Jackson by Pennsylvania Glass Sand Co. A limited quantity of building sand was also produced near Jackson.

Jefferson.—The county continued to rank third in output of coal as 3,377,000 tons (61 percent from strip mines) of coal was produced. Coal was cleaned at the Piney Fork No. 1 plant of Hanna Coal Co., Division of Consolidation Coal Co. and the Jennie plant of Warner Collieries.

The Iron City Sand & Gravel Corp. (Strattonville) dredged sand and gravel from the Ohio River for building and paving uses.

Output of clay (87 percent fire clay, 13 percent miscellaneous clay) was mainly from pits in the eastern part of the county. The fire clay was used for manufacturing vitrified sewer pipe and other heavy clay products, firebrick and block, and for other refractory uses. The miscellaneous clay was used for manufacturing vitrified sewer pipe.

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Freeport Quarries, Inc., Steubenville, produced sandstone rubble at its Freeport quarry near Hammondsville.

Knox.—Commercial output for sand and gravel came from six operations and was mainly building and paving material. Quantities of glass, molding, and filter sand also were produced.

Briar Hill Stone Co., Glenmont, produced sawed sandstone for architectural use.

Lake.—Standard Portland Cement Division, Diamond Alkali Co., Painesville, mined clay and purchased limestone and gypsum for manufacturing portland cement. The cement was shipped mostly to destinations in Ohio.

Diamond Alkali Co. also recovered brine from wells near Painesville for manufacturing chlorine and soda ash.

Sand and gravel output was reported from operations near Kirtland, Eastlake, Mentor, and Painesville.

Lawrence.—Alpha Portland Cement Co., Ironton, mined dolomitic limestone and sandstone for manufacturing portland cement, masonry, and mortar cement in its plant nearby. Marquette Cement Manufacturing Co., Superior, mined dolomitic limestone and shale for use in manufacturing cement at its Superior mill. Lawrence County Highway Department, Ironton, produced limestone for highway construction and maintenance.

From seven operations throughout the county, fire and miscellaneous clay was produced, chiefly for firebrick and block and other refractory uses and also for manufacturing floor and wall tile.

Coal was recovered from five mines (four strip and one underground).

Building sand and gravel and fill gravel were produced at the Chesapeake operation of Wilson Sand & Gravel Co.

Licking.—Sand and gravel consisting chiefly of prepared building and paving material was produced, mainly near Newark. Specimens of chalcedony, flint, jasper, and quartz crystals were recovered, principally near Flint Ridge.

Logan.—Four companies produced limestone, which was consumed mostly as aggregate in concrete construction and as roadstone in highway construction. Limited tonnage was used as riprap and agstone. C. E. Duff & Son, Huntsville, improved crushing facilities by installing a 4-foot cone crusher. Northwood Stone and Asphalt Co., Belle Center, increased capacity by installing a new crushing plant. Bank-run gravel was recovered near Huntsville and Quincy.

Lorain.—The Nicholl Stone Co., Kipton, produced sawed sandstone for architectural applications. Cleveland Quarries Co., Amherst, produced dimension sandstone for architectural and refractory uses and crushed and ground sandstone for fire sand, mortar sand, and miscellaneous applications. Lorain County continued to rank fourth in value of stone in the State. Fill sand and building and paving sand was dredged near Lorain by Lorain Elyria Sand Co., which lengthened its sand sucker and improved its dock facilities. Paving sand was also produced near Lorain. Abrasive stones (grindstones) was quarried near Kipton by Nicholl Stone Co.

Lucas.—Medusa Portland Cement Co., Toledo, mined limestone and clay for use in Types I and II portland cement. The France Stone Co., Waterville, produced limestone for concrete aggregate and road-

stone; some material was sold for riprap. Toledo Stone & Glass Sand Co., Sylvania, quarried limestone for concrete aggregate, roadstone, railroad ballast, agstone, riprap, and open-hearth flux. Dimension limestone was prepared in the form of rough blocks, rubble, and riprap at the Toledo House of Correction, Whitehouse. Sand and gravel was dredged near Toledo. Amateur mineral gem collectors gathered specimens of brachiopods, and fossils near Silica.

Madison.—Mainly building and paving sand and gravel was produced at a stationary plant near West Jefferson. Farm draintile was manufactured from miscellaneous clay produced near London.

Mahoning.—Fifteen strip mines produced 685,000 tons of coal compared with 12 strip mines and 709,000 tons in 1957. Building brick was manufactured from miscellaneous clay mined near Alliance. Fire clay for refractory use was produced in Canfield and Youngstown. Sand and gravel was produced near Salem.

Marion.—Limestone was quarried near Marion and La Rue. At Marion, producers were J. M. Hamilton & Sons Co. and National Lime & Stone Co. Tri-County Stone Co. operated a quarry near La Rue. Stone was shipped mostly by truck, for roadstone, railroad ballast, agstone, and concrete aggregate. Miscellaneous clay was produced near Caledonia and La Rue. Sand and gravel was processed at a stationary plant near Prospect by Penry Sand & Gravel Co.

Medina.—Sand and gravel was produced at two operations near Lodi and one each near Wadsworth and Westfield. Lodi Sand & Gravel (Lodi) improved its processing facilities during the year by adding a new crusher, sand tank, sand screw, screen feeder, and three new bins. The Wadsworth Brick & Tile Co. (Wadsworth) produced miscellaneous clay used for manufacturing building brick. It completed construction (begun in 1957) of its tunnel-kiln face-brick plant.

Meigs.—Coal production, chiefly strip-mined, dropped 18 percent compared with 1957. Sand and gravel was produced at a stationary plant and dredged near Pomeroy. Salt was evaporated in open pans at Pomeroy by Excelsior Salt Works, Inc., and consumed mostly in Kentucky and Ohio; it was also shipped to West Virginia, Indiana, and Pennsylvania.

Mercer.—Rockford Stone Co. (Rockford) and The John W. Karch Stone Co. (Celina) quarried limestone for concrete aggregate, roadstone, agricultural purposes, and riprap.

Miami.—Piqua Stone Products Division, Armco Steel Corp., Piqua, produced limestone, principally for metallurgical flux, concrete aggregate, and roadstone and also in small quantity for riprap, agstone, filler dust for coal mines. Sand and gravel, used mainly for building and paving material, was produced near Ludlow Falls, Troy, and Piqua.

Monroe.—Christman Quarry Co. (Woodsfield) produced limestone for concrete aggregate and roadstone. Bank-run gravel was produced in Jackson Township at the Witten Gravel Pit.

Montgomery.—The county continued to rank third in output of sand and gravel, mostly produced near Dayton. Laura Gravel & Stone Co. (Phillipsburg) and Limestone-Dayton Co. (Dayton) produced limestone for concrete aggregate, roadstone, agstone, riprap, and blast-furnace flux. Specimens of agate, fossils, and flint were col-

lected. Schumacher Industries, Inc., expanded crude perlite from out-of-State sources at its Dayton plant.

Morgan.—A slight increase in coal production was recorded. Coal was cleaned at the Roberts and Schaefer plant of Central Ohio Coal Co. Building and paving sand and gravel was produced near Stockport by Stockport Sand & Gravel Co.

Morrow.—Building sand and paving gravel was produced by Chesterville Sand & Gravel Co.

Muskingum.—Columbia Cement Division, Columbia-Southern Chemical Corp., subsidiary of Pittsburgh Plate Glass Co., produced limestone and shale for manufacturing cement in its East Fultonham plant. One new finish mill was added, and two old finish mills were converted to process raw material during the year. The cement produced was sold in Ohio and West Virginia. Chesterhill Stone Co. (East Fultonham) and Sidwell Bros. (South Zanesville) produced limestone for concrete aggregate, roadstone, and agricultural purposes.

Fifteen coal mines (eight underground, six strip and one auger) were active. The output (mostly strip-mined) decreased 23 percent from the preceding year.

Mostly prepared sand and gravel was produced at two operations near Zanesville and one near Duncan Falls.

Miscellaneous clay for building brick and refractory mortar was mined near Frazeysburg and Zanesville, respectively. Fire clay and stoneware clay (both for stoneware) were mined near Zanesville and Roseville, respectively.

Specimens of jasper were recovered near Hopewell by an amateur gem collector.

Noble.—Coal output from six strip mines totaled 936,000 tons, declining 18 percent from 1957. Central Ohio Coal Co. cleaned coal at its Cumberland plant.

James Merry Stone Co. (Caldwell) quarried limestone for concrete aggregate, roadstone, and agricultural purposes. H. F. Zerger of Woodsfield obtained limestone for road construction from his newly developed quarry in Stock Township. Yerian Bros. (Brookfield) quarried limestone for agstone.

From an open pit near Ava the Ava Brick Co. mined miscellaneous shale for building brick.

Ottawa.—Among counties reporting no coal production, Ottawa County was one of the leading mineral producers because of its output of lime, gypsum, and limestone. Ottawa was the sole gypsum-producing county. Basic, Inc., Clay Center, and United States Gypsum Co., Genoa, quarried limestone for manufacturing quicklime and hydrated lime; both companies sold for excess production for various applications, such as roadstone, concrete aggregate, agstone, and metallurgical flux. Near Marblehead, Chemstone Corp., subsidiary of Mineral and Chemical Corp. of America, quarried limestone, principally for metallurgical flux, concrete aggregate, roadstone, and sinter stone.

Celestite crystals and fluorite were gathered near Clay Center by amateur gem collectors.

Celotex Corp. (Port Clinton) and United States Gypsum Co. (Gypsum) mined and calcined crude gypsum for manufacturing finished building materials.

Paulding.—Near Paulding Consolidated Cement Corp. quarried dolomitic limestone as well as clay and sand for manufacturing standard and high early strength portland cement and masonry cement. It also produced dolomite that was sold for further processing. Auglaize Stone Co., Oakwood, and the France Co., Paulding, produced limestone, principally for concrete aggregate, roadstone, and agstone. Draintile was made from miscellaneous clay mined near Paulding and Haviland.

Perry.—Thirteen strip, 9 underground, and 3 auger mines produced 2.1 million tons of coal, a slight drop from 1957. The bulk of the coal was strip-mined. Most of the coal was cleaned at four plants in the county. Central Silica Co. produced glass and molding sand near Glenford. Miscellaneous clay, recovered from nine operations, was used chiefly for building brick, vitrified sewer pipe, other heavy clay products, and lightweight aggregate. In March 1958, the Claycraft Co. abandoned one ceramic tile kiln (tunnel) at its Shawnee plant.

Pickaway.—Sand and gravel for paving and railroad ballast gravel was produced at Circleville by Strum & Dillard Co.

Pike.—Building and paving sand and gravel and other gravel was produced near Lucasville, Sargents, and Waverley. Glass, molding, fire, and refractory sand as well as refractory gravel was processed near Beaver.

Harbison-Walker Refractories Co. at Beaver and Cambria Clay Products Co. at the Big Rock Quarry near Jackson quarried quartzite for manufacturing silica brick.

Portage.—The county continued as a leading sand and gravel producing area. Nineteen operations most of them near Kent, Ravenna, and Mantua, were active, preparing material used in the construction industry. In addition, quantities of molding and other miscellaneous sands were produced near Geauga Lake and Garrettsville.

Both Niles Fire Brick Division, Mexico Refractories Co. at Garretsville and Harbison-Walker Refractories Co. at Nelson mined quartzite for manufacturing silica brick.

Two coal strip-mines were active. Peterson Coal Co. cleaned coal from its Atwater mine by wet washing.

Vitrified sewer pipe was produced from miscellaneous clay mined at the Palmyra operation of Universal Sewer Pipe Corp.

Moss and humus peat was recovered from a bog near Ravenna.

Preble.—Marble Cliff Quarries Co. at Lewisburg produced limestone for manufacturing quicklime and hydrated lime and also for concrete aggregate, roadstone, blast furnace-flux, and agstone. Sand and gravel was produced at two operations near West Alexandria and one, near Camden.

Putnam.—The limestone, which was produced in Ottawa, Blanchard Township, and Columbus Grove, was consumed as concrete aggregate and roadstone; a few tons was used for agricultural and other purposes. Putnam Stone Co. of Ottawa improved its crushing plant by adding a hammermill. Miscellaneous clay used exclusively for draintile was produced from three open pits near Glandorf, Dupont, and Ottoville.

Richland.—Sand and gravel was produced at four operations in the southern part of the county.

Building brick was produced from miscellaneous clay mined at two places near Mansfield.

Peat was produced from bogs near Shelby and Shiloh.

The highway department of Mansfield produced a small quantity of limestone for road maintenance.

Ross.—Sand and gravel was produced mostly in the Chillicothe area. Central State Construction Co., Chillicothe, installed a new washer at its Ross plant.

Sandusky.—Sandusky County continued to lead in producing limestone although output was 26 percent lower than in 1957. More than a million and a half tons (55 percent of the total) of dolomitic limestone was consumed in manufacturing lime and dead-burned dolomite; 42 percent of this tonnage was used in manufacturing quicklime and hydrated lime; and the remaining 58 percent was converted to dead-burned dolomite in horizontal kilns. About 1¼ million tons of limestone was quarried for use as concrete aggregate and roadstone (41 percent), metallurgical flux (29 percent), agstone (13 percent), and other uses including riprap, chemical, filler, coal mine dust, filter, and stone sand (17 percent). Building sand was dredged from the Sandusky River near Fremont by Home Sand & Coal Co.

Scioto.—Waller Bros. Stone Co., McDermott, produced sandstone for refractory furnace lining and sawed architectural stone; it also manufactured Kemrock, a dressed impregnated sandstone used for laboratory tabletops and sinks. Taylor Stone Co., McDermott, quarried sandstone for refractory furnace linings and architectural stone as well as riprap, flagging, and irregular-shaped facing stone. Fire clay for fire brick and block was produced at three operations in the county during the year.

Seneca.—At its Maple Grove quarry and mill Basic, Inc., produced limestone used in processing dead-burned dolomite at its nearby lime plant and also for agstone, concrete aggregate, roadstone, and metallurgical flux. The France Co. quarried limestone at its Bloomville quarry for blast furnace flux, concrete aggregate, roadstone, railroad ballast, agstone, and riprap. St. Stephens Tile Co. (formerly Arnold Gerhardstein) produced draintile at St. Stephen.

Shelby.—Sand and gravel was produced at stationary plants near Sidney and Fort Laramie.

High magnesium limestone was mined by Miami River Quarry Co. at Sidney mainly for concrete aggregate and roadstone, but small quantities were sold for riprap and rubble. A new cone crusher was installed.

Stark.—Diamond Portland Cement Co., Middlebranch, mined limestone and shale for manufacturing portland cement and produced both general use and high early strength cement in its four kilns. Three mills for raw material were converted to finish mills, and a new loading station was built to include a storage capacity of 100,000 barrels. The output was consumed mostly in Ohio but small quantities were shipped to Pennsylvania and West Virginia. East Ohio Limestone Co., Hartville, produced limestone for concrete aggregate, roadstone, and agstone. Coal was recovered from 1 underground and 16 strip mines in the county.

Stark County continued to rank second in output of clay. Twelve operations were active compared with 11 in 1957, producing mostly

fire clay, for use mainly in building brick and other heavy clay products and also processing clays for wall tile and refractories.

The county continued as a leading sand and gravel producing area. Seventeen operations, mostly near Canton and Massillon were active. Perry Road Sand & Gravel sold its washing plant. Humus peat was recovered from two bogs near Canton.

Summit.—At Barberton, Columbia-Southern Chemical Corp. produced evaporated salt and brine; the salt was employed in chemical, soap, metal, and various other applications; and the brine was used exclusively for manufacturing soda ash and chlorine. Most of the evaporated salt was consumed in Ohio, but some was shipped to neighboring States. The Diamond Crystal Salt Co., Akron, also produced evaporated salt and brine from wells, recovering the salt in both open and vacuum pans.

Columbia-Southern Chemical Corp. quarried dolomitic limestone near Barberton for its plant that produced lime for use as reagent. The material that was undersize for the lime kiln was crushed and sized for use as concrete aggregate, roadstone, and agstone. In Norton Township the company also quarried sandstone for concrete aggregate and glass.

Sand and gravel was produced mostly near Bath, Barberton, Akron, and Peninsula. Portage Lake Sand & Gravel Co. added a washer for fine material at its Akron plant.

Clay for building brick and vitrified sewer pipe was produced at two operations near Mogadore.

The Copley bog of H. W. Codding & Sons was the leading peat-producing area in the State.

Iron oxide (Fe_2O_3) shipped from Delaware was manufactured from pyrite cinders at the Copley plant of Minnesota Mining and Manufacturing Co.

Trumbull.—Prepared sand and gravel was produced at the Kinsman plant of Kinsman Sand & Gravel Co.

Tuscarawas.—Fifty-seven coal mines (31 strip, 20 underground, and 6 auger), were active. Output (mainly strip-mined) decreased only slightly from 1957. Coal from the Midvale and Tri Seam mines was cleaned at two plants in the county.

Mostly building and paving sand and gravel was produced near Beach City, Dundee, Gnadenhutten, Mineral City, New Philadelphia, and Tuscarawas. The county continued to lead in quantity and value of clay production. Fire and miscellaneous clays were produced at 26 active mines. Fire clay furnished 76 and 93 percent of the total clay output and value, respectively, in the county; this output was used for heavy clay products, refractories, and floor and wall tile. Miscellaneous clay was used exclusively for manufacturing heavy clay products, primarily building brick. Of the county's 26 active mines in 1958, 19 were open-pit, 5 were underground, and 2 were combinations of open-pit and underground. As a result of a fire the entire plant of Goshen Brick & Clay Corp., Newcomerstown, was rebuilt during the year.

Union.—L. G. Rockhold & Sons (York Center) and Union Limestone, Inc., successor to Clymer Materials Co. (Ostrander) produced

dolomitic limestone, principally for concrete aggregate, roadstone, and agstone and a small quantity for riprap.

Van Wert.—Delphos Quarries Co. (Delphos) and the Union Quarries Co. (Van Wert) produced limestone for concrete aggregate, roadstone, railroad ballast, and agstone. The France Co. of Toledo abandoned its Middle Point quarry and dismantled the plant.

Draintile was manufactured from miscellaneous clay mined by Delphos Clay Works Co., Delphos, and Weck Tile Plant, Van Wert.

Vinton.—Output of coal mostly from seven strip mines decreased. Ten underground mines were also active. Benedict, Inc., cleaned coal by jigs at its Econocoal plant.

Miscellaneous clay for building brick were produced by McArthur Brick & Co. McArthur Stone & Coal Co., McArthur, produced limestone for road material. The limestone-crushing plant was improved during the year by installing a larger jaw crusher.

Warren.—Sand and gravel was produced near Franklin, Loveland, Morrow, South Lebanon, and Waynesville.

Washington.—One auger and four strip coal mines were active.

Output of sand and gravel was centered near Marietta and Waterford.

Chester Hill Stone Co. quarried and processed limestone at its No. 4 plant near Waterford.

Constitution Stone Co. and Hall Grindstone Co., both near Constitution quarried abrasive stone (grindstone).

Clay for lining furnaces was produced by Briggs Gravel Co. near Marietta.

Wayne.—Morton Salt Co. recovered evaporated salt with open and vacuum pans at Rittman.

Coal was recovered from two strip mines.

Sand and gravel, chiefly for building and paving material, was produced near Marshallville, Rittman, and Wooster.

Miscellaneous clay was recovered near Wooster and Orrville.

Williams.—Sand and gravel was produced near Edgerton, Edon, Blakeslee, and Pioneer. Miscellaneous clay for manufacturing draintile was produced near Stryker.

Wood.—Four producers, active at West Millgrove, North Baltimore, Custar, and Bowling Green, supplied limestone chiefly for concrete aggregate and roadstone; small quantities were used for agstone and riprap. National Gypsum Co. (Luckey) produced limestone and lime, processing the undersized material for roadstone and metallurgical flux.

Terrysburg Tile & Brick Co. (Terrysburg) produced surface clay for manufacturing draintile.

Amateur mineral collectors recovered barite crystals, calcite crystals, marcasite, and various other specimens mostly from the Pugh quarry.

Wyandot.—The National Lime & Stone Co. at Carey mined high magnesium limestone for use in its lime plant and also produced limestone for concrete aggregate, roadstone, metallurgical flux, railroad ballast, glass, agstone, and other uses. J. L. Foucht (Upper Sandusky) quarried limestone for concrete aggregate, roadstone, and agstone.

Mostly building and paving sand and gravel was produced near McCutchenville and Upper Sandusky. H. & M. Sand & Gravel Co. (formerly Hobbs Bros. Sand & Gravel) added a jig to remove shale at its McCutchenville plant during the year.

The Humus Co. recovered humus peat from a bog near Carey.

The Claycraft Co., producers of surface shale for building brick, added a water-type dust-collection system at its upper Sandusky plant during the year.

The Mineral Industry of Oklahoma

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Oklahoma Geological Survey.

By Peter Grandone [1] and William E. Ham [2]

PRODUCTION of 13 minerals and 4 mineral fuels was reported in 1958 from all of the State's 77 counties. The total value ($768 million) of these minerals was $41 million less than in 1957—a production loss that was attributed almost entirely to petroleum. Compared with other States, Oklahoma ranked third as a producer of natural gas and fourth as a producer of natural-gas liquids and crude petroleum. Appreciable quantities of zinc, lead, cement, coal, gypsum, sand and gravel, and stone also were produced.

The mineral fuels—petroleum, natural gas, natural-gas liquids, and coal—were the most important in value, supplying 95 percent of Oklahoma's total mineral production. Metals and nonmetals furnished the remainder. Petroleum and natural gas were produced in 63 of Oklahoma's 77 counties; nonmetals in 71 counties; and metals (lead and zinc) in Ottawa County only. Oil and natural gas were

TABLE 1.—Mineral production in Oklahoma [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays thousand short tons	[2] 641	[2] $642	[2] 576	[2] $579
Coal do	2,195	14,165	1,629	10,858
Lead (recoverable content of ores, etc.)	7,183	2,054	3,692	864
Natural gas million cubic feet	719,794	59,743	696,504	70,347
Natural-gas liquids:				
Natural gasoline and cycle products thousand gallons	460,644	25,329	440,798	26,029
LP-gases do	587,140	21,824	657,114	25,822
Petroleum (crude) thousand 42-gallon barrels	214,661	650,423	[3] 202,699	[3] 599,989
Salt (common) thousand short tons	7	63	4	41
Sand and gravel do	4,960	4,507	7,232	5,859
Stone do	12,016	14,064	10,794	12,232
Tripoli	22,236	67	([4])	([4])
Zinc (recoverable content of ores, etc.)	14,951	3,469	5,267	1,074
Value of items that cannot be disclosed: Native asphalt, bentonite, cement, gypsum, lime, manganese (1957), pumice, and tripoli (1958)		14,573		16,022
Total Oklahoma [5]		809,004		767,856

[1] Production as measured by mine shipments or mine sales (including consumption by producers).
[2] Excludes bentonite, value for which is included with "Value of items that cannot be disclosed."
[3] Preliminary figure.
[4] Included with "Value of items that cannot be disclosed."
[5] Total adjusted to avoid duplicating values of clays and stone.

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produced in a wide belt extending from the northeastern part of the State to the southwestern and northwestern parts; nonmetal mining was widely distributed over the northeast, north central, and central regions and in the Arbuckle and Wichita Mountain area of the southern part.

Employment and Injuries.—*Employment and Wages.*—Total employment of 48,500 in the Oklahoma mineral industries was about 6 percent less than in 1957. The wages for these mineral industries totaled $262.3 million—approximately the same as in 1957.

Accidents.—Accidents reported in metal and nonmetal mining consisted of 259 nonfatal injuries, which were classified as 7 permanent-partial and the rest temporary. In coal mines (14 strip, 11 underground) that produced 1,000 tons or more each, there were 3 fatal and 111 nonfatal injuries.

TABLE 2.—Employment in mineral industries,[1] in thousands

	1949–53 (average)	1954	1955	1956	1957 [2]	1958
Oil and gas drilling and production	40.9	46.5	48.4	49.4	48.8	45.8
Coal mining	1.7	1.3	1.3	1.1	1.1	.9
Other mining	2.5	2.2	2.3	2.4	1.9	1.8
Total	45.1	50.0	52.0	52.9	51.8	48.5

[1] Oklahoma Employment Security Commission, Handbook of Employment Statistics of Oklahoma, 1939–58.
[2] Revised figures.

Consumption and Markets.—Oklahoma mineral industries processed a significant part of their output into finished and semifinished products for in-State consumption and for out-of-State shipments. These industries included oil refineries and natural gasoline and cycle plants stripping natural gas of condensable liquids; zinc smelters reducing zinc concentrate mined in Oklahoma; brick, tile, pottery, glass, and cement plants using clays, shales, silica sands, and limestone of Oklahoma; and producers of building materials made of Oklahoma gypsum. Large quantities of petroleum and natural gas continued to be transmitted by pipelines to industrial sections of the Eastern and North Central States. Ammonia was produced from natural gas, carbon black from petroleum distillates, and high-energy fuel from petroleum hydrocarbons reacted with sodium and boric acid.

Demand for Oklahoma crude petroleum declined during the first quarter of the year; and, although it remained quite steady during the rest of the year, the total was less than in 1957. Production, under State regulatory control, was kept in close balance with demand and stocks.

The metals industry, beset with mounting inventories, declines in prices, and labor strife, continued to curtail operations. Eagle-Picher Co. suspended lead and zinc mining and milling at its Central mill near Commerce, Okla. Its smelter at Henryetta, which had shut down July 1, 1957, reopened about February 1, 1958, only to undergo a second work stoppage from February 15 to December 6, after which 6 of the 10 furnace blocks were reactivated. Low zinc demand also

forced the State's other two smelters to curtail operations. However, during the last quarter of the year, the market situation showed signs of improvement as lead and zinc prices gained.

Total construction (residental, nonresidental, and public works) gained appreciably over 1957, but this was not reflected in all of the construction minerals produced in the State. The demand for both sand and cement was up, while stone and gypsum were down. Lime output, used primarily as a chemical by the Pryor industries and by municipal water-treating works, also was down.

Trends and Developments.—The recoverable petroleum reserve again was reduced slightly in 1958, but the outlook was promising. Widespread drilling resulted in one of the most successful oil-discovery years in Oklahoma history, as 96 of a possible 130 new oil and gas fields were officially named by the Mid-Continent Oil & Gas Association. Of these new fields, Texas County led with seven; Beaver and Osage ranked next with six each. Many impressive discoveries were made in the Pennsylvanian and Mississippian formations in the south central counties. The world's second deepest test well was drilled to 24,002 feet by Shell Oil Co. in the Elk City field, Beckham County. The so-called Woodward trend became a new oil and gas province for the State.

Activity in the secondary recovery of oil by waterflooding was maintained in northeastern Oklahoma. In Nowata and Rogers Counties extensive developments were forecast in old oilfields along the Verdigris River before the Oologah basin is inundated.

In the refining of petroleum, the trend toward converted capacity for producing Premium-grade motor fuel and toward raising the octane rating of motor fuels was continued. The competitive race for upgrading motor fuels was evidenced by installation of electronic instrumentation at a Ponca City refinery and by completion of new processing units at refineries in West Tulsa and Wynnewood.

Two new natural gasoline plants were scheduled for operation. Near Marietta, Love County, Greenville Gasoline Corp. was constructing a $250,000 plant to process up to 5 million cubic feet of gas a day to recover approximately 12,000 gallons of natural gasoline liquids a day. At Laverne, Sun Oil Co. awarded a contract to build a $3.5 million gasoline plant to process 100 million cubic feet of gas a day from the big Laverne gasfield. The processed gas will be transmitted to Detroit and Milwaukee.

Closely related to the refining industry was the rising importance of petrochemicals in Oklahoma. At a Pryor plant yearly ammonia capacity was increased from 65,800 tons to about 70,000 yearly. Adjuncts to two refineries at Ponca City and Duncan were producing benzene, toluene, xylene, and propylene hydrocarbons. At Ponca City, Continental Oil Co. was expanding its annual carbon black capacity to 75 million pounds of all grades of furnace black.

Callery Chemical Co.'s new $38 million high-energy fuel plant was formally opened on November 1 at Muskogee. Occupying 300 acres on a 1,300-acre site, it comprises four processing units to produce HiCal—a rocket and missile fuel for the Navy. Production of the fuel requires considerable quantities of sodium, boric acid, hydrogen, and ethylene. The largest unit—a $3.5 million gas plant—produces

hydrogen, carbon dioxide, and nitrogen. Nitrogen serves as a protective atmosphere throughout the process, because many of the chemicals used in producing the fuel react immediately upon contact with air. All liquid waste from the processing units is pumped into a huge storage lake for treatment before being discharged into the Arkansas River. Initial employment was approximately 500 persons.

The U.S. Department of the Interior awarded a contract to build a $12 million helium-recovery plant in the Keyes gasfield, Cimarron County. Scheduled for completion in August 1959, the plant will boost the Nation's output of the inert, lightweight gas 290 million cubic feet yearly. Processing of the Keyes natural gas, to be supplied by Colorado Interstate Gas Co., will contribute significantly to the helium-conservation program, as this supply, containing about 2 percent helium, has been going direct to fuel markets with resultant loss of helium. Both the helium content and helium reserve of the Keyes gas reserve are considered above average. Demand for helium has been mounting rapidly due to increasing needs as a coolant for nuclear reactors, missile development, and space-exploration programs.

The cement industry of Oklahoma took a forward step in 1958 to satisfy the growing demand for this construction material. In October, Ideal Cement Co. began producing cement at its new $20 million plant at Ada. Equipped with a 12- by 450-foot rotary kiln and a second one of like size to be completed early in 1959, the plant will have a combined cement capacity of 5.5 million barrels annually and will be the largest single unit of Ideal Cement Co. A 5½-mile conveyor system from the company Lawrence quarry will be the longest permanent conveyor ever constructed. Nine silos, each 36 feet in diameter and 140 feet in height, are capable of storing 200,000 barrels of finished cement. About 40,000 barrels of cement can be loaded in a single shift. The original Ada plant was constructed in 1907.

Dewey Portland Cement Co. obtained an option on a 1,500-acre tract 4 miles east of Tulsa and announced plans to build a $12 million cement plant. The new plant, with an initial annual capacity of 1,250,000 barrels of cement, will employ approximately 250 persons; its primary market will be the Tulsa area.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Coal production in Oklahoma declined 26 percent from 1957, primarily because of reduced demand by Lone Star Steel Co.'s Daingerfield plant. At this company's McAlester mine, 113 workers were idled, and the work week was reduced to 4 days. There were 25 operators in nine counties. Rogers, Le Flore, Haskell, Pittsburg, and Sequoyah Counties were the five leaders; each reported over $1 million in value. Of the 1.6 million short tons reported, 14 operators produced 77 percent by strip mining; 11 operators produced the remainder by underground mining.

A report by Midwest Research Institute of Kansas City, Mo., dated July 25 and prepared for the Oklahoma Department of Commerce

and Industry, concluded that conversion of Henryetta coal deposits to coke for use in smelting zinc could be economically feasible. The coke would be competitive in quality and price with that produced from Arkansas anthracite now used in the area.

TABLE 3.—Coal production, in thousands

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	2,457	$13,919	1956	2,007	$12,341
1954	1,915	11,265	1957	2,195	14,165
1955	2,164	12,668	1958	1,629	10,858

Natural Gas.—Oklahoma continued to rank fourth in the Nation in the marketed production of natural gas. Production was reported from 63 counties, of which Texas, Beaver, Garvin, Oklahoma, and Beckham led, in the order named. Of the 12 major gas-producing States, Oklahoma was one of three that gained over 1957 in number of gas wells completed. The industry pressed its search for more reserves. Most promising exploratory drilling again was in the Panhandle and northwest, where seven gas discoveries were made in Texas, six in Beaver, three in Harper, two in Woodward, and one in Woods County.

TABLE 4.—Marketed production of natural gas [1]

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1949–53 (average)	522,073	$28,766	1956	678,603	$54,288
1954	616,355	43,145	1957	719,794	59,743
1955	614,976	45,508	1958	696,504	70,347

[1] Comprises gas either sold or consumed by producers including losses in transmission, amounts added to storage, and increases in gas pipelines.

Natural-Gas Liquids.—Five percent more natural-gas liquids was produced at 67 natural gasoline plants and 2 cycling plants. However, natural gasoline and cycle products, taken alone, were 4 percent less than in 1957, partly because of reduced allowables for petroleum, which meant less casinghead gas to process, and partly because of the trend for increased separation of LP-gases (propane and butane).

TABLE 5.—Estimated proved recoverable reserves of crude oil, natural-gas liquids, and natural gas [1]

	Proved reserves, Dec. 31, 1957	Changes in proved reserves, due to extensions and new discoveries in 1958	Proved reserves, Dec. 31, 1958 (production was deducted)	Change from 1957, percent
Crude oil—thousand barrels	1,941,521	155,126	1,898,128	−2
Natural-gas liquids [2]—do	342,643	44,449	357,507	+4
Natural gas—million cubic feet	14,259,480	1,858,131	15,206,769	+7

[1] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural-Gas Liquids and Natural Gas: Vol. 13, Dec. 31, 1958, pp. 9, 10, 19.
[2] Includes condensate, natural gasoline, and LP-gases.

TABLE 6.—Natural-gas liquids produced

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)	Thousand gallons	Value (thousands)
1949–53 (average)	371,938	$25,392	329,938	$11,643	701,876	$37,035
1954	478,590	24,332	453,810	13,506	932,400	37,838
1955	504,692	28,770	512,320	14,297	1,017,012	43,067
1956	489,963	26,543	579,101	23,427	1,069,064	49,970
1957	460,644	25,329	587,140	21,824	1,047,784	47,153
1958	440,798	26,029	657,114	25,822	1,097,912	51,851

To adjust for this changing utilization pattern, refinery capacity was being increased to catalytically reform the heavier fractions of natural gasoline, an operation that improves the octane rating and widens the use of natural gasoline in motor fuels. Consumption continued to grow for LP-gases for domestic heating fuels and for production of petrochemicals, particularly polyethylene.

Underground storage capacity for LP-gases at three sites in Oklahoma totaled 300,000 barrels. These sites were abandoned oil wells in Pontotoc County, a salt layer in Beckham County, and a shale mining shaft in Seminole County.

Petroleum.—Oklahoma remained the fourth-ranking domestic producer of petroleum. The State regulatory body, under the Interstate Oil Compact, reduced allowable daily production from 600,000 to 504,000 barrels in the first quarter of the year, then raised it gradually to 560,000 at midyear with no further change. An 11-percent cut in oil production by waterflooding, applied in March for the first time,

TABLE 7.—Production of crude petroleum

Year	Thousand 42-gallon barrels	Value (thousands)	Year	Thousand 42-gallon barrels	Value (thousands)
1949–53 (average)	179,227	$465,194	1956	215,862	$600,096
1954	185,851	518,520	1957	214,661	650,423
1955	202,817	563,830	1958 [1]	202,699	599,989

[1] Preliminary figures.

TABLE 8.—Indicated demand, production, and stocks of crude petroleum in 1958, by months, in thousand barrels

Month	Indicated demand	Production	Stocks originating in Oklahoma	Month	Indicated demand	Production	Stocks originating in Oklahoma
January	18,233	17,811	18,194	September	15,440	16,839	17,558
February	16,398	15,953	17,749	October	17,383	17,405	17,580
March	15,886	16,024	17,887	November	16,630	16,734	17,684
April	16,263	16,459	18,083	December	17,622	17,346	17,408
May	17,131	16,948	17,900				
June	17,648	16,124	16,376	Total: 1958	203,907	202,699	
July	17,950	17,400	15,826	1957	219,061	214,661	
August	17,323	17,656	16,159				

was lifted in April. The permitted increase at midyear was attributed to a stronger market and reduced stocks. Petroleum production was reported from 63 counties—the leading five producers being Osage, Garvin, Stephens, Carter, and Creek. Half of the 1958 production came from nonallocated fields which included stripper fields and secondary-recovery projects. According to a survey by the Interstate Compact Commission, as of January 1, 1957, Oklahoma had 58,136 stripper wells that produced 82 million barrels of oil in 1956. The total reserve of these wells was 1,186 million barrels.

TABLE 9.—Production of crude petroleum by fields, in thousand barrels

[Oil and Gas Journal]

Field	1954	1955	1956	1957	1958 [1]
Allen	1,709	1,733	1,638	1,608	1,590
Bebee	926	836	745	707	625
Burbank	3,466	10,139	13,519	14,280	14,548
Cache Creek	787	707	661	721	827
Camp	1,329	(2)	(2)	(2)	(2)
Cement	3,517	4,186	4,372	4,061	4,405
Cumberland	1,690	1,841	1,944	1,812	1,474
Cushing	3,176	2,823	2,549	2,650	2,702
Dilworth	1,279	1,135	921	677	517
Doyle	2,976	2,683	3,056	2,798	2,421
Elk City	5,348	6,277	5,326	4,078	2,806
Eola	1,424	2,193	3,566	3,886	3,188
Fox-Graham	4,559	(2)	(2)	(2)	(2)
Glennpool	2,045	1,983	1,901	2,259	2,773
Golden Trend	(2)	(2)	20,204	17,245	13,106
Healdton	2,171	2,307	2,347	2,260	2,331
Hewitt	3,339	3,411	3,495	3,240	3,084
Holdenville-East	1,149	1,476	1,117	628	476
Hoover-Northwest	1,189	1,662	2,063	1,863	2,417
Knox	1,165	1,143	1,291	1,232	1,045
Milroy	1,755	(2)	(2)	(2)	(2)
Oklahoma City	4,148	3,803	3,743	3,482	3,290
Olympic	4,083	2,662	1,752	1,573	1,341
Payson-East	1,076	918	786	467	----------
Ringwood	727	551	484	----------	----------
Seminole:					
Bowlegs	872	718	685	655	619
Little River	756	699	571	478	430
St. Louis	1,464	1,672	1,486	1,443	1,410
Seminole	998	921	827	912	876
Sholem-Alechem	10,261	(2)	(2)	(2)	(2)
Sho-Vel-Tum	----------	30,316	29,717	29,008	25,823
South Burbank	1,429	(2)	(2)	(2)	(2)
Tatums	3,321	(2)	(2)	(2)	----------
Velma-West	8,435	(2)	(2)	(2)	----------
West Edmond	1,821	1,733	1,945	1,292	1,153
Witcher	541	439	378	----------	----------
Yale-Quay	1,915	1,479	1,322	1,765	1,927
Other fields [3]	99,005	110,371	101,451	107,581	105,495
Total	185,851	202,817	215,862	214,661	202,699

[1] Preliminary figures.
[2] Included with "Other fields."
[3] Bureau of Mines figures.

The average price a barrel of petroleum at the wells was $2.96 in 1958 compared with $3.03 in 1957. The search for more oil led to the drilling of 854 exploratory wells. The test wells totaled 3,605,217 feet drilled, an average of 4,222 feet each compared with an average of 4,485 feet each in 1957. Field-development wells totaled 17,408,228 feet drilled, an average of 3,165 feet each compared with an average of 3,324 feet each in 1957.

Exploratory drilling, which attained an oil-success ratio of 16.5:1, was focused mainly in two important areas—the northwestern Anadarko basin and the deep Ordovician formations of the south-central counties. Impressive discoveries were made in the Pennsylvanian rocks of Major, Woodward, Harper, and the Panhandle counties. A most important discovery was the prolific North Buffalo oilfield in Harper County. Gas and distillate fields were opened in the Morrow-Pennsylvanian formations in Ellis, Harper, and Woodward Counties. Rich Morrow oilfields were opened in the Permian gas area in Texas County. The world's second deepest well (Shell Oil Co. Rumberger No. 5) was drilled to 24,002 feet in the Elk City field, Beckham County.

TABLE 10.—Oil and gas wells drilled in 1958, by counties [1]

County	Proved field wells				Exploratory wells			Grand total
	Oil	Gas	Service	Dry	Oil	Gas	Dry	
Alfalfa	35	6	------	4	3	1	18	67
Atoka	2	------	------	1	------	------	6	9
Beaver	44	60	------	27	8	6	14	159
Beckham	6	31	------	15	2	1	4	59
Blaine	2	1	------	1	------	------	1	5
Bryan	1	1	------	------	1	------	3	6
Caddo	123	2	1	23	2	------	6	157
Canadian	------	------	------	------	------	------	2	2
Carter	164	5	------	74	2	------	9	254
Cherokee	------	------	------	------	------	------	1	1
Choctaw	------	------	------	------	------	------	1	1
Cimarron	3	12	------	8	2	------	4	29
Cleveland	71	4	2	22	7	------	22	128
Coal	3	1	------	3	2	1	1	11
Comanche	45	3	1	48	3	1	13	114
Cotton	9	------	------	17	------	------	18	44
Creek	306	7	101	97	1	------	3	515
Dewey	------	------	------	------	------	------	1	1
Ellis	2	1	------	6	3	2	8	22
Garfield	44	4	------	26	2	1	9	86
Garvin	100	2	2	55	6	1	12	178
Grady	24	1	------	13	------	------	------	38
Grant	36	26	1	24	4	2	21	114
Greer	------	2	------	13	------	1	7	23
Harper	27	28	1	11	6	3	12	88
Haskell	------	------	------	------	------	------	1	1
Hughes	54	8	2	34	------	------	4	102
Jackson	------	------	------	1	1	------	------	2
Jefferson	22	------	------	17	------	------	11	50
Johnston	------	------	------	------	------	------	2	2
Kay	79	2	1	37	3	2	30	154
Kingfisher	3	------	------	3	4	------	2	12
Kiowa	250	4	3	219	3	2	157	638
Le Flore	------	1	------	------	------	1	------	2
Lincoln	73	7	5	48	3	------	12	148
Logan	71	1	1	31	4	------	16	124
Love	12	------	1	14	3	------	5	35
McClain	62	------	------	23	8	------	7	100
McCurtain	------	------	------	------	------	------	2	2
McIntosh	1	1	------	3	1	1	1	8
Major	9	1	------	4	2	1	13	30
Marshall	25	------	------	16	5	------	7	53
Mayes	------	------	------	2	------	------	1	3
Murray	10	------	------	4	2	------	4	20
Muskogee	8	------	------	3	------	------	6	17
Noble	70	2	4	34	3	1	9	123
Okfuskee	103	4	6	49	5	------	6	173
Oklahoma	38	3	------	13	2	1	4	61
Okmulgee	161	5	18	92	1	1	------	278
Osage	440	4	87	202	11	------	78	822
Pawnee	54	------	13	35	2	------	16	120
Payne	68	3	5	36	2	------	8	122
Pittsburg	------	------	------	------	------	------	1	1
Pontotoc	46	2	40	19	1	------	5	113

See footnotes at end of table.

TABLE 10.—Oil and gas wells drilled in 1958, by counties [1]—Continued

County	Proved field wells				Exploratory wells			Grand total
	Oil	Gas	Service	Dry	Oil	Gas	Dry	
Pottawatomie	50	1	6	34	2	------	7	100
Pushmataha	------	------	------	------	------	------	1	1
Rogers	------	------	------	1	------	------	------	1
Seminole	195	14	2	69	1	------	5	286
Sequoyah	------	------	------	------	------	------	1	1
Stephens	220	9	1	87	8	------	16	341
Texas	16	30	------	22	7	7	7	89
Tillman	39	------	1	18	------	------	19	77
Washita	------	1	------	------	------	------	2	3
Woods	2	------	------	2	1	1	8	14
Woodward	4	------	------	3	2	2	3	14
Total: 1958	[2][3]3,232	300	305	1,663	[2]141	40	673	6,354
1957	[2][3]3,429	203	------	[3]1,856	[2]107	31	609	6,235

[1] Oil and Gas Journal, vol. 57, No. 4, Jan. 26, 1959.
[2] Includes distillate wells.
[3] Includes service wells.

TABLE 11.—Summary of seismograph, magnetometer, and core drill prospecting in 1958, by counties [1]

(In crew-weeks)

County	Seismograph	Magnetometer	Core drill	County	Seismograph	Magnetometer	Core drill
Atoka	14	------	------	Logan	2	------	------
Beckham	75	------	------	Love	70	------	------
Blaine	3	------	------	McClain	123	------	------
Bryan	29	------	------	McIntosh	23	------	------
Caddo	64	------	------	Major	5	------	------
Carter	25	------	------	Marshall	27	------	------
Cherokee	------	1	------	Mayes	------	8	------
Cimarron	37	------	------	Murray	34	------	------
Cleveland	90	------	------	Muskogee	------	1	------
Coal	28	------	------	Osage	11	------	------
Comanche	46	------	------	Pittsburg	26	------	------
Cotton	7	------	------	Pontotoc	5	------	------
Custer	29	------	------	Pottawatomie	17	------	------
Dewey	27	------	------	Pushmataha	3	------	------
Ellis	31	------	------	Roger Mills	7	------	------
Garfield	36	------	------	Rogers	------	6	------
Garvin	36	------	------	Seminole	28	------	------
Grady	57	------	------	Stephens	84	------	------
Grant	7	------	------	Texas	21	------	------
Hughes	5	------	------	Tillman	12	------	------
Jefferson	3	------	------	Wagoner	------	5	------
Johnston	11	------	------	Washita	96	------	------
Kay	9	------	------				
Kingfisher	4	------	------	Total: 1958	1,300	21	------
Kiowa	24	------	------	1957	1,187	44	54
Le Flore	9	------	------				

[1] National Oil Scouts & Landmen's Association, Oil and Gas Field Development in the United States, vol. 29, 1959, Austin, Tex.

In the south-central section drilling into Ordovician formations in Cleveland, McClain, Love, Marshall, and Bryan Counties yielded several important discoveries. Opening of the East Durant oilfield in Bryan County was especially significant. Osage County, again first in total wells drilled, reported 11 discoveries out of 89 tests. Beaver and Texas Counties, credited with 14 discoveries each, were followed by Harper with 9, Stephens and McClain with 8, and Cleveland and Garvin with 7 successful tests each.

An engineering study [3] by the Bureau of Mines concludes that application of waterflooding to the Bartlesville and Layton producing formations of the Cushing oilfield, Creek County, may be expected to yield an additional 45 million barrels of oil.

At the end of 1958 Oklahoma had 14 operating refineries (with a daily crude-oil capacity that totaled 392,000 barrels) and 3 nonoperating refineries. This capacity represented an 11-percent gain over 1957, according to the Oil and Gas Journal. These refineries processed about 62 percent of the 1958 production. Crude oil runs to stills compared with total receipts, intra-State receipts, and ending stocks at these refineries were as follows, in thousand barrels:

Year	Runs to stills	Total receipts	Intra-State receipts	Yearend stocks
1957	126,722	126,582	98,671	3,172
1958	126,533	126,084	94,789	2,646

Upgrading of motor fuels was continued by installing more reforming capacity.

D–X Sunray Oil Co. opened four new processing units at its West Tulsa refinery. The units, costing $12 million, did not increase the refinery's 75,000-barrel-a-day capacity but enable raising the rating of gasoline produced beyond the 105-octane range. The new processing units are: A 20,000-barrel-a-day naphtha Unifier, a 12,000-barrel platforming unit designed to produce 97-leaded octane number platformate, a butane isomerization unit to produce 2,400 barrels a day of isobutane, and a hydrofluoric acid alkylation unit that will make available 2,500 barrels a day of 105-octane (or higher) blending stock. The new processing units are controlled electronically.

The multimillion-dollar expansion program at the Wynnewood refinery of Kerr-McGee Oil Industries, Inc., was completed in July. The new units are a 7,350-barrel naphtha prefractionater, a 4,400-barrel Unifier, a 5,500-barrel Platformer, and a 4,000-barrel middle distillate Unifier. Kermac's new Platformer will give the company an additional supply of high-octane gasoline for its retail stations in a 19-State marketing area.

NONMETALS

Oklahoma, endowed with abundant resources of nonmetals, yielded a record $32.9 million worth of these commodities compared with the previous record $32.1 million established in 1957. This was reflected in the gain in overall construction. Sand and gravel was the only nonmetal that established an individual alltime high value in 1958.

Asphalt (Native).—Output of native rock asphalt for road surfacing from Murray County was down 15 percent from 1957.

Cement.—Production of cement, the leading nonmetal in terms of value produced in Oklahoma, gained 13 percent. Two plants (at

[3] Riggs, C. H. and others, History and Potentialities of the Cushing Oilfield, Creek County, Okla.: Bureau of Mines Rept. of Investigations 5415, 1958, 109 pp.

Dewey in Washington County and at Ada in Pontotoc County) were active. At Ada, Ideal Cement Co. began producing from its new $20 million plant, which will raise the total annual capacity at Ada to 5.5 million barrels. Dewey Portland Cement Co. stopped operations from March 25 to May 5 to install electrical equipment and reduce surplus stocks. According to the company annual report, Dewey Portland Cement Co. purchased 1,500 acres of suitable quarry land just east of Tulsa and planned to build a $12 million, 1¼-million-barrel-a-year plant. The report stated further that it appears economic to recognize the obsolescence of the Dewey plant and consider the more advantageous market hub at Tulsa.

Clays.—Clay production was used primarily in manufacturing brick and tile and to a lesser extent for manufacturing of portland cement and lightweight expanded-clay products. Brick and tile were produced in Creek, Custer, Garfield, Greer, Lincoln, Oklahoma, Pittsburg, Rogers, Seminole, and Tulsa Counties. Bentonite, produced in Dewey County, was used in equal quantities for filtering and as an absorbent. Expanded lightweight aggregate was made from clay in Tulsa and Oklahoma Counties. Pottery was manufactured in Creek and Ottawa Counties.

TABLE 12.—Clays sold or used by producers, in thousands

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	537	$529	1956	705	$701
1954	452	1,283	1957	641	642
1955	724	727	1958	576	579

Gem Stones.—A minor quantity of gem stones (valued at less than $500) was reported by individuals mainly in Alfalfa, Cleveland, Comanche, and McCurtain Counties. The materials were essentially crystalline specimens of quartz, barite, calcite, and selenite.

Gypsum.—Production of gypsum was slightly less than in 1957, although demand continued for wallboard, plasters and portland cement. Most gypsum was from Blaine County, where the United States Gypsum Co. operated quarries and plants at Southard to Manufacture wallboard and plasters. Production also was reported from Caddo County. A report [4] on gypsum resources in Custer County, estimated the gypsum reserve accessible by opencut mining at 1.3 billion tons. Described as one of the major gypsum deposits in the United States, the area also is close to transportation routes and to large supplies of natural gas.

Lime.—Lime production, all by the St. Clair Lime Co. in Sequoyah County, was 15 percent less than the record production in 1957. Consumption was mostly by chemical plants at Pryor and for treating water at municipal plants.

Pumice.—A 60-percent gain in the production of pumice was reported by one operator in Beaver County, although total tonnage was relatively small. Principal use was for abrasive type cleansers.

[4] Ham, William E., and Curtis, Neville M., Gypsum in the Weatherford-Clinton District, Okla.: Oklahoma Geol. Survey Miner, Rept. 35, June 10, 1958, 32 pp.

Salt.—Output of salt by three producers in three counties declined 38 percent from 1957. At Sayre in Beckham County, salt continued to be produced by injecting fresh water through wells into a salt bed and recovering the brine for surface evaporation. In Woods County salt was produced from surface incrustations on the Big Salt Plain of the Cimarron River; in Harmon County, it was recovered by solar evaporation of brine from springs. The principal uses were for stock food and for recharging water softeners.

Sand and Gravel.—Sand and gravel production was reported from 66 counties, with Johnston, Tulsa, Le Flore, Oklahoma, Logan, Cherokee, Kiowa, and Pontotoc leading; they supplied over half of the total value.

Most of the sand and gravel produced was used for paving concrete and mortar. High-purity glass sand (second in tonnage and value), was produced by two plants in Johnston and Pontotoc Counties (Arbuckle Mountain district). In addition to glass manufacturing, a small part of the high-purity sand was used as foundry sand and for making sodium silicate.

TABLE 13.—Sand and gravel sold or used by producers, in thousands

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	2,204	$2,000	1,430	$675	3,634	$2,675
1954	3,211	3,380	2,213	885	5,424	4,265
1955	3,654	3,719	2,640	1,067	6,294	4,786
1956	3,417	3,886	2,530	957	5,947	4,843
1957	3,297	3,608	1,663	899	4,960	4,507
1958	4,245	4,417	2,987	1,442	7,232	5,859

Stone.—Eleven million tons of stone was produced in 36 counties, of which Comanche, Tulsa, Murray, and Ottawa supplied most of the quantity. Crushed limestone was reported by 19 producers at 32 quarries and by the State highway department. The material was used principally for cement and concrete aggregate and for road construction; in lesser amounts as agricultural limestone.

Chat.—Chat, included with miscellaneous stone, denotes the coarse tailing from the milling of zinc and lead ores. The material is mostly chert or microcrystalline silica and small quantities of limestone, sphalerite, galena, marcasite, and pyrite.

Most of the chat sold was used for railroad ballast, concrete aggregate, and road surfacing. Operators in Ottawa County reported 7 percent more tonnage than in 1957.

Granite.—The dimension-granite industry was centered in the Wichita Mountains in the southwestern part of the State, where four producers operated five quarries in Greer, Comanche, and Kiowa Counties. One quarry was operated in Johnston County in the Arbuckle Mountains. Granite was quarried and crushed in Greer County by the State highway department.

Production was from pre-Cambrian granites, which are predominantly pink and red. Dimension granite was used mostly for monu-

mental stone and partly for exterior trim. Much of the stone was finished in plants in the Wichita Mountains, and some was shipped as rough rock to other States.

TABLE 14.—Stone sold or used by producers, by kinds, in thousands

Year	Granite		Limestone		Sandstone	
	Short tons	Value	Short tons	Value	Short tons	Value
1954	11	$666	[1] 6,975	[1] $7,528	161	$233
1955	576	1,276	[2] 8,827	[2] 10,124	237	276
1956	[3] 5	[3] 523	[2] 8,626	[2] 10,603	153	227
1957	[3] 5	[3] 557	[2] 10,238	[2] 12,041	306	373
1958	31	569	9,383	10,833	275	264

Year	Other stone		Total	
	Short tons	Value	Short tons	Value
1954	2,092	$720	[1] 9,239	[1] $9,147
1955	1,293	619	10,933	12,295
1956	1,763	1,064	10,547	12,417
1957	1,467	1,092	12,016	14,064
1958	1,105	566	10,794	12,232

[1] Excludes dimension limestone.
[2] Dimension limestone included with "Other stone."
[3] Crushed granite included with "Other stone."

Limestone and Dolomite.—Limestone and dolomite were quarried in 27 counties; the largest production was from Tulsa, Comanche, and Murray Counties.

Chemical-grade limestone was quarried at Marble City in Sequoyah County for limemaking, for use as flux in glass manufacturing, and for fertilizers and mineral food. Dolomite was quarried in Johnston County for flux in glass manufacturing and for fertilizers.

About 2,600 short tons of dimension limestone was quarried for building stone in the Arbuckle Mountains in Pontotoc County, in Caddo County, and in Johnston County; limestone for portland cement was quarried in Washington and Pontotoc Counties.

Sandstone.—Dimension sandstone, produced in Okmulgee and Mayes Counties, was used for building and veneer stone. The stone was cut in slabs 1½ to 6 inches thick from shallow, open-face quarries.

Tripoli.—Output of tripoli in eastern Ottawa County was 9 percent less than in 1957. All of it was shipped to Seneca, Mo., where it was processed by the American Tripoli Division of the Carborundum Co. and sold chiefly for buffing compounds and in minor amount for foundry use.

METALS

Output of metals declined for the fourth consecutive year.

Lead.—Mine production of lead, all from Ottawa County, was mostly by Eagle-Picher Co., followed by Dewey Sims Mining Co., Contack Mining Co., Mark Twain Mining Co., and Searcy-Henderson Mining Co. Production was halted during the last 6 months because

of low demand. The price of lead opened the year at 13 cents a pound New York, dropped gradually to 10.75 cents on August 13, and returned to 13 cents on October 14, where it remained unchanged to the end of the year.

Uranium.—Prospecting for radioactive minerals was done near Foss in Washita County and near Cement in Caddo County.

TABLE 15.—Mine production of lead and zinc, in terms of concentrate and recoverable metals [1]

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content [2]			
					Lead		Zinc	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1949–53 (average)	21,894	$3,995	86,574	$8,642	16,320	$4,983	46,510	$13,913
1954	19,004	3,194	84,444	5,467	14,204	3,892	43,171	9,325
1955	19,555	3,369	78,726	5,997	14,126	4,210	41,543	10,220
1956	17,971	3,225	52,993	4,485	12,350	3,878	27,515	7,539
1957	10,198	1,896	27,702	2,288	7,183	2,054	14,951	3,469
1958	5,213	689	9,791	594	3,692	864	5,267	1,074
1891–1958	1,672,806	162,561	9,731,560	482,132	1,283,151	194,053	5,131,115	771,739

[1] Based on Oklahoma ore ("dirt") and old tailing treated at mills during calendar year indicated.
[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 concentrate ("ore") and metal, it should be borne in mind that the value given for the concentrate is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

TABLE 16.—Tenor of lead-zinc ore milled and concentrates produced

	1957	1958
Total material milled—short tons	899,973	384,196
Recovery of concentrate and metal from quantity milled:		
Galena—short tons	10,198	5,213
Sphalerite—do	27,702	9,791
Galena—percent	1.13	1.36
Sphalerite—do	3.08	2.55
Lead [1]—do	0.80	0.96
Zinc [1]—do	1.66	1.37
Average lead content of galena concentrate—do	71.88	72.28
Average zinc content of sphalerite concentrate—do	59.95	59.70
Average value per ton:		
Galena concentrate	$185.94	$132.23
Sphalerite concentrate	82.61	60.70

[1] Figures represent metal content of the crude ore (dirt) only insofar as it is recovered in the concentrate Data on tailing losses not available.

TABLE 17.—Mine production of lead and zinc in 1958, by months, in terms of recoverable metals

Month	Lead (short tons)	Zinc (short tons)	Month	Lead (short tons)	Zinc (short tons)
January	685	845	May	596	796
February	720	800	June	457	883
March	617	985	July–December		
April	617	958	Total	3,692	5,267

Zinc.—Owing to increased inventories and to a 10-month work stoppage at the Henryetta smelter, zinc output (all from Ottawa County) declined 69 percent from the 1957 value. Eagle-Picher Co. was the principal producer in the State, followed by Dewey Sims Mining Co., Mark Twain Mining Co., Thunderbird Mining Co., and Buffalo Mining Co.

Zinc-metal price at the beginning of 1958 was quoted at 10 cents a pound, East St. Louis, increased to 11.5 cents a pound on November 7, and remained stable to the end of the year.

Custom Mills and Smelters.—Two custom mills (in Oklahoma and Kansas) treated lead-zinc ores mined in both States, and two mine mills treated lead-zinc ores from company mines only.

Three smelting companies operated three horizontal-retort zinc plants. These were the plants of American Metal Climax, Inc., at Blackwell, Kay County; National Zinc Co. at Bartlesville, Washington County; and Eagle-Picher Co. at Henryetta, Okmulgee County. Only the Henryetta smelter treated domestic ores exclusively, and outputs of all these plants were curtailed. Federal Metals Division of American Smelting & Refining Co. operated a secondary zinc plant in Sand Springs, Tulsa County.

TABLE 18.—Quoted prices of 60 percent zinc, concentrate and 80 percent lead concentrate at Joplin, Mo., in 1958 [1]

Zinc concentrate		Lead concentrate	
Effective date	Price per short ton	Effective date	Price per short ton
Jan. 1–Oct. 7	$56.00	Jan. 1–Mar. 31	$156.12
Oct. 8–Nov. 6	64.00	Apr. 1–May 13	141.72
Nov. 7–Dec. 31	68.00	May 14–June 2	134.52
		June 3–June 17	127.32
		June 18–June 30	134.52
		July 1–Aug. 12	127.32
		Aug. 13–Sept. 17	123.72
		Sept. 18–Sept. 29	127.32
		Sept. 30–Oct. 7	134.52
		Oct. 8–Oct. 13	148.92
		Oct. 14–Dec. 31	156.12

[1] E&MJ Metal and Mineral Markets.

TRI-STATE DISTRICT

Declining metal prices led to a general shutdown at midyear of all major mining operations in the Tri-State district. Consequently, metal concentrate recovered was down 56 percent for lead and 68 percent for zinc from 1957 recoveries. Oklahoma produced 74 percent of the district's lead concentrate and 54 percent of the zinc concentrate; Kansas, 26 percent of the district's lead concentrate and 46 percent of the zinc concentrate. Southwest Missouri reported no production.

Mineral Brokers.—Several smelting companies maintained mineral brokers or ore buyers in the Tri-State district of Oklahoma, Kansas, and Southwest Missouri. No metal concentrates were stockpiled at

the mines, as all production continued to be purchased f.o.b. the mill by the brokers. However, these mills became inactive during the second half of the year as deliveries of mined ores ceased.

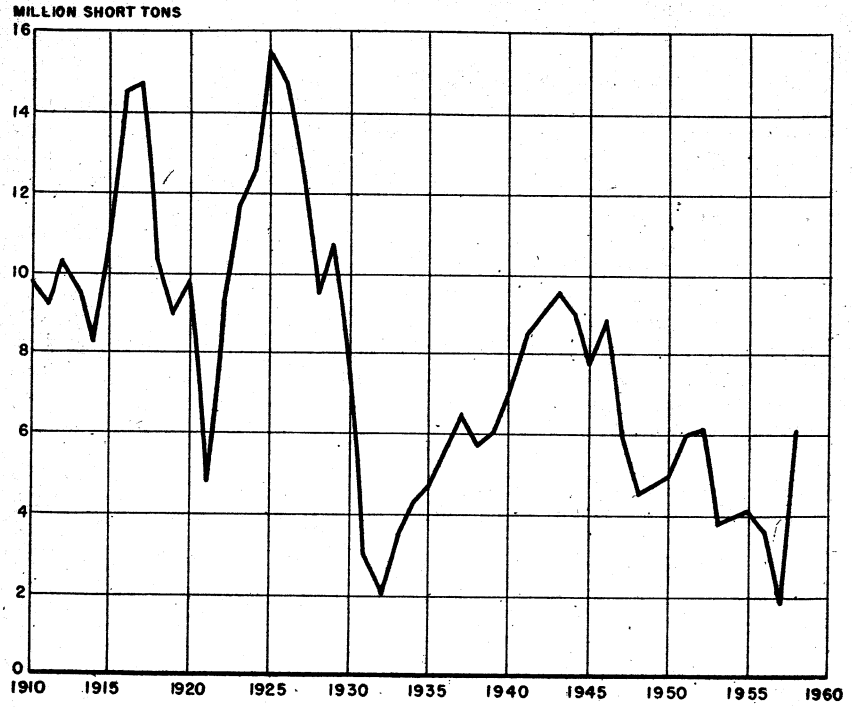

FIGURE 1.—Quantity of crude ore (rock) milled in the Tri-State district, 1910–58.

TABLE 19.—Mine production of lead and zinc concentrates in the Tri-State district, in terms of concentrate and recoverable metals

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content			
					Lead		Zinc	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1949–53 (average)	34,444	$6,379	147,551	$14,679	25,915	$7,953	79,396	$23,714
1954	24,497	4,127	[1] 127,053	8,484	18,314	5,018	[2] 64,322	13,894
1955	[3] 26,992	4,734	[4] 131,026	10,052	[4] 19,679	5,864	[5] 69,696	17,145
1956	28,597	5,282	107,997	9,335	20,373	6,397	57,215	15,677
1957	15,930	2,928	57,052	4,604	11,462	3,278	30,895	7,168
1958:								
Kansas	1,828	242	8,210	499	1,299	304	4,421	902
Southwest Missouri								
Oklahoma	5,213	689	9,791	594	3,692	864	5,267	1,074
Total: 1958	7,041	931	18,001	1,093	4,991	1,168	9,688	1,976

[1] Includes 360 tons from old tailing remilled.
[2] Includes 194 tons from old tailing remilled.
[3] Includes 2,736 tons from old tailing remilled.
[4] Includes 44 tons from old tailing remilled.
[5] Includes 256 tons from old tailing remilled.

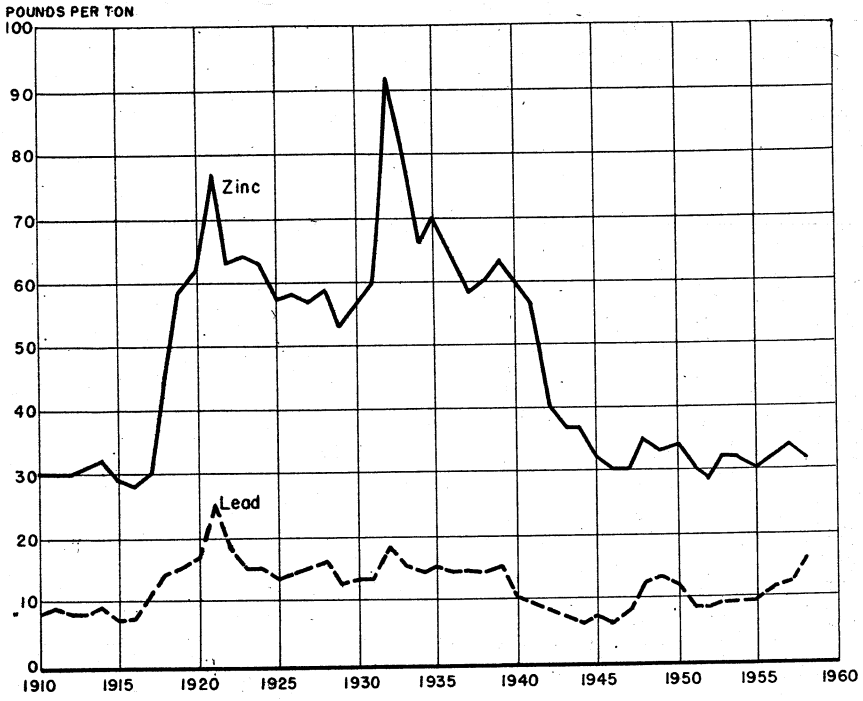

FIGURE 2.—Metal recovered per ton of crude ore (rock) milled in the Tri-State district, 1910–58.

TABLE 20.—Tenor of lead and zinc ore milled and concentrate produced in Tri-State district

	1954	1955	1956	1957	1958
Total material milled:					
Crude ore, short ton	4,092,278	4,140,281	3,584,902	1,836,942	611,556
Tailing and slimes, do	18,000	486,280	----------	----------	----------
Recovery of concentrate and metal from material milled:					
Galena, percent	0.60	0.58	0.80	0.87	1.15
Sphalerite, do	3.09	2.83	3.01	3.11	2.94
Lead [1], do	0.45	0.43	0.57	0.62	0.82
Zinc [1], do	1.56	1.51	1.60	1.68	1.58
Average lead content of galena concentrate, percent	76.28	74.41	72.69	73.46	72.35
Average zinc content of sphalerite concentrate, percent	56.24	59.09	58.87	60.16	59.76
Average value per ton:					
Galena concentrate	$168.48	$175.40	$184.72	$183.80	$132.29
Sphalerite concentrate	66.77	76.72	86.44	80.70	60.74

[1] Figures represent metal content of the crude ore (dirt) only insofar as it is recovered in the concentrate

REVIEW BY COUNTIES

Mineral production was reported from all of the 77 Oklahoma counties.

Alfalfa.—Petroleum and natural gas were produced. Construction sand and gravel was produced by Earl Kirkpatrick.

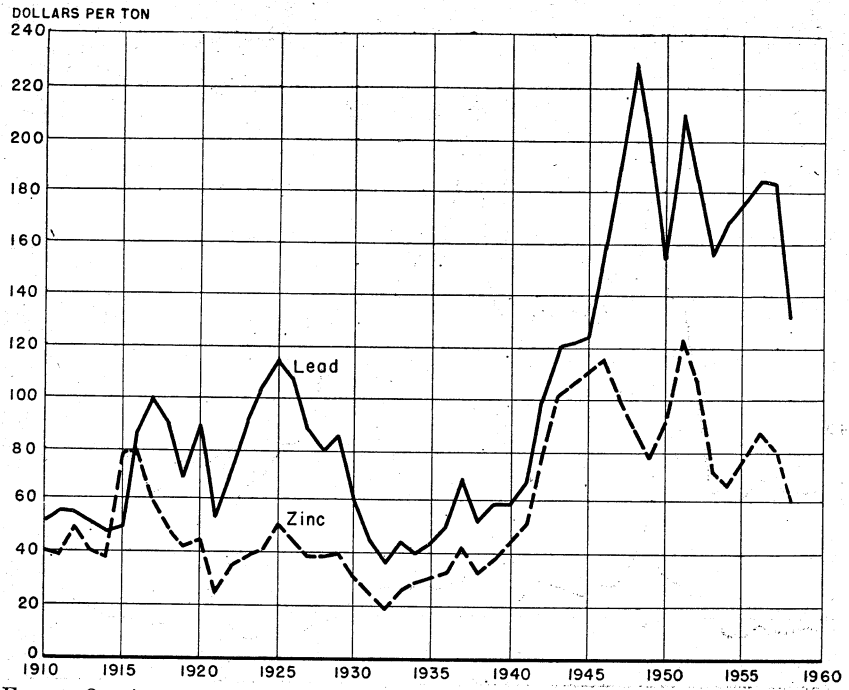

FIGURE 3.—Average prices received by sellers per ton of concentrate in the Tri-State district, 1910–58.

TABLE 21.—Value of mineral production in Oklahoma by counties

County	1957	1958	Minerals produced in 1958 in order of value
Adair		$13,819	Petroleum.
Alfalfa	$1,718,488	2,583,448	Petroleum, natural gas, sand and gravel.
Atoka	353,800	(1)	Stone, sand and gravel, petroleum.
Beaver	4,028,321	8,493,308	Natural gas, petroleum, natural-gas liquids, pumice, sand and gravel.
Beckham	15,227,639	14,912,703	Petroleum, natural-gas liquids, natural gas, sand and gravel, salt.
Blaine	1,328,525	1,189,066	Gypsum, sand and gravel, natural gas, stone, petroleum.
Bryan	2,126,922	1,584,752	Petroleum, natural gas, sand and gravel, stone.
Caddo	14,933,724	16,508,948	Petroleum, natural gas, stone, gypsum, sand and gravel.
Canadian	279,425	217,008	Petroleum, natural gas.
Carter	67,007,569	62,154,540	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Cherokee	384,200	392,116	Sand and gravel, stone.
Choctaw	14,666	27,000	Sand and gravel.
Cimarron	2,058,407	2,435,330	Natural gas, petroleum, sand and gravel.
Cleveland	22,694,614	20,218,457	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Coal	2,220,726	1,982,606	Petroleum, stone, natural gas, sand and gravel.
Comanche	2,582,034	3,178,432	Stone, petroleum, natural gas, sand and gravel.
Cotton	4,913,586	4,667,133	Petroleum, sand and gravel, natural gas.
Craig	439,820	373,065	Coal, petroleum, natural gas, sand and gravel.
Creek	33,373,127	31,264,363	Petroleum, natural-gas liquids, natural gas, stone, clays, sand and gravel.
Custer	309,566	301,510	Natural-gas liquids, clays, sand and gravel.
Delaware	36,250	7,100	Sand and gravel.
Dewey	105,290	(1)	Bentonite, sand and gravel, stone, petroleum.
Ellis	2,818	118,528	Petroleum, natural gas, sand and gravel.
Garfield	8,604,804	7,390,104	Petroleum, natural-gas liquids, natural gas, sand and gravel, clays.
Garvin	105,243,869	87,236,808	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.
Grady	21,821,701	19,548,722	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone.

See footnotes at end of table.

TABLE 21.—Value of mineral production in Oklahoma by counties—Continued

County	1957	1958	Minerals produced in 1958 in order of value
Grant	$3,081,385	$4,068,440	Petroleum, natural gas.
Greer	584,753	433,643	Petroleum, stone, sand and gravel, clays, natural gas.
Harmon	17,600	14,101	Salt, sand and gravel.
Harper	427,090	1,575,046	Petroleum, natural gas.
Haskell	2,593,846	2,089,674	Coal, natural gas, sand and gravel.
Hughes	10,311,313	7,544,978	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Jackson	1,168,369	563,738	Petroleum, sand and gravel, natural gas.
Jefferson	3,605,448	3,850,120	Petroleum, natural gas, sand and gravel.
Johnston	1,788,635	1,416,317	Sand and gravel, stone.
Kay	13,929,526	13,823,807	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Kingfisher	1,238,486	1,427,577	Petroleum, sand and gravel, natural-gas liquids, natural gas.
Kiowa	2,308,747	3,424,876	Petroleum, stone, natural gas, sand and gravel.
Latimer	814,201	312,409	Natural gas, coal.
Le Flore	2,980,745	4,971,469	Natural gas, coal, sand and gravel, stone.
Lincoln	24,568,278	21,328,771	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel, clays.
Logan	12,421,767	11,777,168	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone.
Love	2,584,021	2,389,408	Petroleum, natural gas, sand and gravel.
Major	1,957,484	1,860,255	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Marshall	8,708,780	7,262,848	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Mayes	23,967	(1)	Stone, sand and gravel, petroleum.
McClain	10,038,360	12,666,664	Petroleum, natural gas, natural-gas liquids, sand and gravel.
McCurtain	79,559	158,938	Sand and gravel, petroleum.
McIntosh	580,938	581,162	Coal, natural gas, petroleum, sand and gravel.
Murray	2,592,518	3,961,948	Petroleum, stone, sand and gravel, asphalt, natural gas.
Muskogee	864,356	1,091,805	Petroleum, sand and gravel, natural gas.
Noble	9,781,474	9,166,068	Petroleum, natural gas, natural-gas liquids, stone.
Nowata	15,230,491	13,252,754	Petroleum, stone, natural gas.
Okfuskee	11,117,032	10,638,321	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone.
Oklahoma	30,532,255	28,235,541	Petroleum, natural-gas liquids, natural gas, sand and gravel, clays.
Okmulgee	7,957,790	7,595,443	Petroleum, coal, natural gas, sand and gravel, stone.
Osage	81,009,593	76,367,259	Petroleum, natural-gas liquids, natural gas, stone.
Ottawa	6,054,064	2,541,178	Zinc, lead, stone, tripoli, sand and gravel.
Pawnee	8,242,510	7,478,807	Petroleum, sand and gravel, natural-gas liquids, natural gas, stone.
Payne	15,166,521	13,844,933	Petroleum, natural gas, stone, natural-gas liquids, sand and gravel.
Pittsburg	2,642,451	1,881,534	Coal, stone, natural gas, clays, sand and gravel.
Pontotoc	17,547,261	17,959,446	Petroleum, cement, natural-gas liquids, sand and gravel, natural gas, stone.
Pottawatomie	11,962,650	13,047,870	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Pushmataha	2,062	201,497	Sand and gravel, stone.
Roger Mills		4,000	Sand and gravel.
Rogers	6,887,366	6,389,351	Petroleum, coal, sand and gravel, clays, natural gas.
Seminole	31,465,563	28,965,424	Petroleum, natural-gas liquids, natural gas, clays, sand and gravel.
Sequoyah	3,462,054	2,555,062	Coal, lime, stone, natural gas.
Stephens	72,716,356	66,002,427	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.
Texas	24,365,976	24,221,556	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Tillman	2,379,124	2,514,767	Petroleum, sand and gravel, natural gas.
Tulsa	7,198,975	7,176,100	Petroleum, stone, sand and gravel, clays, natural gas.
Wagoner	1,596,165	1,981,574	Petroleum, natural gas.
Washington	18,553,788	19,351,834	Petroleum, cement, stone, natural gas.
Washita	1,396,625	1,196,439	Petroleum, natural gas, sand and gravel.
Woods	432,443	696,845	Natural gas, petroleum, sand and gravel, salt.
Woodward	8,815	37,810	Sand and gravel, petroleum, natural gas.
Various	214,566	80,119	Stone.
Undistributed [2]		9,078,492	
Total	809,004,000	767,856,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes some stone, clays, sand and gravel, and petroleum not assigned to counties and values indicated by footnote 1.

Atoka.—Limestone was crushed at the Southwest Stone Co. quarry near Stringtown for use as railroad ballast, riprap, road base, and aggregate in concrete. Sand and gravel was produced by the State highway department. A small quantity of petroleum was produced.

Beaver.—Petroleum and natural gas were produced. The Mocane gas area was the largest. LaRue-Axtell Pumice Co. mined almost pure volcanic ash near Gate. Sand and gravel was produced by the State highway department.

Beckham.—Petroleum, natural gas, and natural-gas liquids were produced, mostly from the Elk City field. Salt was produced from wells southwest of Sayre by the Oklahoma Salt Industries, Inc. Sand and gravel was produced by the State highway department.

Blaine.—Northeast of Watonga gypsum was produced by Universal Atlas Cement Co. and west of Okeene by S. A. Walton & Sons. U.S. Gypsum Co. also quarried and crushed gypsum and operated a large calcining, sheet-rock, and plaster plant at Southard. Minor quantities of petroleum and natural gas were produced.

Bryan.—Sand and gravel for construction was produced from pits near Colbert; and for paving by the State highway department. Petroleum and natural gas were produced from the Aylesworth, S. E., field.

Caddo.—Petroleum and natural gas were produced. Cement, the largest of these fields, produced 4.4 million barrels of oil. The plant of Apache Gasoline Co. remained shut down. At Cyril the 12,000-barrel-a-day refinery of Anderson-Prichard Oil Corp. operated throughout the year. Construction sand and gravel was produced by one operator and by a Government agency and paving sand by the State highway department. Dimension limestone, crushed limestone, and crushed sandstone were produced. Gypsum was produced near Lindsay by the Harrison Gypsum Co.

Carter.—Carter County ranked fourth in the value of minerals and mineral fuels produced in the State. Petroleum and natural gas were produced from numerous fields, of which Fox-Graham, Healdton, Hewitt, Sholem-Alechem, and Tatums were the largest. Natural-gas liquids were recovered by five plants. At Ardmore the 12,000-barrel-a-day refinery of Ben Franklin Refining Co. operated during the year. Sand and gravel was produced by the State highway department.

Cimarron.—Petroleum and natural gas were produced from several small fields in the Keyes area. At Keyes the U.S. Department of the Interior awarded a contract to construct a $12 million plant for extracting helium from the Keyes gas. Gas for processing was to be supplied to the plant by Colorado Interstate Gas Co.

Cleveland.—Petroleum and natural gas were produced. Natural-gas liquids were recovered by Continental Oil Co. and Sunray Mid-Continent Petroleum Corp. Sand and gravel was produced by the State highway department.

Coal.—Petroleum and natural gas valued at about $1.7 million were produced. Crushed limestone was produced by Dolese Bros. and paving sand and gravel by the State highway department.

Comanche.—Crushed limestone was produced by Dolese Bros. Co. from its Richard Spur quarry north of Lawton. Petroleum and nat-

ural gas were produced from a group of small fields (comprising three districts) and Fort Sill Reservation field.

Cotton.—Petroleum and natural gas were produced from a group of fields in the Walters and Cache Creek districts and from several other fields. Sand and gravel was produced by the State highway department.

Craig.—Coal was strip-mined at four pits by three producers. Minor amounts of petroleum and natural gas were produced. Sand and gravel was produced by the State highway department.

Creek.—Petroleum and natural gas were produced from numerous fields; of these, the prolific Cushing and Glennpool fields furnished 5.5 million barrels of petroleum. Natural-gas liquids were recovered by five plants. At Sapulpa clay for the manufacture of brick and tile was produced by Sapulpa Brick & Tile Co. and for pottery by Frankhoma Pottery Co. Minor amounts of crushed limestone and sand and gravel were produced for highway purposes.

Garfield.—Petroleum and natural gas were produced. Natural-gas liquids were recovered by the plants of Sterling Oil Co. of Oklahoma near the East Spring Valley field and by Sinclair Oil & Gas Co. at Covington. The 32,000-barrel-a-day Enid refinery of Champlin Refining Co. operated throughout the year. Enid Brick & Tile Manufacturing Co. continued to produce clay for manufacturing of brick. Sand and gravel was produced by the State highway department.

Garvin.—Garvin County retained first position in total value of minerals and mineral fuels produced in the State, although it ranked second in petroleum production. Petroleum and natural gas were produced from numerous fields, which furnished 22 million barrels of petroleum in 1958. Natural-gas liquids were recovered by six plants. The 17,000-barrel-a-day refinery of Kerr-McGee Oil Industries, Inc., at Wynnewood operated throughout the year. Construction sand was obtained by two operators from deposits east of Pauls Valley; paving sand and gravel and crushed limestone were produced for highways by the State highway department.

Grady.—Petroleum, natural gas, and natural-gas liquids were produced. Sand and gravel for construction and paving was obtained from pits near Tuttle by Dolese Bros. Co. Crushed limestone for road construction was produced by the State highway department.

Grant.—Petroleum and natural gas were produced from numerous small fields.

Greer.—Petroleum and natural gas were produced from the Lake Creek district. Granite was quarried by J. P. Gilman Granite Co. near the town of Granite. Clay was produced from the pit of Mangum Brick & Tile Co., south of Mangum. Sand and gravel was produced by two operators.

Harper.—Small quantities of petroleum and natural gas were produced. Sun Oil Co. awarded a contract to build a $3.5 million gasoline plant to process 100 million cubic feet of gas a day from the big Laverne gasfield.

Haskell.—Haskell County ranked third in value of coal produced. Coal was mined underground by Dock Coal Co., and McAlpine and Dock Coal Co.; and strip-mined by Garland Coal & Mining Co., Cedar Creek Coal Co., and Choctaw Coal, Inc. Natural gas was pro-

duced from Quinton and Kinta districts. A minor quantity of sand and gravel was produced by the State highway department.

Hughes.—Petroleum and natural gas were produced from numerous fields. The Holdenville East field, discovered in 1946, produced 476,000 barrels of oil. Natural-gas liquids were recovered by Grimes Gasoline Co. Paving gravel was produced for highways.

Jackson.—Petroleum and natural gas were produced from fields to the southeast of Altus. Sand and gravel was produced by the State highway department.

Jefferson.—Petroleum and natural gas were produced. Sand for road construction was produced by the State highway department.

Johnston.—Pennsylvania Glass Sand Corp. of Oklahoma continued to produce glass sand and ground silica from pits north of Mill Creek. Construction sand from a pit east of Tishomingo and paving gravel were produced for highways. Dimension limestone for construction was produced near Pontotoc by Ada Stone Co. and crushed limestone for road construction by Rock Products Co. Dimension granite was quarried south of Mill Creek.

Kay.—Petroleum and natural gas were produced from numerous fields, and natural-gas liquids were recovered by plants of Cities Service Oil Co. and Underlich Development Co. Petroleum refineries of Cities Service Oil Co. and Continental Oil Co. at Ponca City operated throughout the year. The petrochemical units of the Continental Oil Co. refinery continued to produce benzene, toluene and propylene hydrocarbons and carbon black. Effective February 22, 1958, the American Metal Climax, Inc., zinc smelter at Blackwell cut zinc production 2,000 tons a month. Operation of furnace blocks was reduced from 13 to 10. Crushed limestone was produced by Cookson Stone Co. from its quarry and plant northeast of Ponca City and by Mervine Stone Co. Sand was produced for construction and paving by three operators and by the State highway department.

Kingfisher.—Construction and paving sand were produced from pits near Dover by Dolese Bros. Co. and paving sand by the State highway department. Petroleum, natural gas, and natural gasoline were produced.

Kiowa.—Dimension granite was quarried near Snyder by three operators and near Hobart by Century Granite Co. Century's finishing plant at Snyder was moved to Frederick, Tillman County. Construction sand and gravel and crushed limestone for highways were produced by four operators. Petroleum and natural gas were produced.

Latimer.—Coal was strip-mined by Kinta Stripping Co. Natural gas was produced from the Red Oak and Morris fields.

Le Flore.—Coal was mined by eight operators, one using strip mining and the rest underground mining. The county was the second ranking coal producer in the State. Sand and gravel and crushed sandstone were produced for highway surfacing. Natural gas was produced, mainly from three fields.

Lincoln.—Petroleum and natural gas were produced from numerous fields. Natural-gas liquids were recovered by five plants. Allied Materials Corp. refinery at Stroud operated throughout the year. Crushed limestone was produced at two quarries by Cookson Stone

Co. and sand for concrete aggregate by the State highway department. Stroud Clay Products Co. produced clay for building brick.

Logan.—Petroleum and natural gas were produced from numerous fields, and natural-gas liquids were recovered by the Eason Oil Co. Construction sand was produced by two operators and stone for riprap by the State highway department.

Major.—Petroleum and natural gas were produced mostly from the Ringwood field and from other smaller fields. Natural-gas liquids were recovered by Warren Petroleum Co. at Ringwood. Construction sand was produced by one operator and paving sand by the State highway department.

Marshall.—Petroleum and natural gas were produced from several fields, of which the Cumberland field yielded 1.5 million barrels of oil. Natural-gas liquids were recovered by Warren Petroleum Co. and Universal Gasoline Co. Near Madill sulfur from waste sour gas was recovered by Central Chemical Co. Sand and gravel and crushed limestone were produced for highways.

McClain.—Petroleum and natural gas were produced from numerous small fields and natural gasoline by Texas Consolidated Oils. Sand and gravel for paving was produced by the State highway department.

McIntosh.—Coal was strip-mined by Magic City Coal Co. Petroleum and natural gas were produced from the Coalton and Morris fields. Sand was produced for highways.

Murray.—Asphaltic limestone and sandstone were produced near Dougherty by the United States Asphalt Corp. Limestone was crushed at the Rayford and Big Canyon quarries of Dolese Bros. Co. Structural sand was produced by Makin Sand & Gravel Co. and sand and gravel by the State highway department. Petroleum and natural gas were produced from two fields.

Muskogee.—Petroleum and natural gas were produced. Sand and gravel was pumped from the Arkansas River by three producers and by the State highway department. At Muskogee, Fansteel Metallurgical Corp. held a formal public opening on March 14 of its new $6.5 million columbium-tantalum plant designed to increase the domestic supply of tantalum by 50 percent. Also at Muskogee, Callery Chemical Co. completed its $38 million energy fuel plant to produce HiCal for Navy missiles.

Noble.—Petroleum and natural gas were produced from numerous fields and natural-gas liquids were recovered by the Lucien unit plant of the Gasoline Plant Management Co. Riprap was produced by the State highway department.

Nowata.—Petroleum and natural gas were produced from six fields. Crushed limestone was produced by Peerless Rock Co.

Okfuskee.—Petroleum and natural gas were produced from numerous fields, of which the Olympic field furnished 1.3 million barrels of oil. Natural-gas liquids were recovered by two plants of Grimes & Grimes. Sand and gravel and stone riprap were produced by the State highway department.

Oklahoma.—Petroleum and natural gas were produced from numerous fields. Oklahoma City and West Edmond fields had oil productions that exceeded 3 million and 1 million barrels, respectively. Natural-gas liquids were recovered by Patton & Swab, Inc., Champlin

Oil & Refining Co., Phillips Petroleum Co. (three plants), and Cities Service Oil Co. The plant of Monarch Refineries, Inc., was inactive during the year. Clay for manufacturing brick and tile was obtained from pits in the west part of Oklahoma City by Acme Brick Co. and United Brick & Tile Co. Near Choctaw clay for lightweight aggregate was produced by Oklahoma Lightweight Aggregate Corp. Structural and paving sand was produced by four operators and paving sand also by the State highway department.

Okmulgee.—Coal was mined underground near Henryetta by Ben Hur Coal Co. Petroleum and natural gas were produced from numerous fields. Phillips Petroleum Co. refinery at Okmulgee was in operation. Paving sand was produced for highways; sandstone was quarried near Henryetta by the Ada Stone Co.

Osage.—Osage, with many fields producing oil and gas, was the leading oil-producing county. The Burbank field, under an extensive waterflooding program, produced 14.5 million barrels of oil and remained the most prolific. Natural-gas liquids were recovered by Phillips Petroleum Co. (two plants) and Neal Gasoline Co. The county was second in new fields (six) discovered. Crushed limestone was produced by Burbank Rock Co., Mervine Stone Co., Cookson Stone Co., and Amis Construction Co.

Ottawa.—All of Oklahoma's lead and zinc output and a major part of the Tri-State district's output was supplied from 30 operating mines in Ottawa County. Because of declining metal prices, these mining operations were shut down during the last 6 months of the year. At Miami the Rare Metals plant of Eagle-Picher Co. and Winart Pottery operated during the year. Chat, a byproduct of zinc and lead milling, was supplied by four producers. Tripoli was quarried in east central Ottawa County by the American Tripoli Division and processed in its plant at Seneca, Mo. Paving sand was produced by the State highway department.

Pawnee.—Petroleum and natural gas were produced from numerous fields, and natural-gas liquids were recovered by Frame Natural Gasoline Co. Construction and paving sand and gravel were produced by two operators and the State highway department. Crushed limestone was produced at the Ralston quarry by Cookson Stone Co.

Payne.—Petroleum and natural gas were produced from numerous fields, of which Yale-Quay, with a production of 1.9 million barrels of oil, was the largest. Natural-gas liquids were recovered by the plant of Boswell-Frates Co. At Cushing refineries of Kerr-McGee Oil Industries, Inc., and of Midland Cooperatives, Inc., operated throughout the year. Crushed limestone was produced by Cookson Stone Co. at the Cushing quarry and sand by the Payne County Highway Department.

Pittsburg.—Pittsburg County ranked fourth in the value of coal produced. Coal was mined underground by Lone Star Steel Co. at the Carbon No. 5 mine. Natural gas was produced from three fields near Quinton. Sand and crushed limestone were produced for highway construction. Clay for manufacturing brick and tile was produced by the Oklahoma State Penitentiary west of McAlester.

Pontotoc.—Petroleum and natural gas were produced from many fields, and natural-gas liquids were recovered by plants of the Carter

Oil Co. and Kerr-McGee Oil Industries, Inc. Building limestone was quarried near Fittstown by Townsend Quarry. Shale and limestone were quarried near Lawrence by the Ideal Cement Co. for use in its Ada plant. Mid-Continent Glass Sand Co. produced glass and molding sands. Paving sand and gravel was produced by the State highway department. At Ada, Oklahoma Ideal Cement Co. put in operation its new $20 million plant, which includes a 12- by 450-foot kiln and a second of like size is to be installed. Combined annual cement capacity of the new and old plants will be 5.5 million barrels.

Pottawatomie.—Petroleum and natural gas were produced from numerous fields, of which the St. Louis field was the largest. Natural-gas liquids were recovered by the plants of Warren Petroleum Co. and Sinclair Oil & Gas Co. Paving gravel was produced for highways.

Rogers.—The county ranked first in coal production. Coal was strip-mined by the McNabb Coal Co. (two mines) and Peabody Coal Co. Clay and shale were also produced by McNabb Coal Co. Petroleum and natural gas were produced from three fields, of which the Chelsea district supplied most of the oil produced. State permits to waterflood oilfields showed a gain, as operators planned more oil recovery before the Oologah basin is inundated. Sand and gravel was produced for highways.

Seminole.—Petroleum and natural gas were produced from numerous fields, of which the Seminole City field was the most prolific. Natural-gas liquids were recovered by the plants of Redco Corp., Sinclair Oil & Gas Co. (two plants), and Phillips Petroleum Co. Clay for manufacturing brick and tile was obtained west of Wewoka by Wewoka Brick & Tile Co. Sand and gravel was produced for highways.

Sequoyah.—The county ranked fifth in value of coal. Coal was strip-mined by Sallisaw Stripping Co. Limestone was crushed north of Marble City at the quarry of the St. Clair Lime Co. Part of the limestone crushed at Marble City was burned at Sallisaw in the kilns of the St. Clair Lime Co.; the remainder was used as agricultural lime and for highways. Natural gas was produced from a small field.

Stephens.—This county ranked third in petroleum production. Considerable natural gas also was produced. Natural-gas liquids were recovered by five plants. D–X Sunray refinery at Duncan operated throughout the year. Crushed limestone and paving gravel were produced for highways.

Texas.—Natural gas from the vast Hugoton gasfield and petroleum were produced during the year. Natural-gas liquids were recovered in the vicinity of Guymon by Cities Service Oil Co. and Hugoton Plains Gas & Oil Co. and elsewhere by Dorchester Corp. and Excelsior Corp. Construction sand and gravel was produced by three operators. The State highway department produced paving sand.

Tillman.—Petroleum, natural gas, and sand and gravel were produced. The refinery of Bell Oil & Gas Co. at Grandfield operated throughout the year. Construction sand was produced by two operators and gravel for paving by the State highway department.

Tulsa.—Petroleum and natural gas were produced. In Tulsa brick and tile were manufactured by Acme Brick Co. and by United Brick

& Tile Co.; in Collinsville by United Brick & Tile Co. East of Tulsa near Garnett crushed limestone was produced by Anchor Stone Co. and by Chandler Materials Co. and elsewhere by Standard Industries, Inc. Construction and paving sands were produced by nine operators; for paving by the State highway department. At West Tulsa refineries of The Texas Co. and of D–X Sunray operated throughout the year. D–X Sunray opened four new processing units at the West Tulsa refinery. These units will not increase the refinery's capacity but are capable of upgrading gasoline beyond the 105-octane range.

Washington.—Petroleum and natural gas were produced from five districts. Limestone and clay were quarried near Dewey for manufacturing portland cement by the Dewey Portland Cement Co. Crushed limestone also was produced near Bartlesville by the Matoaka Stone Co.

Washita.—Petroleum and natural gas were produced from several small fields and from part of the prolific Elk City field. Sand and gravel was produced for highways.

Woods.—Construction sand was produced near Waynoka by Waynoka Sand & Gravel Co. Salt was produced west of Freedom by Ezra Blackmon. Petroleum and natural gas were produced from several small fields.

Woodward.—Petroleum and natural gas were produced. Sand and gravel was produced by one operator and by the State highway department.

The Mineral Industry of Oregon

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Oregon State Department of Geology and Mineral Industries.

By Kenneth D. Baber,[1] Frank B. Fulkerson,[1] and Norman S. Petersen [1]

OREGON mineral-industry production benefited from increased construction in the last half of 1958 and advanced to a record total of $45 million, compared with the previous high of $43 million in 1957. Greater output of crushed stone and cement for highways and dams explained much of the gain; cement capacity had been increased in 1956–57. More diatomite, building stone, volcanic cinder and scoria, lime, and shale and pumice for lightweight aggregate was also produced. Not all parts of the industry reported increases. Sand and gravel output declined $3.2 million; clay production for building brick and draintile also was less than in 1957.

In southern Oregon, production of nickel ore continued, but the chromite mines in that area and in Grant County, eastern Oregon, were closed when Federal stockpile purchases ended. Malheur County was the principal source of mercury. Small quantities of gold, silver, copper, and lead were recovered, mainly in Grant County.

A new aluminum plant began production at The Dalles, and a uranium mill was completed at Lakeview.

Markets.—The Oregon construction industry continued to be the main consumer of mined and processed mineral commodities. Published annual statistics reflected the strength of construction activity and the work in progress as the year closed. Employment in contract construction gained 8 percent, mostly in the last 4 months after settlement of a strike. Building permits, totaling $198 million, rose 42 percent for one of the largest percentage increases in the Nation. Construction contracts awarded, exclusive of public works and utilities, increased 28 percent, contrasted with a 5-percent national advance. The largest gain was in residential construction. Work on the highway-building program cost $39 million, compared with $36 million in 1957; contracts awarded by the Oregon State Highway Department totaled $68 million—far surpassing the previous high of $38 million in 1953. Cement shipments to Oregon destinations, totaled 2.6 million barrels, 61,000 barrels more than in 1957.

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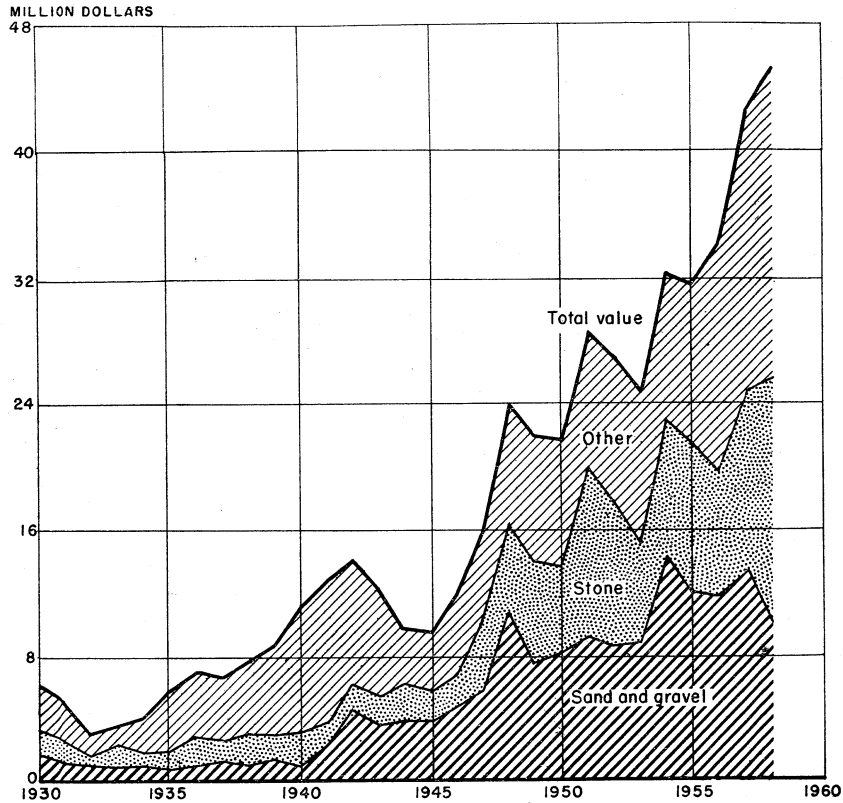

FIGURE 1.—Value of sand and gravel, stone, and total value of mineral production in Oregon, 1930–58.

TABLE 1.—Mineral production in Oregon[1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Chromite ---------- gross weight	7,900	$675	4,133	(2)
Clays ---------- thousand short tons	240	266	252	$293
Copper (recoverable content of ores, etc.) ----------	23	14	10	5
Gold (recoverable content of ores, etc.) ---- troy ounces	3,381	118	1,423	50
Lead (recoverable content of ores, etc.) ----------	5	1	1	(3)
Mercury ---------- 76-pound flasks	3,993	986	2,276	521
Nickel (content of ore and concentrate) ----------	12,276	(2)	12,697	(2)
Pumice ---------- thousand short tons	123	294	138	331
Sand and gravel ---------- do	12,843	13,481	10,464	10,265
Silver (recoverable content of ores, etc.) thousand troy ounces	16	14	3	2
Stone ---------- thousand short tons	[4] 10,583	[4] 11,745	15,004	15,483
Value of items that cannot be disclosed: Carbon dioxide, cement, diatomite, gem stones, iron ore (1957), iron oxide pigments (1957), lime, tungsten (1957), uranium (1957), and values indicated by footnote 3 ----------	----------	16,154	----------	19,311
Total [5] ----------	----------	[4] 42,820	----------	45,053

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Less than $500.
[4] Revised figure.
[5] Total adjusted to eliminate duplicating value of clays and stone.

Employment.—Employment rose in the mining industry and in nonmetal-products manufacturing from January to December. Improved markets during the last 6 months and good weather in the fall benefited both mine production and consumption. Primary metals employment in December was lower than in January, mainly because of curtailment in smelting and refining nonferrous metals. The number of workers at steel works and iron and steel foundries remained about the same throughout the year. Total employment in the mineral industries, averaging 9,700 persons, apparently increased 1,100 over 1957; but most of the difference can be attributed to changes in the system of industrial classification.

Average weekly earnings of production workers in primary metals continued to increase ($106.82 compared with $101.55 in 1957). Average weekly hours remained at 39.3; average hourly earnings rose from $2.58 to $2.72.

TABLE 2.—Employment and payrolls in mineral-industry establishments subject to Oregon Unemployment-Compensation law, by industry [1]

Industry	1957		1958	
	Employment	Payrolls (thousand)	Employment	Payrolls (thousand)
Mining:				
Metal	296	$1,518	330	$2,171
Nonmetal	920	4,633	1,000	5,210
Total	1,216	6,150	1,330	7,381
Stone, clay, and glass products:				
Glass and pottery	312	1,727	291	1,694
Hydraulic cement	442	2,420	480	2,712
Structural clay products	237	1,111	204	1,028
Concrete, gypsum, and plaster products	518	2,532	[2] 1,344	[2] 6,827
Cut-stone and stone products	48	236	48	256
Miscellaneous	106	457	133	623
Total	1,663	8,482	2,500	13,140
Primary metals:				
Blast furnaces, steelworks, rolling and finishing mills	2,525	15,499	955	6,572
Smelting and refining of nonferrous metals			1,792	11,319
Iron and steel foundries	1,902	10,434	1,824	10,488
Nonferrous foundries	364	1,788	235	1,160
Miscellaneous	194	1,006	217	1,276
Total	4,985	28,728	5,023	30,814
Industrial chemicals	331	1,779	416	2,329
Fertilizer manufacture	70	324	65	309
Products of petroleum and coal	300	1,538	320	1,760
Grand total	8,565	47,002	9,654	55,733

[1] Prepared from data supplied by Oregon State Unemployment Compensation Commission. Comparability between 1957 and 1958 totals reduced because of revisions of the industrial classification system. Figures may not add to totals because of rounding.
[2] Includes ready-mixed concrete.

Government Programs.—Four small contracts (three for mercury and one for uranium) were active under the Defense Minerals Exploration Administration (DMEA) program. The program of the DMEA, terminating June 30, 1958, was replaced by a more restricted plan administered by the new Office of Minerals Exploration, Department of the Interior.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Production and shipments of cement were 14 percent and 16 percent greater, respectively, than in 1957. Output was from three plants, one each in Baker, Clackamas, and Jackson Counties. The value of portland cement shipped by producers in Oregon and Washington averaged $3.55 per barrel (376 pounds) f.o.b. mill compared with $3.51 in 1957. Output was shipped chiefly to destinations within the State, but shipments also went to Idaho and Washington, and a small quantity to California. Transportation, mainly by truck, also included rail and water. Bulk shipments furnished a greater part of the total than in 1957.

Combined production from nine cement plants in Oregon and Washington in 1958 was 7,788,200 barrels of finished portland cement; the same plants shipped 7,905,000 barrels during the year.

TABLE 3.—Defense Minerals Exploration Administration contracts active during 1958

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
CROOK					
Orion Exploration & Development Co.	Log Cabin, Ridge, and Camp claims.	Mercury	Aug. 9, 1957	$12,100	75
DOUGLAS					
Moneta Porcupine Mines	Elkhead	do	June 20, 1958	5,198	50
HARNEY					
Timber Beast Mining Co.	Timber Beast group.	Uranium	Oct. 22, 1957	24,772	75
JEFFERSON					
International Engineering & Mining Co.	Axehandle	Mercury	Aug. 21, 1957	10,420	75

Clays and Shale.—Clays sold or used by producers increased 5 percent in tonnage and 10 percent in value compared with 1957. The larger increase in value reflected the greater output of higher value shales used to make lightweight aggregate in 1958. Miscellaneous clay output for heavy clay products, principally building brick and drain-tile, was 10 percent less than in 1957. This type of clay was produced in Benton, Clackamas, Klamath, Malheur, Marion, Multnomah, Polk, Tillamook, Union, Washington, and Yamhill Counties. The clays and shales used at cement plants were mined in Baker and Jackson Counties.

Output of shale for processing to expanded clay aggregate rose sharply over 1957. The raw shale was expanded at plants of Smithwick Concrete Products Co. and Northwest Aggregate, Inc., in Washington County. The expanded product was used chiefly as lightweight aggregate for precast and poured concrete products.

Diatomite.—Output of diatomite, 4 percent greater than in 1957, came from the quarry and plant of the Great Lakes Carbon Corp., Mining & Mineral Products Division, Terrebonne, Deschutes County. The prepared product was sold principally for filter, filler, and insulation.

Lime.—Production of lime at the Baker plant of the Chemical Lime Co. continued in 1958. The two-kiln plant produced quicklime chiefly for use at calcium carbide, metallurgical, and paper plants in Oregon and Washington.

Perlite.—Supreme Perlite Co., Portland, Multnomah County, produced 17 percent more expanded perlite than in 1957. Nevada mines supplied the crude perlite processed at the Portland plant. The expanded product was used chiefly for plaster aggregate; smaller quantities were for concrete aggregate and soil conditioner.

During development at a perlite deposit south of Paisley, Lake County, a small tonnage of ore was mined; however, no shipments were made.

Pumice and Volcanic Cinder.—Output of pumice and volcanic cinder, 12 percent greater than in 1957, came from four operations—three in Deschutes County and one in Harney County.

Output of crude and prepared pumice (excluding cinder and volcanic scoria) increased 10 percent compared with 1957. Most of the pumice produced was sold as lightweight-concrete aggregate; some output was also used for insulation, roofing rock, and road material.

Volcanic cinder and scoria output advanced 22 percent. The cinder was used mainly for surfacing roads; volcanic scoria and cinder were sold for concrete aggregate.

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

Use	1957		1958	
	Thousand short tons	Value (thousand)	Thousand short tons	Value (thousand)
COMMERCIAL OPERATIONS				
Building	3,042	$4,099	1,905	$2,385
Concrete and roadstone	4,183	4,388	3,467	4,133
Railroad ballast	235	359	78	97
Other [1]	662	390	846	608
Total	8,122	9,236	6,295	7,224
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Building	175	57	23	43
Concrete and roadstone	4,546	4,188	4,146	2,998
Total	4,721	4,245	4,169	3,041
TOTAL ALL OPERATIONS				
Building	3,217	4,156	1,928	2,429
Concrete and roadstone	8,729	8,576	7,612	7,131
Railroad ballast	235	359	77	97
Other [1]	662	390	846	608
Grand total [2]	12,843	13,481	10,464	10,265

[1] Includes molding, engine, and ballast sands and sand and gravel used for miscellaneous unspecified purposes..

[2] Owing to rounding, the individual items may not add to total shown.

Sand and Gravel.—Sand and gravel output declined 19 percent compared with 1957, principally because of curtailed commercial production (down 22 percent). Sand and gravel for construction and building purposes decreased 40 percent and for road construction and maintenance 13 percent. The quantity of sand and gravel required at State highway department projects remained substantially the same as in 1957.

Sand and gravel output was used in the following percentages: 73 percent for road construction and maintenance (68 percent in 1957); 18 percent for construction and building (25 percent in 1957); and 9 percent for other purposes, including railroad ballast and special sands (7 percent in 1957). Production was derived from 35 of the 36 counties; output exceeding 1 million tons was reported from Clackamas, Lane, Marion, and Multnomah Counties.

Stone.—Production of stone increased 42 percent compared with 1957, largely owing to expanded use of crushed stone by the State highway department. An increase of 1 million tons in the quantity of stone used at U.S. Army Corps of Engineers dams and companion relocation works was a contributing factor.

Crushed limestone output of 1.2 million tons was 19 percent higher than in 1957. Greater quantities of limestone for cement and lime manufacture furnished the increase; limestone was produced at quarries in Baker, Josephine, Polk, and Wallowa Counties. In order of tonnages, producers reported output used for cement, lime, sugar, paper, calcium carbide, agricultural, and metallurgical (flux) purposes.

TABLE 5.—Stone sold or used by producers, by uses

	1957		1958	
	Thousand short tons	Value (thousand)	Thousand short tons	Value (thousand)
Building (dimension stone)	(1)	(1)	4	$113
Concrete, roadstone, and screening	6,252	$7,518	11,721	12,241
Riprap	[2] 3,060	[2] 2,356	1,921	1,323
Railroad ballast	(1)	(1)	(1)	(1)
Other [3]	1,271	1,872	1,359	1,806
Total [4]	[2] 10,583	[2] 11,745	15,004	15,483

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Revised figure.
[3] Used at sugar refineries, in manufacturing paper and cement, in metallurgical and chemical plants, and for other unspecified purposes.
[4] Owing to rounding, the individual items may not add to total shown.

Production of industrial silica (quartzite) continued at the Bristol quarry, Rogue River, Jackson County. The output was consumed for manufacturing ferrosilicon, abrasives, and refractories, and for other industrial needs. G. D. and Roy Rannells began developing silica (quartz) deposits at Quartz Mountain northeast of Tiller, Douglas County. Silica for test purposes was shipped to the nickel smelter at Riddle.

A report, listing the principal silica deposits and pertinent data about various deposits in Idaho, Montana, Oregon, Washington, and British Columbia, was published.[2]

[2] Sterrett, C. K., Industrial Silica for Pacific Northwest Industries: Raw Materials Survey, Inc., Resource Rept. 1, 1958, 29 pp.

Volcanic tuff, basalt, rhyolite, and granite for building and decorative stone were quarried in Multnomah (basalt), Baker (granite), Jefferson (rhyolite), and Marion and Wasco Counties (volcanic tuff). Total output increased 12 percent.

Talc and Soapstone.—Soapstone produced at mines in Skagit County, Wash., was ground at two plants in Portland, Multnomah County. Output of the ground product, used as a carrier in insecticides, declined sharply.

Vermiculite (Exfoliated).—Despite production at a new plant, output of exfoliated vermiculite dropped 21 percent compared with 1957. The Portland plants of Vermiculite Northwest, Inc., and Supreme Perlite Co. obtained crude material from mines in Montana and the Union of South Africa. The expanded product was sold for insulation, aggregate (plaster and concrete), soil conditioning, and various industrial uses.

METALS

Aluminum.—An apparent contradiction in the aluminum-reduction industry was presented when a long-established producer of aluminum metal, Reynolds Metals Co., was forced by a declining market to shut down one potline at its Troutdale plant for about 6 months while the new Harvey Aluminum Co. 108-million-pound-annual-capacity plant began producing aluminum at The Dalles early in August. This temporary situation ceased when aluminum markets improved and output from all four potlines at Troutdale was resumed. The competitive position of Pacific Northwest plants with respect to those in the East, particularly in the Ohio River Valley, remained a cause for local concern. The increasing costs of transporting raw materials to the Northwest and aluminum pigs, ingots, and semifabricated products to predominantly eastern markets, coupled with development of more efficient coal-fired, steam-electric generation facilities in the East had been offsetting steadily the advantage of low-cost hydropower in the Northwest. In July the railroads reduced rates on inbound raw material and outbound product shipments, partly compensating the poorer competitive position of the Northwest. Aluminum-industry officials also attempted to increase the percentage of firm electric power available by contracts with private power companies.

Chromium.—Federal Government purchase of chromite ores and concentrates under a stockpiling program begun in August 1951, was discontinued in May 1958, when the authorized goal of 200,000 long tons was reached. Output from 1951 through 1958 came mostly from California and Oregon, and smaller quantities from Alaska and Washington. Oregon producers delivered 4,133 short tons to the Grants Pass depot in 1958. Josephine County led with more than half the total; Grant County ranked second; Curry, Douglas, and Jackson Counties shipped smaller quantities. From 1951 through 1958, producers shipped 46,456 tons (valued at $3,887,000) of material newly mined in Oregon. In addition in 1955–56, 45,710 tons was recovered under Government contract from low-grade concentrates stockpiled during World War II; this material, which originally was mined from black sand deposits on the Oregon coast in Coos County, was shipped to a plant at Mead, Wash., for conversion to ferrochromium.

TABLE 6.—Shipments of chromium ore and concentrate

County	1957	1958			
	Value	Number of operations	Gross weight, short tons		
			45 percent or more Cr_2O_3	Less than 45 percent Cr_2O_3	Total
Coos	$3,060				
Curry, Douglas, and Jackson [1]	62,844	5	169	14	183
Grant	140,678	4	1,467	238	1,705
Josephine	468,049	16	1,708	537	2,245
Total	674,631	25	3,344	789	4,133

[1] Counties combined to avoid disclosing individual company confidential data.

Termination of the Government program and the availability of comparatively low-cost, high-grade foreign ores to industry left the producers without a market, and Oregon mines ceased producing. Early in the year in an effort to avoid the mine closures, two Oregon State agencies authorized a study of the feasibility of a western plant for processing domestic ores into ferrochromium. The California-Oregon Chrome Producers Association, a cooperative organization of producers, was formed in October for the same purpose.

Copper.—Output of copper ore remained low; the entire quantity of recoverable metal produced (10 tons) came from two mines in Grant County, mostly from the Standard mine.

Ferroalloys.—The Hanna Nickel Smelting Co. at Riddle produced 23,793 short tons of ferronickel containing 44.5 percent nickel. Output had begun early in June 1954 under a Government contract extending through mid-1962. Ore was from the nearby affiliated Hanna Mining Co. mines.

Union Carbide Metals Co. reported that production at its ferroalloy and calcium carbide plant at Portland was about 36 percent of capacity. Declining demand for these products reduced the output.

Gold.—The quantity of gold recovered was about 58 percent less than in 1957, principally because of decreased output at the Buffalo mine (Boaz Mining Co.) in Grant County. This mine supplied much of the small total State production. An adit was being driven at the property to intersect ore veins at a depth of about 230 feet below the lowest level of existing workings.

Most placer gold mined in 1958 was from Josephine County.

Lead.—Ore from the Buffalo lode-gold mine in Grant County contained a small quantity of recoverable lead.

Mercury.—Quicksilver production dropped 43 percent to 2,276 flasks from the 14-year high of 3,993 flasks in 1957. The Bretz mine (Arentz Mining Venture) in Malheur County, the leading source, supplied over half the total. Ore from the Bretz open pit was concentrated by flotation, and the resulting concentrate was passed through a 54-inch, 6-hearth Pacific furnace. This mine was described in an article.[3]

[3] Engineering and Mining Journal, Bretz Mine Gets Large Scale New Reactivation: Vol. 159, No. 3, March 1958, pp. 144–148.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousand)	Troy ounces	Value (thousand)
1949–53 (average)	19	30	2,823	9,842	$344	9,655	$9
1954	20	26	2,916	6,520	228	14,335	13
1955	19	21	3,835	1,708	60	8,815	8
1956	15	15	1,991	2,738	96	13,542	12
1957	25	17	2,594	3,381	118	15,924	14
1958	17	33	1,947	1,423	50	2,728	2
1852–1958			[3]	5,790,000	130,617	5,373,000	4,928

Year	Copper		Lead		Zinc		Total value (thousand)
	Short tons	Value (thousand)	Short tons	Value (thousand)	Short tons	Value (thousand)	
1949–53 (average)	12	$5	7	$2	6	$2	$362
1954	5	3	5	1			245
1955	4	3	3	1			72
1956	7	6	5	2			116
1957	23	14	5	1			148
1958	10	5	1	[4]			58
1852–1958	12,468	4,705	823	99	173	23	140,372

[1] Includes recoverable metal content of gravel washed (placer operations), old tailings re-treated, ore milled, and ore shipped to smelters during calendar year indicated. Owing to rounding, individual items may not add to total shown.
[2] Does not include gravel washed.
[3] Figure not available.
[4] Less than $500.

TABLE 8.—Gold produced at placer mines

	Mechanical and hydraulic mines			Small-scale hand mines [1]			Total		
	Number	Material treated (thousand cubic yards)	Gold (troy ounces)	Number	Material treated (thousand cubic yards)	Gold (troy ounces)	Number	Material treated (thousand cubic yards)	Gold (troy ounces)
1949–53 (average)	18	2,981	8,378	10	12	189	28	2,993	8,567
1954	20	1,489	4,910	6	12	82	26	1,501	4,992
1955	8	24	125	13	9	78	21	33	203
1956	10	52	314	5	3	40	15	55	354
1957	10	34	126	8	7	53	18	41	179
1958	[2] 24	258	489	9	6	56	33	264	545

[1] Includes surface and underground (drift) placers.
[2] Includes 22 hydraulic mines, 1 nonfloating washing plant, and 1 suction dredge; Bureau of Mines not at liberty to publish separately.

The Bonanza Oil & Mine Corp. Bonanza mine in Douglas County and the Cordero Mining Co. Horse Heaven mine in Jefferson County produced considerably less than in 1957. Work at the latter mine was terminated in April because of declining mercury prices. An article on the geology and history of the Horse Heaven mine was published.[4]

The Platner mine in Crook County and the Glass Butte and Four Square properties in Lake County produced small quantities.

[4] Gilbert, J. Eldon, Horse Heaven Mine, Jefferson County, Oreg.: Oregon Dept. of Geol. and Min. Ind., The Ore-Bin, vol. 20, No. 3, March 1958, pp. 25–29.

TABLE 9.—Mine production of gold, silver, copper, and lead in 1958, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)
Lode ore:						
Dry gold	16	1,097	763	2,587	500	2,000
Copper	1	850	115	76	19,500	
Total lode	17	1,947	878	2,663	20,000	2,000
Gravel (placer operations)	33	(1)	545	65		
Grand total	50	1,947	1,423	2,728	20,000	2,000

[1] 264,022 cubic yards of placer gravel washed.

Nickel.—Hanna Mining Co. mined ore averaging 1.5 percent nickel from an open pit near Riddle, Douglas County, at a slightly higher rate than in 1957; output increased 4 percent to 846,489 short dry tons. The company reported that its open pit was in full production and that additional benches were opened.

Silver.—The Boaz Mining Co. Buffalo gold mine supplied most of the silver recovered in the State; its output of metal dropped sharply, furnishing the decline from a total of 15,924 ounces in 1957 to 2,728 ounces in 1958. Most other gold-producing mines, both lode and placer, in the State also contributed small quantities of silver as a byproduct.

Uranium.—After the Atomic Energy Commission (AEC) approved construction of a $2.6 million, 210-ton-per-day uranium-ore-processing plant at Lakeview, Lake County, in October 1957, Lakeview Mining Co. began building the facility in the spring and by the end of November it was ready for operation. Most ore requirements of the plant were to be met by the nearby company-leased White King and Lucky Lass mines. By AEC regulation, however, the plant capacity was partly available on a custom basis to independent producers of ore that was amenable to the process used. The output of uranium oxide concentrate was to be delivered to AEC under a 5-year contract.

Other Metals.—Several "reactive" metals were processed by Oregon Metallurgical Corp., Wah Chang Corp., and the Federal Bureau of Mines at facilities in Albany, Linn County. Oregon Metallurgical Corp. purchased sponge metal for zirconium and titanium ingot from other companies and announced plans for a $2.5 million expansion. Wah Chang Corp. ceased zirconium production at AEC facilities at the Bureau of Mines station in June when the 2-year Government contract expired. It produced hafnium-free zirconium sponge at its new plant, which was completed in 1957. Work was partly suspended at the plant because the anticipated AEC contract for zirconium production was not received; the separation and reduction of columbium-tantalum begun on a trial basis in 1957 was emphasized. Using columbite ore chiefly from Malaya, the company supplied columbium and tantalum powder, sinter bars, arc-melted and electron-beam-melted ingots, and columbium foil to the AEC and private industry.

The Bureau of Mines continued to produce hafnium sponge by processing byproduct material from the Wah Chang zirconium-purification plant until late in the year when the Bureau contract with

AEC was terminated in accordance with the intent of both agencies to turn such work over to private industry at the earliest possible date. The Bureau continued research on separation, reduction, fabrication, and properties of these metals at Albany.

FUELS

Carbon Dioxide.—Recovery of natural carbon dioxide from mineral waters at the Gas-Ice Corp. plant at Ashland, Jackson County, dropped sharply. The plant processed carbon dioxide to manufacture dry ice.

Petroleum.—The Oregon State Department of Geology and Mineral Industries issued four new drilling permits—one each in Crook, Douglas, Linn, and Marion Counties—compared with seven permits issued in 1957. In addition, a permit to deepen a well previously drilled in Polk County was issued. A total of 18,060 feet was drilled in 1958. There were no significant discoveries during the year, and five wells (totaling 14,556 feet) officially were abandoned.[5]

REVIEW BY COUNTIES

Mineral production was reported from all 36 counties. With certain important exceptions, output was principally from nonmetal mineral deposits. Only 12 of the 36 counties produced metal ores, and only 5 of these contributed a significant quantity. Reviews of activity in the most significant mineral producing counties follows:

Baker.—Increased output of cement, limestone, lime, and clays was reported. Cement production at the lime plant of Oregon Portland Cement Co. continued as the principal mineral-industry activity. Output at the two-kiln facility increased sharply; limestone was obtained from the nearby company-operated Limerock quarry.

Chemical Lime Co. continued output of quicklime at a plant north of Baker; the limestone was supplied from its Marble Creek quarry northwest of Baker.

Limestone for use at cement plants, sugar refineries, paper mills, and metallurgical plants was quarried and crushed by National Industrial Products Corp. near Durkee. Northwestern Granite Co. produced dimension granite from a quarry near Haines at about the 1957 rate.

Benton.—Sand and gravel, stone, and clays were produced, all in decreased quantity, compared with 1957. Clay for manufacturing heavy clay products, principally building brick and draintile, was obtained near Corvallis and Monroe; output was 20 percent less than in 1957.

Clackamas.—The county led in value of mineral production in the State. The principal mineral-industry activity was cement production at the Oregon Portland Cement Co. Oswego plant. Moderately larger quantities of portland cement were produced and shipped from this facility than in 1957. Output of sand and gravel and crushed stone increased compared with the preceding year. Increased use of roadstone at State highway projects and expanded requirements for gravel by the U.S. Forest Service were the principal causes for the rise in output of these commodities. Clay, used in manufacturing building brick and draintile, was produced in two places.

[5] Oregon State Department of Geology and Mineral Industries, The Ore.-Bin: Vol. 21, No. 1, January 1959, pp. 7–9.

TABLE 10.—Value of mineral production in Oregon, by counties

County	1957	1958	Minerals produced in 1958 in order of value
	Value (thousand)		
Baker	(1)	(1)	Cement, stone, lime, sand and gravel, clays, gold, silver.
Benton	$311	$181	Sand and gravel, stone, clays.
Clackamas	7,471	8,732	Cement, sand and gravel, stone, clays.
Clatsop	140	115	Stone, sand and gravel.
Columbia	(1)	194	Do.
Coos	213	564	Do.
Crook	324	272	Stone, sand and gravel, mercury.
Curry	282	106	Sand and gravel, chromite, stone, gold.
Deschutes	1,089	1,100	Diatomite, pumice, sand and gravel, stone.
Douglas	7,395	6,830	Nickel, sand and gravel, stone, mercury, chromite, gold.
Gilliam	17	299	Stone, sand and gravel.
Grant	319	413	Stone, chromite, sand and gravel, gold, copper, silver, lead.
Harney	(1)	75	Stone, pumice, sand and gravel.
Hood River	116	64	Sand and gravel, stone.
Jackson	3,165	3,129	Cement, sand and gravel, stone, clays, gold, carbon dioxide, chromite, silver.
Jefferson	454	166	Stone, mercury, sand and gravel.
Josephine	931	826	Stone, chromite, sand and gravel, gold, silver.
Klamath	225	515	Stone, sand and gravel, clays.
Lake	341	194	Stone, sand and gravel, mercury.
Lane	2,928	3,663	Stone, sand and gravel, gold, silver.
Lincoln	873	612	Stone, sand and gravel.
Linn	716	514	Sand and gravel, stone, gold.
Malheur	909	845	Sand and gravel, mercury, stone, gold, clays, silver.
Marion	1,035	1,058	Sand and gravel, stone, clays.
Morrow	182	247	Stone, sand and gravel.
Multnomah	3,675	2,657	Sand and gravel, stone, clays.
Polk	811	629	Stone, sand and gravel, clays.
Sherman	234	159	Stone.
Tillamook	302	324	Sand and gravel, stone, clays.
Umatilla	(1)	1,013	Stone, sand and gravel.
Union	257	448	Stone, sand and gravel, clays.
Wallowa	121	243	Stone, sand and gravel.
Wasco	1,162	509	Do.
Washington	483	985	Stone, clays, sand and gravel.
Wheeler	92	206	Stone, sand and gravel.
Yamhill	332	263	Stone, sand and gravel, clays.
Undistributed [2]	6,843	8,110	
Total [3]	42,820	45,053	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes value of mineral production that cannot be assigned to specific counties and values indicated by footnote 1.
[3] Total adjusted to eliminate duplicating value of clays and stone—1957 total revised.

Columbia.—Output of sand and gravel was sharply reduced compared with 1957. A quantity of basalt was produced for roadstone and riprap. C. K. Williams & Co., Western Division, (crude iron oxide pigment) near Scappoose was inactive. Its 1957 production was shipped to its Emeryville, Calif., paint-manufacturing plant.

Deschutes.—In Terrebonne, Great Lakes Carbon Corp., Mining & Mineral Products Division, mined and processed diatomite, which continued as the principal commodity (in value) produced. The county was also the principal source in the State of pumice and volcanic cinder. Output of pumice and cinder rose 15 percent over 1957.

Douglas.—Hanna Mining Co. and Hanna Nickel Smelting Co. operated at about capacity. Nickel ore was moved from an open pit on Nickel Mountain to electric smelting furnaces in a plant at the base of the mountain. Ferronickel produced at the smelter was delivered under contract to the national stockpile.

Ore treated at the Bonanza mercury mine near Sutherlin totaled 10,204 tons; 795 flasks of mercury was recovered in a 60-ton Gould rotary furnace and 12- by 20- by 9-foot "D" retort.

G. D. and Roy Rannells shipped silica (quartz) from a newly opened quarry on Quartz Mountain northeast of Tiller to the Hanna nickel smelter at Riddle for test purposes.

Grant.—William Gardner at the Haggard-New Mine continued to supply most of the chromite mined in Grant County. Shipments from the mine to the Grants Pass stockpile depot before the stockpile program closed totaled over 1,300 short tons of ore and concentrate. The Buffalo and Standard mines were the source of all of the copper and lead and most of the gold and silver produced in the State during the year.

Harney.—Harney Concrete Tile Co. continued production of crude and prepared pumice near Burns. Crude pumice was used for road surfacing; the prepared product was consumed as concrete aggregate. Output declined compared with 1957.

Jackson.—The Gold Hill facility of Ideal Cement Co. continued as the principal Jackson County mineral-industry. Output increased moderately. Limestone for the plant was quarried in Josephine County, and shale (clay) was supplied from the company-operated Gold Hill quarry. The Bristol Silica Co., Rogue River, quarried quartzite, which was crushed and sold for industrial silica purposes; it also quarried and crushed granite for poultry grit. The Gas-Ice Corp. recovered natural carbon dioxide from ground water for processing to dry ice at Ashland. Production of sand and gravel and stone declined 7 percent and 18 percent, respectively.

Jefferson.—Cordero Mining Co. produced 201 flasks of mercury from 2,607 tons of ore at the Horse Heaven mine near Ashwood. Declining mercury prices forced the mine to shut down in April; the property, idle since 1944, was reactivated in 1955.

Josephine.—Output of chromite ore and concentrate from about 20 mines ceased because the Government chromium-ore stockpiling program terminated. Josephine County supplied over half of the chromite produced in Oregon in 1958. The Oregon Chrome mine, largest in the State, was closed in March; this mine also had produced Metallurgical-grade chromite during World War I and World War II.

Increased use of crushed roadstone (primarily basalt) and decreased requirements of sand and gravel for State highway department and U.S. Forest Service roads resulted in more than three fold increased production of crushed stone over 1957, and a sharp drop in sand and gravel output. The Ideal Cement Co. Marble Mountain quarry yielded a decreased quantity of limestone for use at the Gold Hill cement plant in Jackson County.

Lane.—Production of 3.9 million tons of stone and 1.2 million tons of sand and gravel ranked the county first and fourth in the State, respectively, for production of these commodities. Gravel used for construction and road purposes at U.S. Army Corps of Engineers works dropped sharply and resulted in a 29-percent decline in output. Stone quarried for use at dams was more than double the 1957 rate.

Linn.—Several primary and intermediate raw materials were processed into ingots of titanium, zirconium, hafnium, columbium, and tantalum at facilities of Oregon Metallurgical Corp., Wah Chang Corp., and the Federal Bureau of Mines at Albany. Fabrication and casting of these metals also was done.

Malheur.—Arentz Mining Venture mined 19,087 tons of mercury ore and treated 38,207 tons of material in a flotation plant at the Bretz open-pit mine near McDermitt; the concentrate produced yielded 1,258 flasks of mercury after furnacing.

Marion.—Output of sand and gravel was 27 percent greater in 1958 owing to increased production for the State highway department. Volcanic tuff, used as building and decorative dimension stone, was produced at a quarry near Sublimity; a fourfold increase in output was reported. Production of clay increased 25 percent; output was used to manufacture draintile and building brick at a plant near Donald.

Multnomah.—Calcium carbide, ferrosilicon, ferromanganese, caustic soda, chlorine, and steel were among the products of mineral-processing facilities in Portland. Large quantities of base-metal ores and concentrates from foreign mines passed through the port of Portland to domestic smelters. Port facilities were completed for unloading aluminum oxide from Japan for transshipment by rail to the new Harvey Aluminum Co. reduction plant at The Dalles. At Troutdale, Reynolds Metals Co. reduced the output of its 91,500-ton-annual-capacity plant about 25 percent from May to October because of lower demand.

Sand and gravel, stone, and clays were produced; in addition perlite, soapstone, and vermiculite mined out-of-State were processed in the county. Output of 2 million tons of sand and gravel was the largest reported from any county in the State, but production was 29 percent lower than in 1957, mostly because of curtailed output by commercial producers. Clay output from the Columbia Brick Works Gresham pit and the Sylvan Brick Co. Sylvan pit declined 36 percent from 1957. The latter firm began dismantling its plant and facilities during the latter part of 1958. Supreme Perlite Co. expanded crude perlite from mines in Nevada. The Portland plants of Stauffer Chemical Co. and Miller Products Co. ground soapstone mined in Skagit County, Wash. Crude vermiculite was expanded at two plants. Vermiculite Northwest, Inc., expanded crude material produced in Montana. Supreme Perlite Co. began exfoliating at a plant in Portland; it imported crude vermiculite from the Union of South Africa.

Polk.—Oregon Portland Cement Co. quarried and crushed limestone at Dallas for use at its Oswego cement plant, producing substantially the same quantity of limestone as in 1957. Limestone for agricultural use also was quarried near Dallas. The output of clay was used principally in manufacturing draintile and was slightly less than in 1957.

Washington.—The county remained the principal clay-producing area in the State, owing to large quantities used for processing to expanded lightweight aggregate. Quarries near Vernonia and Banks produced shale (clay) for lightweight aggregate, and a pit near Scholls produced clay used for manufacturing draintile.

Wasco.—In August the first output of aluminum metal from the new Harvey Aluminum Co. two potline, 240-pot electrolytic reduction plant at The Dalles was the culmination of work begun in February 1956. Low-cost electricity from hydroelectric plants in the Pacific Northwest and aluminum oxide from Japan were the principal raw materials to be supplied to the facility.

The Mineral Industry of Pennsylvania

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior and the Pennsylvania Bureau of Topographic and Geologic Survey.

By Robert D. Thomson,[1] Mary E. Otte,[2] and Robert E. Ela[3]

PENNSYLVANIA'S mineral output in 1958 was characterized by decreased and limited markets due to a widespread drop in State as well as national economy. The index of general business in Pennsylvania was 166 (1947–49=100) 7 points lower than 1957, while the index of industrial activity dropped to the lowest point since 1945, being 9 points under the peak years 1956 and 1957. Two major factors that affected 1958 mineral production, in addition to a business recession, were extremely adverse weather conditions during the first quarter, which created a slowdown in construction work, and the im-

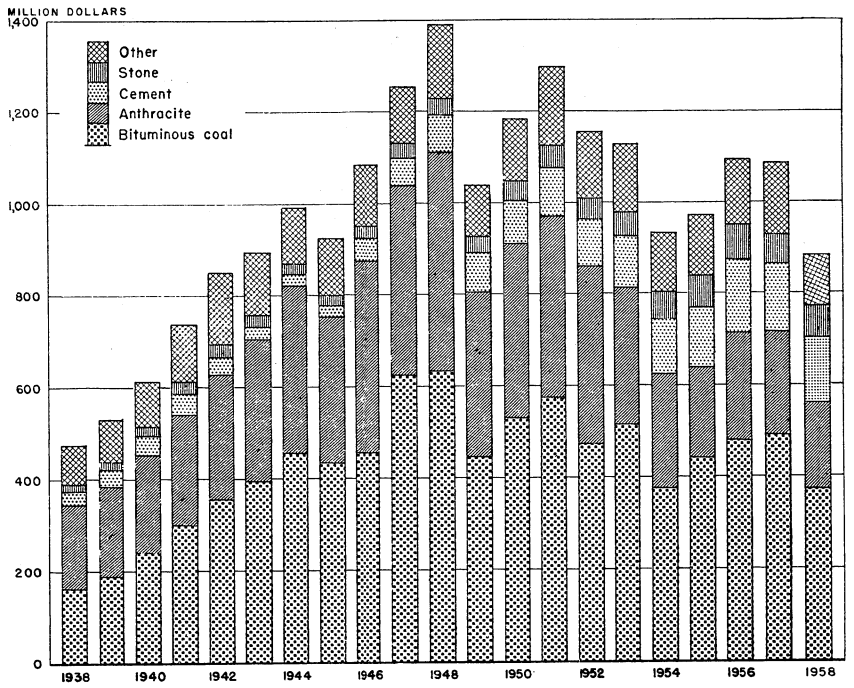

FIGURE 1.—Value of bituminous coal, anthracite, cement, and stone and total value of mineral production in Pennsylvania, 1938–58.

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pact of continuing inflation. Reflecting the adverse 1958 economy, all major mineral industries declined in value of output. The production of bituminous coal, clays, iron ore, and stone was affected by a drop in steel production; cement, clays, sand and gravel, and stone by a decline in construction. Delays in the Federal highway programs were reflected in lower outputs of nonmetals.

Significant developments in mining were the shipments of metallic ore from two new mines. One mine in Lehigh County revived zinc production, last reported in 1876, and the other (Berks County) became the second active iron-ore mine in the State.

Employment and Injuries.—Injury experience in the selected nonmetallic mineral industries shown in table 2 was much better than in 1957. No fatalities were reported, compared with 8 for 1957, and nonfatal injuries decreased from 498 to 481. The granite industry had the lowest frequency rate, reporting no injuries for a total of 20,048 man-hours. The cement industry was the second-ranking industry in injury rates—1.96 per million man-hours.

The bituminous coal industry had a better safety record than in 1957, having only 32 fatalities, 22 less than in 1957. The number of fatalities per million short tons was 0.47 compared with 0.63 in 1957.

TABLE 1.—Mineral production in Pennsylvania [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland ---- 376-pound barrels	42,519,334	$140,100	40,147,578	$135,118
Masonry ---- do	2,161,109	8,030	1,967,517	7,281
Clays	4,073,666	22,012	[2] 3,317,600	[2] 17,051
Coal:				
Anthracite	25,338,321	227,754	21,171,142	187,898
Bituminous	85,365,254	492,539	67,770,862	373,812
Cobalt (content of ore) ---- pounds	599,122	[3]	564,382	[3]
Gem stones	[4]	[5]	[4]	2
Iron oxide pigments (crude)	998	9	1,154	10
Lime	1,298,401	18,406	1,003,058	12,457
Natural gas ---- million cubic feet	101,801	31,660	95,869	27,131
Natural-gas liquids:				
Natural gasoline ---- thousand gallons	3,106	192	1,608	107
LP-gases ---- do	1,211	106	1,363	123
Peat	26,086	236	23,623	203
Petroleum (crude) ---- thousand 42-gallon barrels	8,179	38,687	[6] 6,678	[6] 27,380
Sand and gravel	12,405,654	19,570	11,825,024	19,180
Slate	139,283	4,005	(7)	(7)
Stone	43,257,558	73,090	40,049,162	69,694
Zinc [8]	----	----	10,812	2,229
Value of items that cannot be disclosed: Copper, gold, iron ore, mica, pyrites, sericite schist, silver, soapstone, tripoli, and values indicated by footnote [3]	----	[9] 16,604	----	15,950
Total Pennsylvania [10]	----	[9] 1,077,157	----	881,181

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producer).
[2] Excludes kaolin; value included with "Items that cannot be disclosed."
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Weight not recorded.
[5] Less than $500.
[6] Preliminary figure.
[7] Included with stone.
[8] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.
[9] Revised figure.
[10] Total adjusted to eliminate duplicating value of clays and stone in manufacturing lime and cement.

Of the underground fatalities, 16 were from falls of roof, 7 from haulage, 2 from explosives and machinery, and 1 from electricity. Fatalities for surface and strip operations were two from machinery and two from miscellaneous causes. Nonfatal injuries (1,535) also decreased by 525. The number of injuries per million man-hours was 0.53 for fatal and 25.47 for nonfatal injuries, compared with 0.66 and 25.16 for 1957, respectively. The number of injuries per million short tons was 0.47 for fatal injuries and 22.57 for nonfatal injuries, compared with 1957 rates of 0.63 and 23.87, respectively.

The fatality experience for the anthracite industry was somewhat better than in 1957, with deaths reported 37 percent lower in number and occurring 17 percent less frequently. Twenty-six of the 32 fatalities reported by the anthracite industry occurred underground, 3 at surface operations, and 3 at stripping operations. In 1958, 19 of the 26 underground fatalities resulted from falls of roof, face, or rib; and in 1957, 30 of the 49 underground fatalities resulted from the same cause: The number of injuries per million man-hours of exposure was 59.88, compared with a rate of 61.93 in 1957.

The Germantown Colliery, Raven Run Coal Co., Centralia, Pa., operating in Columbia, Schuylkill, and Northumberland Counties, was the winner of the National Safety Competition for anthracite mines.

Consumption, Trade, and Markets.—Most of the mineral commodities produced in Pennsylvania were consumed within the State. Bituminous coal (the State's foremost mineral) was consumed locally for coke production and other industrial uses, for residential fuel, and for electric power generation. Most of the anthracite was shipped out of the producing region. The other mineral fuels produced in Pennsylvania found ready markets within the State.

Although Pennsylvania ranks high as a coke producer, some coking coal was shipped into the State for consumption by the steel industry. The steel industry relied on shipments of iron ore from other States and foreign deposits and depended on imports for all of its ferroalloys.

Basically the nonmetallic minerals in Pennsylvania were consumed within the State. There were a few exceptions to this trend. Cement

TABLE 2.—Employment and injuries for selected mineral industries in 1958

Commodity	Average number of men working	Total man-hours	Total number of lost-time injuries		Number of injuries per million man-hours
			Fatal	Nonfatal	
Anthracite	22,400	33,480,000	32	2,124	59.88
Basalt	541	1,189,565	----------	17	14.29
Bituminous coal	40,200	60,270,000	32	1,535	25.47
Cement [1]	4,266	10,738,796	----------	21	1.96
Clays	2,764	5,002,151	----------	168	33.59
Granite	11	20,048	----------	----------	0
Lime [1]	1,389	3,058,212	----------	32	10.46
Limestone [2]	2,688	4,943,875	----------	130	26.95
Miscellaneous stone	35	57,434	----------	4	69.65
Sand and gravel	1,484	2,759,673	----------	40	14.49
Sandstone	495	738,485	----------	30	40.62
Slate	626	1,326,006	----------	39	29.41

[1] Includes quarries or pits producing raw material used in manufacturing cement or lime for captive operations.
[2] Excludes quarries or pits producing limestone used exclusively in manufacturing cement or lime.

was shipped to 38 States and the District of Columbia, the major portion being shipped to the Northeastern States. Most of the lime was consumed in the State, but large quantities were shipped to bordering States. Clay production in Pennsylvania was primarily captive tonnage for use in manufacturing refractories and heavy clay products. These products were consumed in the State as well as bordering States.

Other metallic materials and ores were shipped into the State for processing into semifinished or fully fabricated products, such as aluminum, beryllium, lead, and molybdenum.

Trends and Developments.—Important among the new plants constructed or in process of construction was completion of a fabricating plant by Beryllium Corporation at Ashmore. This was reported to be the first integrated, privately owned plant in the United States for fabricating beryllium metal. Pittsburgh Coke & Chemical Co., Neville Island, Pittsburgh, completed rebuilding and adapting of an existing blast furnace for producing ferromanganese. The total cost of the changeover was about $2.5 million, giving a blast furnace with a capacity of 400 tons a day of high-carbon ferromanganese, 600 tons a day of spiegeleisen, or 900 tons a day of pig iron. Jones & Laughlin Steel Corp. announced construction of a new iron-ore sintering plant and ore-screening facilities at its Aliquippa works. Universal Cyclops Steel Corp. began constructing a $4 million plant at Bridgeville for manufacturing high-temperature metals to be used in jet missiles and rockets. The New Jersey Zinc Co. added new equipment to its smelter at Palmerton, achieving greater efficiency in the firm's system of producing zinc oxide.

The new American Cyanamid Co. ammonium nitrate manufacturing plant in New Castle began continuous production in September, marking completion of the company industrial rebuilding expansion program, begun in 1957.

The Glen Alden Coal Co. put into operation a new $1 million steel-frame, aluminum-sheeted breaker at Audenried. The plant was designed to handle 250,000 tons annually of all sizes of coal.

Keystone Division of Dravo Corp. began constructing a new sand and gravel dredge. The dredge, to be completed by 1960 and costing $2 million, will have a capacity of 500 tons of material an hour and will replace its 30-year-old predecessor.

The cement and lime industries were characterized by plant improvements and modernization of older plants. Certain plants had extensive programs for dust control. The refractories industry was active in plant improvements and in the development of new products, particularly refractories for high-temperature ranges. The structural clay industry developed new outlets for its products through application of research.

Legislation and Government Program.—Eighteen projects under the joint Federal-State program for controlling mine water in the anthracite region, with an aggregate cost (contracted or estimated) of nearly $6.75 million, were in an active status or had been completed by the close of 1958. During 1958 five projects, totaling nearly $2.5 million, were approved for Federal participation.

Nine of the active or completed projects required large-capacity vertical, turbine-type pumps to control the level of water pools in abandoned underground workings, as well as to prevent the flooding

of anthracite reserves and protect adjacent mines. The 25 pumps required for these projects had a total capacity of 119,000 gallons of water a minute. The remaining nine projects dealt principally with improving surface drainage, such as by backfilling old strip pits and constructing ditches and flumes designed to prevent water from seeping into underlying mine workings. Of the seven projects completed in 1957–58, one of the installations comprised two pumps for the total capacity of 10,000 gallons a minute, while the other six were surface-drainage improvements. These improvements are estimated to prevent more than 1 billion gallons of water from entering the anthracite mines annually.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Anthracite.—The downward trend in anthracite output was accelerated in 1958. The drop resulted from a combination of adverse factors, including a 2-million-ton drop in exports, lower domestic business activity, and continued losses to competitive fuels. All major United States markets showed losses; however, total apparent consumption fell only 9 percent as the effect of competitive losses to other fuels was partly minimized by increased demand for space-heating fuels because of unusually cold weather in January through March.

Production was 21.2 million short tons—a 16-percent decline from 1957—and was valued at $187.9 million, an 18-percent decrease. The average price a ton at preparation plants fell from $8.99 a ton in 1957 to $8.88 in 1958. Production from underground mines represented 51 percent of the total anthracite production (1 percent greater than in 1957), and output from strip pits represented 32 percent—approximately 2 percent greater than in 1957. The remaining production came from culm banks and river dredging.

More of the coal produced underground was loaded by hand than in 1957. Fifty percent of the underground production was mechanically loaded, compared with 53 percent in 1957. In all, 290 scraper loaders (5 less than in 1957), 51 mobile loaders (15 less than 1957), and 1,234 conveyors and pit-car loaders (203 less than in 1957) were used to load coal mechanically underground.

Production from strip mines totaled 6.9 million tons, 179 power shovels and 245 draglines being used in stripping Pennsylvania anthracite and in the recovery of culm banks. Of the total, 31 were driven by gasoline, 95 by electric, and 298 by diesel.

Production from culm banks totaled 2.9 million tons and by dredge 692,000 tons. Of the total production by dredges, 94 percent came from the Susquehanna River and 4 percent from the Lehigh River. Value a ton for dredged anthracite was $1.92—18 cents more than in 1957. Production from culm banks came from the Lehigh, Schuylkill, and Wyoming regions and Sullivan County.

Apparent consumption continued to decrease, totaling 19 million tons, a 9-percent decrease compared with 1957. Slightly over 16 million tons of anthracite was shipped out of the producing areas (23 percent less than was shipped out in 1957), whereas 4.8 million tons was sold to local trade (an increase of 19 percent), and 195,000

tons was used as colliery fuel (a decline of 30 percent). According to the Pennsylvania Department of Mines, 11 million tons of anthracite was shipped by rail, 76 percent of which went to the New England States, New York, New Jersey, and Pennsylvania. Truck shipments totaling 9 million tons went primarily to the eastern coast; the majority was destined to Pennsylvania consumers. Average values for Pennsylvania anthracite were $9.02 a ton for that shipped outside the producing regions, $8.51 for local sales, and $6.33 for colliery fuel.

The average number of days worked was 13 less than in 1957, totaling 183. The average number of men working totaled 26,540, with an output a day of 4.36 net tons and per man per year of 798 tons. These output rates compare with 4.18 and 819 for 1957.

Schuylkill County was the leading county in the production of anthracite in Pennsylvania, totaling 7.9 million tons. Luzerne County was the second-ranking county, with a production of 6.8 million tons. Other counties producing anthracite (in order of decreasing tonnage) were Northumberland, Lackawanna, Columbia, Lancaster, Carbon, Dauphin, Snyder, Wayne, Sullivan, Lebanan, and Susquehanna. Producers in Schuylkill and Luzerne Counties supplied 70 percent of the total tonnage (66 percent in 1957) and 73 percent of the total value (68 percent in 1957).

Bituminous Coal.—Bituminous coal output was 21 percent (17.6 million tons) less than in 1957 and the lowest since 1898. Bituminous coal production remained the principal mineral industry in Pennsylvania, although the coal index of production dropped to 55 (1947–49=100) from 70 in 1957 and 72 in 1956. The unit value of output also decreased averaging $5.52 per ton—25 cents lower than in 1957.

In 1958, 1,412 mines producing 1,000 tons or more were active—187 less than in 1957. The number of active underground mines decreased from 893 to 809, strip mines from 663 to 565, and auger mines from 43 to 38.

Approximately 71 percent of the total bituminous output came from underground mines; this was 4 percent or 16 million tons less than was mined in 1957 by underground methods. Of the total underground output, 98 percent was cut by machine, including 46 percent mined by continuous miners; the remainder was cut by hand or shot from the solid—1958 showed an increase of 13 percent in the use of continuous miners underground. In all, 1,447 cutting machines and 303 continuous miners were used. Locomotives (2,343), animals (2,201), mother conveyors (1,925), shuttle cars (1,155), and rope hoists (701) were used for underground haulage. Pennsylvania underground production was characterized by highly mechanized operations, with 93 percent of the underground production mechanically loaded through the use of 1,382 machines. Mobile loaders were the primary moving device, loading into shuttle cars a total of 14,419,000 tons, into mining cars 3,312,000 tons, and onto conveyor belts 2,161,000 tons. Handheld and post-mounted drills as well as mobile drills were used underground; 18.7 million tons of coal was drilled, using 1,367 handheld or post-mounted drills, and 5.2 million tons of coal was drilled with 146 mobile drills. A total of 282 rotary and 545 percussion roof or rock drills was used. Bituminous coal produced from underground mines was shipped primarily by rail (87 percent) and truck (8 percent). Captive markets dominated,

only 46 percent of the total underground output being sold on the open market. The average value of underground output totaled $6.21, with an average value of $5.69 for coal sold on the open market.

Pennsylvania strip mining continued to decrease, dropping 7 percent to the lowest output since 1954. Most of the strip coal (62 percent) was shipped by rail for sale on the open market. A total of 1,919 trucks or trailer tractors was active, having an average capacity of 11 tons per unit. Truck shipment to consumers totaled 7.4 million tons, representing 38 percent of the strip-mine output. The average value a ton of strip-mine coal was $3.86, 24 cents lower than in 1957. Open-market coal was valued at $3.82 and captive coal at $4.92.

Bituminous coal was stripped and loaded, using electric, diesel-electric, diesel, and gasoline power shovels and draglines. Of the 968 power shovels in use, 903 had a capacity of less than 3 cubic yards, 60 of 3 to 5 cubic yards, 2 of 6 to 12 cubic yards, and 3 over 12 cubic yards. Draglines totaled 377—6 less than in 1957—of which 154 had a capacity of less than 3 cubic yards, 140 of 3 to 5 cubic yards, 77 of 6 to 12 cubic yards, and 6 over 12 cubic yards. A total of 24 carryall scrapers was used; 14 had a capacity of over 12 cubic yards, 5 of 6 to 12 cubic yards, 4 of less than 3 cubic yards, and 1 of 3 to 5 cubic yards. Also used were 833 bulldozers, 143 horizontal power drills, and 118 vertical power drills.

There were 38 auger mines, 5 less than in 1957. Over 60 percent of the auger-mine production was shipped by rail to the open market. Auger coal was sold at an average value of $3.12. A total of 38

TABLE 3.—Bituminous-coal production, by types of mining and counties, 1958

County	Underground		Strip		Auger	
	Number of mines	Short tons	Number of mines	Short tons	Number of mines	Short tons
Allegheny	32	4,555,141	25	423,625		
Armstrong	56	1,164,058	37	1,125,232	6	44,837
Beaver	3	25,336	13	197,325	1	6,161
Bedford	28	127,470	(1)	(1)		
Blair	3	18,619	(1)	(1)	1	4,399
Bradford			(1)	(1)		
Butler	31	258,722	38	1,607,569	(1)	(1)
Cambria	109	7,815,378	20	364,175	2	4,974
Cameron			(1)	(1)		
Centre	17	60,898	19	872,539	2	13,760
Clarion	16	78,779	29	2,664,479		
Clearfield	89	1,311,172	109	4,194,252	7	38,412
Clinton	4	14,892	7	599,143		
Elk	16	156,256	8	169,978	3	43,606
Fayette	35	2,563,959	30	295,564	1	3,942
Greene	22	9,733,221	3	13,504		
Huntingdon	7	15,637	4	29,665		
Indiana	84	4,756,431	30	944,850	5	31,849
Jefferson	39	468,222	30	901,745	3	26,821
Lawrence	(1)	(1)	24	1,043,989		
Lycoming	(1)	(1)	2	45,398		
McKean			3	47,432		
Mercer	3	45,119	8	582,428		
Somerset	115	1,612,551	59	1,185,085	3	16,248
Tioga	5	29,117	3	265,149		
Venango			14	621,285		
Washington	24	9,495,225	25	1,202,723	1	15,300
Westmoreland	66	3,459,225	17	138,893	(1)	(1)
Undistributed	5	24,420	8	179,817	3	14,861
Total	809	47,789,848	565	19,715,844	38	265,170

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

augers was used during the year, plus 2 bulldozers and 5 each of horizontal and vertical power drills.

Ninety-three preparation plants compared with 98 for 1957 were operated. These plants produced 38.2 million tons of clean coal, 92 percent of which came from underground mines and 8 percent from strip mines. Of the total production mechanically cleaned, 87 percent was wet-washed (29 percent by jigs and 71 percent by other wet methods), and 13 percent was cleaned by pneumatic methods. Pneumatic cleaning gave the better recovery, 90 percent of the raw coal being recovered compared with 76 for jigs and 78 for other than wet jigs or other wet methods.

At the mines having crushing facilities, 30.1 million tons was crushed, representing 65 percent of the tonnage produced at these mines. The total output of mines having treatment facilities equaled 22 million tons. Of this total, 6.1 million tons was treated—852,000 tons was treated with calcium chloride, 3.9 million with oil, 267,000 with both calcium chloride and oil, and 1 million with all other materials.

Coke and Coal Chemicals.—Pennsylvania ranked first in tonnage and value for both beehive and oven coke produced in the United States, despite a 34-percent decrease in production in 1958. Declines of 30 percent in production of oven coke and 78 percent for beehive coke were due primarily to a lower operating rate of blast furnaces and a large reduction in demand for foundry coke for automobile production. In addition, the steel industry made substantial improvement in fuel efficiencies at blast furnaces. Fourteen coke plants operating 4,168 slot-type ovens (99 more than were operated in 1957) carbonized 20.3 million short tons of coal to produce 14 million tons of oven coke, a 69-percent yield of coke from coal. A total of 581,000 tons of coal was carbonized in 7,316 beehive ovens (720 less than in 1957) to produce 355,000 tons of coke. The average value for oven coke at the ovens was $16.92 a ton, compared with $13.46 for beehive coke—a decrease of 19 cents and 96 cents, respectively, from 1957. Of the oven coke produced in Pennsylvania, 95 percent was used by producers, 99 percent of which was used in blast furnaces. Commercial shipments went to blast furnaces, foundries, and other industrial plants and for residential heating. Blast furnaces consumed 44 percent, other industries 29 percent, and foundries 20 percent of the total oven coke marketed. Of the total sales of beehive coke, 63 percent was used by blast furnaces, 33 percent by other industries, and 4 percent by foundries. A total of 787,000 tons of coke breeze was recovered at coke plants in Pennsylvania. Producers reported using 578,000 tons for steam raising, 64,000 for sintering iron ore, and 52,000 for other industrial uses. Sales of coke breeze from Pennsylvania plants totaled 76,000 net tons at an average value of $5.33.

Coal produced in Kentucky, West Virginia, Virginia, and Pennsylvania was used in oven-coke plants in Pennsylvania. The major portion (66 percent) came from mines in Pennsylvania. Of this coal, 78 percent was high volatile, 10 percent medium volatile, and 12 percent low volatile.

Of the 209 billion cubic feet of coke-oven gas produced in Pennsylvania, 39 percent was used in heating ovens, 60 percent was surplus

used or sold, and 1 percent was wasted. Eighty-three percent of the surplus coke-oven gas was used by producers in steel or allied plants and 12 percent under boilers; 5 percent was distributed through city mains. Thirteen plants produced coke-oven ammonia having a yield of 420 million pounds of sulfate equivalent. A total of 207 million gallons of coke-oven tar was produced by companies in Pennsylvania, of which producers used 132 million gallons for refining or topping, and 34 million gallons as fuel and 45 million gallons was sold for refining into tar products. Fourteen plants produced 63 million gallons of crude light oil. Plants in Pennsylvania also produced benzene (32 million gallons), toluene (8.6 million gallons), xylene (3 million gallons), and solvent naphtha (1.9 million gallons).

TABLE 4.—Annual capacity of coke ovens owned by iron and steel companies on January 1, 1959, in short tons [1]

Company	Plant location	Beehive		Other		Total annual capacity
		Number of ovens	Annual capacity	Number of ovens	Annual capacity	
United States Steel Corp. (central operations).	Allegheny County: Clairton			1,567	7,833,800	7,833,800
Pittsburgh Coke & Chemical Co.	Neville Island			140	1,000,000	1,000,000
Jones & Laughlin Steel Corp	Pittsburgh			379	1,200,000	1,200,000
Jones & Laughlin Steel Corp	Beaver County: Aliquippa			352	2,062,000	2,062,000
Crucible Steel Co. of America	Midland			213	790,000	790,000
United States Steel Corp. (central operations).	Bucks County: Fairless Hills.			174	952,100	952,100
Bethlehem Steel Co	Cambria County: Johnstown.			316	1,836,000	1,836,000
Bethlehem Steel Co	Dauphin County: Steelton.			130	768,000	768,000
Interlake Iron Corp	Erie County: Erie			58	267,000	267,000
Republic Steel Corp	Fayette County: Brownsville Junction.	296	215,000			215,000
Alan Wood Steel Co	Montgomery County: Swedeland.			151	600,000	600,000
Bethlehem Steel Co	Northampton County: Bethlehem.			496	2,136,000	2,136,000
Carpentertown Coal & Coke Co.	Westmoreland County: Mount Pleasant	277	160,000			160,000
Pittsburgh Steel Co	Monessen	320	228,000	93	600,000	828,000
United States Steel Corp. (central operations).		1,147	687,500			687,500

[1] American Iron and Steel Institute.

Peat.—Pennsylvania ranked fifth among the twenty-one peat-producing States. Production and value of output of humus and reed-sedge decreased 9 and 14 percent, respectively, compared with 1957. Producers were active in Luzerne, Mercer, Erie, and Lawrence Counties, in order of importance.

Petroleum and Natural Gas.—Crude-petroleum output decreased 18 percent in quantity and 29 percent in value, continuing a long-term downward trend. The value of crude petroleum was $4.10, 63 cents less than that reported for 1957. Among the States, Pennsylvania ranked 19th as a crude-petroleum producer. Quarterly production totaled 1,687,000 barrels for the first quarter, 1,754,000 for the second quarter, 1,695,000 for the third quarter, and 1,542,000 for the fourth quarter. January was the month with the largest production, total-

ing 615,000 barrels, the lowest production (482,000 barrels), being reported in November. The Bradford-Allegheny field, lying in Pennsylvania and New York, ranked 41st in leading fields in 1958. Production from this field totaled 6,459,000 barrels, bringing production since discovery to 683 million barrels.

Pennsylvania ranked 10th in natural gas production and eighth in total dollars, showing a decrease in both quantity and value compared with 1957.

The number of wells completed in Pennsylvania continued to decline, dropping to a total of 652. Of this total, 193 were oil wells, 281 gas wells, 81 dry holes, and 97 service wells. Wildcat wells completed totalled 26—the largest number since 1954. Of this total, 9 were in new gas pools, 16 in dry holes, and 1 in crude oil. Completed field wells dropped from 815 in 1957 to 626 (192 oil wells, 272 gas wells, 65 dry holes, and 97 service wells). The footage for completed wells totaled 1,963,000 with an average footage of 3,011—a decline from 3,190 for the previous year. Footage for completed wildcat wells totalled 1,556,000 and for field wells 1,807,000. Ninety-seven percent of all wells drilled were put down with cable tools and the remainder by rotary.

The proved recoverable crude-oil reserve in Pennsylvania was estimated at 120 million barrels as of December 31, 1958—6 million barrels less than was reported in 1957. This represented 0.36 percent of the U. S. total reserve. The proved recoverable reserve of natural gas in Pennsylvania was 870,000 million cubic feet as of December 31, 1958, 16,000 million more than on December 31, 1957. Of the natural gas reserves, 487 billion cubic feet was nonassociated reserves, 27 billion was dissolved, and 356,000 million was held in underground reservoirs for storage purposes.

Natural-Gas Liquids.—Natural-gas liquids (natural gasoline, and liquefied-petroleum gas) were produced in Pennsylvania in 1958. Output of natural gasoline decreased and LP-gases increased in 1958, having an average value per thousand gallons of $66.54 and $90.24. Reserves of natural-gas liquids as of December 31, 1958, were estimated at 3.7 million barrels—200,000 barrels more than was reported at the end of 1957.

Refineries.—Thirteen petroleum refineries were active.

TABLE 5.—Capacity of petroleum refineries, January 1, 1959

Company	Location	County	Type of plant	Crude-oil capacity [1]		Production-barrels per stream day [1]			
				Barrels per calendar day	Barrels per stream day	Alkylation	Polymerization	Lubes	Asphalt
East:									
Atlantic Refining Co	Philadelphia	Philadelphia	Comp	148,000	156,000	[2] 5,400	[2] 1,700	[2] 5,000	[2] 7,500
Gulf Oil Corp	Girard Point	do	S-C-L	182,000	192,000	6,800	3,600		
Sinclair Refining Co	Marcus Hook	Delaware	S-C	133,000	140,000		1,850		
Sun Oil Co	do	do	Comp	160,000	(3)	[2] 7,000		[2] 11,800	[2] 800
West:									
Franklin Refinery Division of L. Sonneborn Sons, Inc.	Franklin	Venango	S-L	2,000	2,000			500	
Kendall Refining Co	Bradford	McKean	Comp	4,800	5,200			1,200	
Pennsylvania Refining Co	Karns City	Butler	S-L	1,300	1,500			325	
Pennzoil Division of South Penn Oil Co	Rouseville	Venango	Comp	10,000	10,400		380	2,500	
Quaker State Oil Refining Corp	Emlenton	do	do	2,540	3,000		75	1,700	
Do	Farmers Valley	McKean	do	3,810	4,500		100	2,300	
United Refining Co	Warren	Warren	do	15,000	15,600		375		1,500
Valvoline Oil Co. Division of Ashland Oil & Refining Co.	Freedom	Beaver	S-L	5,500	6,000			800	
Wolf's Head Oil Refining Co., Inc	Reno	Venango	Comp	2,500	2,600			750	
Total				670,450	706,800	20,600	8,280	28,675	10,700

[1] Oil and Gas Journal, vol. 57, No. 14, Mar. 30, 1959, p. 130.
[2] Barrels per calendar day.
[3] Not reported.

NONMETALS

Cement.—Adverse weather conditions hampered construction and resulted in a substantial drop in cement shipments during the first quarter of 1958. Gradual improvement in housing starts and in general business activity increased shipments in the second and third quarters, but the total output did not reach the 1957 level.

The capacity of the 24 plants totaled 56 million barrels—67 percent by the dry process and 33 percent by the wet process. The industry consumed 983 million kw.-hr. of electrical energy, of which 652 million was purchased from public utility companies. Stocks of portland cement on hand in the beginning of the year totaled 5 million barrels, while stocks at the end of the year totaled 5.6 million barrels.

Portland cement was shipped to 38 States and the District of Columbia; 24 percent went to New York, 21 percent to New Jersey, 6 percent to Connecticut, 5 percent to Ohio, and 3 percent to Maryland; 33 percent of the shipments was consumed in Pennsylvania.

Masonry-cement shipments, chiefly from Lehigh and Northampton Counties, decreased much as did portland-cement shipments. Masonry cement was shipped to 23 States, of which 39 percent was consumed in Pennsylvania, 18 percent in New Jersey, 14 percent in New York, and 11 percent in New Hampshire.

The principal raw materials used for manufacturing portland cement were cement rock and limestone. Totals of 8.9 million short tons of cement rock and 2.8 million tons of limestone were used. In addition, the following tonnages of raw materials were used: Gypsum 301,000, sand 169,000, slag 154,000, clay 232,000, and iron material 66,000. Quantities of slate, flue dust, carbon black, flint rock, and air-entraining compounds also were used.

TABLE 6.—Shipments of portland cement by counties

County	Number of plants in 1958	1957		1958	
		Short tons	Value	Short tons	Value
Lehigh	5	7,239,300	$23,585,408	6,599,198	$21,769,945
Northampton	11	20,616,513	67,448,502	19,957,871	66,432,924
Allegheny	2	[1] 9,492,915	[1] 31,061,528	[2] 7,128,370	[2] 24,317,578
Lawrence	2				
Butler	1				
Berks	1	[1] 5,170,606	[1] 18,004,400	[2] 6,462,139	[2] 22,597,610
Montgomery	1				
York	1				
Total	24	42,519,334	140,099,838	40,147,578	135,118,057

[1] Allegheny, Lawrence, and Butler Counties and Berks, Montgomery, and York Counties combined for 1957 to avoid disclosing individual company confidential data.
[2] Allegheny and Lawrence Counties and Butler, Berks, Montgomery, and York Counties combined for 1958 to avoid disclosing individual company confidential data.

Clays.—A sharp drop in the activities of the refractory-consuming industries and the construction industry caused an 18-percent decrease in the output of clay in Pennsylvania. The production of fire clay dropped 26 percent to the lowest annual rate of production since 1947. This decline was due to a 36-percent drop in the demand for refractory materials by the steel, glass, and foundry industries and a 12-percent decline in the production of heavy clay products.

TABLE 7.—Clays sold or used by producers, by kinds and uses, in short tons

Uses	Fire clay		Miscellaneous clay		Kaolin	
	1957	1958	1957	1958	1957	1958
Refractories:						
Bauxite, high-alumina brick	(1)	4,000				
Firebrick and block	931,680	598,320			9,078	(2)
Fire-clay mortar	(1)	12,516				
Clay crucibles		8,669				
Foundries and steelworks	94,815	65,794	(1)	(1)		
Heavy clay products	896,076	773,295	1,590,363	1,414,282		
Lightweight aggregate	(1)		126,360	103,740		
Paint filler or extenders			219			
Cement			201,250	232,120	26,555	(2)
Undistributed	[3] 168,731	[3] 81,681	[4] 28,539	[4] 23,183		
Total	2,091,302	1,544,275	1,946,731	1,773,325	35,633	(2)

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes art pottery and stoneware, glass and miscellaneous refractories, and items indicated by footnote 1.
[4] Includes art pottery and stoneware, foundries and steelworks, linoleum and oilcloth, high-grade tile, miscellaneous filler, other uses, and items indicated by footnote 1.

For the first time, production of miscellaneous clays exceeded the output of fire clay, even though the output of miscellaneous clays declined 9 percent in tonnage and 9 percent in value. Lower demand for miscellaneous clays for producing heavy clay products, and lightweight aggregate, offset a slight increase in the use of this clay for manufacturing cement.

Kaolin was again produced in Pennsylvania; output remaining approximately the same as in 1957. It was used to produce firebrick and block and portland cement (the more important use).

Clay was produced in 34 counties, 2 less than in 1957. Fire clay was produced in 19 counties, miscellaneous clay in 27 counties, and

TABLE 8.—Clays sold or used by producers in 1958, by counties

County	Short tons	Value	Types of clay
Adams	61,850	$31,600	Miscellaneous clay.
Allegheny	251,925	779,555	Do.
Armstrong	217,611	2,363,039	Fire clay.
Beaver	365,913	1,654,924	Fire clay, miscellaneous clay.
Blair	11,875	123,498	Do.
Butler	19,920	29,430	Do.
Cambria	45,387	(1)	Do.
Chester	72,744	90,930	Miscellaneous clay.
Clarion	59,186	322,708	Fire clay, miscellaneous clay.
Clearfield	404,689	3,885,648	Do.
Columbia	13,311	11,980	Miscellaneous clay.
Fayette	90,542	(1)	Fire clay, miscellaneous clay.
Lancaster	70,163	(1)	Do.
Lawrence	158,413	449,950	Do.
Luzerne	39,833	59,750	Miscellaneous clay.
Montgomery	54,913	(1)	Fire clay, miscellaneous clay.
Schuylkill	131,740	44,339	Miscellaneous clay.
Somerset	58,386	477,949	Fire clay.
Washington	32,980	44,339	Miscellaneous clay.
Westmoreland	5,940	4,752	Do.
Undistributed [2]	1,150,279	6,676,260	
Total [3]	3,317,600	17,050,651	

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes tonnage and value for counties that must be concealed as indicated by footnote 1 and for the following counties: Berks, Bucks, Centre, Clinton, Cumberland, Dauphin, Elk, Huntingdon, Indiana, Jefferson, McKean, Northumberland, Snyder, and York.
[3] Incomplete total; excludes kaolin.

kaolin in 2 counties. Clearfield County led in production, with a value of $3.9 million; Beaver County ranked second in tonnage produced, followed, in decreasing order, by Allegheny, Jefferson, and Armstrong Counties. Clearfield County was the principal area for fire clay, while Allegheny County was the principal area for miscellaneous clay.

Gem Stones.—Activities of many gem clubs and societies increased. Eastern Pennsylvania continued to be the most popular source of gem materials. Substantial quantities of various types of gem stones were gathered for private collections or sale. The principal varieties collected were quartz, calcite, pyrite, sphalerite, galena, magnetite, and dolomite.

Graphite (Artificial).—Manufactured (artificial) graphite powder and products were produced by Speer Carbon Co., International Graphite & Electrode Division, at a plant in St. Marys. Work at the Chester Springs plant of Graphite Corp. of America was limited to research and development. The company estimated that production would begin in April 1959.

Iron Oxide Pigments.—Sulfur mud continued to be the only crude iron oxide pigment produced in Pennsylvania, with the output increasing in both tonnage and value. Crude iron oxide pigments were produced in Cambria and Elk Counties. Pennsylvania was the leading State in the production of finished natural and manufactured iron oxide pigments; however, its output decreased 5 percent in tonnage and increased 2 percent in value. The decrease in production was attributed principally to a cutback in the output of manufactured red iron oxide pigments and natural brown metallic oxides. Brown iron oxide, red iron oxide, and burnt umber were the principal finished natural iron oxide pigments, and red iron oxide, yellow iron oxide, and Venetian red, the principal manufactured iron oxide pigments.

Lime.—The production of lime dropped to the lowest rate since 1939, owing largely to a lower demand for lime by chemical and other related industries. Sales decreased 33 percent for agricultural and refractory uses and 23 percent for chemical and industrial uses. Of the total sold or used, 74 percent was quicklime and dead-burned

TABLE 9.—Lime sold by producers by uses

Year	Agricultural		Building		Chemical and industrial		Refractory		Total	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1949–53 (average)	130,762	$1,481	121,853	$1,701	[1] 807,073	[1] $9,056	[2] 209,299	[2] $2,887	1,268,987	$15,125
1954	129,146	1,538	120,661	1,698	816,044	9,754	15,732	217	1,081,583	13,207
1955	118,274	1,430	118,727	1,530	1,083,043	13,179	104,007	1,493	1,424,051	17,632
1956	360,718	5,140	110,344	1,456	972,368	11,686	(3)	(3)	1,443,430	18,282
1957	286,720	4,469	110,815	1,874	900,866	12,063	(3)	(3)	1,298,401	18,406
1958	193,433	3,077	112,437	1,839	697,188	7,541	(3)	(3)	1,003,058	12,457

[1] Includes "Refractory" lime for 1950–51.
[2] 1952–53.
[3] Refractory lime included with "Agricultural" to avoid disclosing individual company confidential data.

TABLE 10.—Lime sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Armstrong	1,220	$14,658	1,019	$11,190
Centre	614,653	8,325,614	462,771	4,532,611
Dauphin	31,313	404,060	9,866	126,062
Franklin	2,307	20,763	2,046	15,549
Fulton	833	7,497	495	4,455
Lebanon	192,000	2,482,307	151,059	1,912,460
Mifflin	2,500	28,750	5,656	65,589
Montgomery	71,817	1,225,240	(1)	(1)
Northumberland	700	6,000	420	3,682
Snyder	890	8,010	1,301	9,755
Undistributed [2]	380,168	5,882,924	368,425	5,775,195
Total	1,298,401	18,405,823	1,003,058	12,456,548

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes tonnage and value for counties that must be concealed as indicated by footnote 1 and for the following counties: Bedford, Blair (1958), Butler, Chester, Lancaster, and York.

dolomite, and 26 percent was hydrated lime. Approximately 1.8 million short tons of limestone was used in producing lime.

Twenty companies operated 22 plants in 16 counties in 1958. Centre County continued to be the leading producer, with 46 percent of the State's lime production. Centre, York, Lebanon, Chester and Montgomery Counties each had an output of over $1 million.

Magnesium Compounds.—Decreased demand for magnesium compounds, principally magnesia for insulation, continued the decline in the production from Pennsylvania plants. Magnesium carbonate was produced at Ambler and Plymouth Meeting from raw dolomite for use in producing magnesium oxide and magnesia for insulation purposes.

Mica.—Output of mica decreased in tonnage and value principally from decreased demand for ground mica for use by paint and rubber industries. The mica was mined and processed near Glenville and marketed for use in welding rods and as a mold lubricant for the rubber industry.

Perlite (Expanded).—Crude perlite mined in Western States was expanded at plants in Allegheny, Delaware, Lehigh, and Montgomery Counties. A total of 14,500 short tons valued at $795,500 was marketed from these plants—a decrease compared with 1957 of 14 and 18 percent, respectively. The expanded perlite was used principally as an aggregate in building plaster, with smaller quantities consumed as a filler, soil conditioner, concrete aggregate, and in insulation.

Pyrite.—For the second consecutive year the output of pyrite increased in both quantity and value. It was obtained as a byproduct of iron mining in eastern Pennsylvania and was processed at the Bethlehem Steel Co. plant at Steelton. Further processing was done at Wilmington, Del. for the recovery of cobalt.

Pyrophyllite (Sericite Schist).—Output of sericite schist decreased both in tonnage and value mainly because of a decline in demand for this material as a filler in asphaltic compounds. After processing,

sericite schist also was marketed as a carrier in insecticide chemicals and for use in joint-filler cements.

Roofing Granules.—The output of natural and artificially colored roofing granules decreased in both tonnage and value compared with 1957, owing mainly to a decreased demand for natural granules. Of the total production, artificially colored granules represented 87 percent. Three plants were active—one at Delta (York County) produced roofing granules from slate, one at Charmian (Adams County) used quartzite and basalt, and one at Darlington (Beaver County) used clay. Stone flour was produced, in addition to roofing granules.

Sand and Gravel.—Decreased construction and highway building hampered the growth of the sand and gravel industry. A 5-percent increase in demand for sand and gravel as paving material did not suffice to overcome a decrease in the demand for construction material, resulting in an overall 5-percent decrease in commercial operations.

Sand was sold for nine major uses, of which only grinding and polishing sand showed increases in sales. Sand for building purposes decreased 4 percent in tonnage and 2 percent in value and paving sand increased slightly in both tonnage and value, mainly as a result of the production reported by Government-and-contractor operations. Sales of engine, molding, fire, and ground sands declined.

A total of 97 commercial operators was active, of which 94 produced sand and 61 produced gravel. Three sand operations produced over 400,000 short tons of sand, 12 operations over 100,000 tons, 18 operations 50,000 to 99,999 tons, and 34 operations 10,000 to 49,999 tons. Of the 61 gravel operations 1 plant produced over 1 million tons, 8 operations 100,000 to 999,999 tons, and 18 plants each producing 50,000 to 99,999 tons and 18 plants 10,000 to 49,999 tons. Of the total commercial sand and gravel tonnage 53 percent was transported by truck, 31 percent by waterways, and 15 percent by railroad. Ninety-eight percent of the sand and gravel production was washed or otherwise processed before use.

Commercial production of sand and gravel was reported in 43 counties, 2 more than in 1957. Fulton and Washington Counties were added to the 1958 lists, while operations in Cambria County were discontinued. Fifteen counties reported increases in production, but the remaining counties showed decreases. Bucks County was the leading producer of sand and gravel, with 29 percent of the State's total tonnage and 24 percent of the State's total value although showing a production decrease of over 400,000 short tons. Other leading counties in decreasing order were Armstrong, Lycoming, and Huntingdon. Government-and-contractor production was reported from Dauphin and Susquehanna Counties, compared with 1957 production from Centre County only.

Slag (Iron-Blast-Furnace).—Output of blast-furnace slag declined owing primarily to cutbacks in the steel industry. The output of all types of slag decreased from 8.2 million short tons to 7.2 million. The value of output also decreased from $11.8 million to $11.3 million. Air-cooled (screened) blast-furnace slag was produced at 21 plants, granulated slag at 5 plants, and lightweight slag at 5 plants. Screened air-cooled output decreased from 6 million short tons to 5.3 million at a value of $9.9 million to $9.3 million. Pennsylvania was the leading producer of blast-furnace slag.

TABLE 11.—Sand and gravel sold or used by producers, by uses

Use	1957		1958	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Molding	(1)	(1)	151,243	$457,555
Building	3,630,924	$4,812,433	3,488,941	4,931,685
Paving	1,884,880	2,828,916	1,878,762	2,809,596
Engine	(1)	(1)	53,451	110,612
Other	233,272	453,888	165,506	428,360
Undistributed [2]	1,318,629	4,280,659	840,095	3,214,234
Total	7,067,705	12,375,896	6,577,998	11,952,042
Gravel:				
Building	3,456,047	4,760,230	3,258,596	4,593,614
Paving	1,527,864	2,204,341	1,707,011	2,442,856
Undistributed [3]	197,432	174,235	119,830	112,688
Total	5,181,343	7,138,806	5,085,437	7,149,158
Total sand and gravel	12,249,048	19,514,702	11,663,435	19,101,200
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	44,239	15,484		
Paving			161,589	78,770
Total	44,239	15,484	161,589	78,770
Gravel: Building	112,367	39,328		
Total	112,367	39,328		
Total sand and gravel	156,606	54,812	161,589	78,770
Grand total	12,405,654	19,569,514	11,825,024	19,179,970

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes glass, grinding and polishing, fire or furnace, filter (1958), and ground sand.
[3] Includes railroad ballast and other uses.

TABLE 12.—Sand and gravel sold or used by producers in 1958, by counties and areas

Area and county	Short tons	Value	Type of operation			Kind of material	Transportation			Principal population centers in area
			Stationary	Portable	Dredge		Rail	Water	Truck	
Northwestern:										
Crawford	103,092	$154,417	5			Building and paving sand and gravel, fill gravel	X		X	Erie. New Castle. Sharon.
Erie	150,050	214,316	4			Building and paving sand and gravel, molding sand	X		X	
Forest, Venango, Warren	388.585	750,346	5		2	Building and paving sand and gravel, fire and furnace sand, molding sand.	X		X	
Lawrence, Mercer	710,747	1,006,207	5			Building and paving sand and gravel, filter and fill sand.	X	X	X	
Total	1,352,474	2,125,286	19		2					
Southwestern:										
Allegheny						Building and paving sand and gravel, molding sand, fill sand and gravel, railroad ballast gravel, and other uses.	X		X	Butler. McKeesport. Pittsburgh. Uniontown. Washington.
Armstrong	1,975,593	3,745,959	6		3		X	X	X	
Beaver								X	X	
Fayette							X	X	X	
Butler	123,993	176,462	3			Building sand and gravel			X	
Somerset	900	2,750	2			Building sand and other sand				
Total	2,100,486	3,925,171	11		3					
North Central:										
Clearfield	(1)	(1)				Building and paving sand and gravel, railroad gravel, engine, molding, and other sands.			X	Williamsport.
Elk	(1)	(1)	4	1					X	
Lycoming	(1)	(1)					X		X	
McKean	(1)	(1)					X			
South Central:										
Bedford	(1)	(1)				Building and paving sand and gravel; glass, molding, grinding, engine, fire and furnace and other sands, ground sands (abrasive, enamel, foundry, filler, glass, pottery, and other).			X	Altoona. Harrisburg. Johnstown. York.
Blair	(1)	(1)							X	
Dauphin	(1)	(1)							X	
Fulton	(1)	(1)	13	1	1				X	
Huntingdon	(1)	(1)					X		X	
Mifflin	(1)	(1)					X	X	X	
York	(1)	(1)					X		X	
Cumberland	108,936	176,232	3			Building and paving sand			X	
Franklin	132,905	199,641	2			Building sand			X	
Northumberland	10,621	11,985	2			Building, molding, and fill sand				
Undistributed [2]	2,426,777	5,126,526								
Total	2,679,239	5,514,384	24	2	1					

Northeastern:										
Bradford	467,799	532,618	5			Building and paving sand and gravel and engine sand.			X	Hazleton. Scranton. Wilkes-Barre.
Columbia							X		X	
Wyoming							X		X	
Carbon	197,009	297,397	5			Building, paving, fire and furnace sand, and engine sand.	X		X	
Luzerne	433,234	526,915	4			Building and paving sand and gravel and engine sand.			X	
Monroe	67,206	84,988	3			Building and paving sand and gravel and other sand			X	
Susquehanna	74,949	81,690	4			Building and paving sand and gravel			X	
Wayne									X	
Total	1,240,197	1,523,608	21							
Southeastern:										
Berks	260,336	339,451	6			Building and paving sand and gravel and fill gravel			X	Allentown. Bethlehem. Chester. Lancaster. Philadelphia. Reading.
Montgomery									X	
Northampton									X	
Bucks	3,386,427	4,677,701	9			Building and paving sand and gravel and molding sand.	X	X	X	
Lancaster	176,214	380,880	3			Building, paving and fire and furnace sand	X		X	
Philadelphia	533,023	399,767			1	Building sand and gravel		X		
Schuylkill	96,628	293,722	1			Paving and fire and furnace sand	X		X	
Total	4,452,628	6,091,521	19		1					
Grand total	11,825,024	19,179,970	94	2	7					

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes tonnage and value for counties that must be concealed as indicated by footnote 1.

Stone.—Output of stone (including slate) decreased in both tonnage and value (7 percent and 10 percent, respectively). The decline was due primarily to lower demand for dimension stone as rubble and for rough architectural purposes and crushed or broken stone as riprap, flux, railroad ballast, and refractory material and for agricultural purposes. Rough architectural consumption decreased 16 percent, flux 39 percent, railroad ballast 36 percent, and agricultural purposes 9 percent. The only crushed stone usage to show a significant increase was for concrete aggregate. Stone (sandstone, granite, basalt, limestone, shell, miscellaneous stone, and slate) was produced in 44 of the 67 counties, giving Pennsylvania rank as a leading stone-producing State.

Output of limestone, the leading stone produced, decreased as an increase of 12 percent in demand for crushed limestone as concrete aggregate did not offset a 39-percent decrease in demand for flux, a 9-percent drop for agricultural purposes, and a sharp decline for limestone as railroad ballast. A lower demand for dimension limestone as rubble and rough construction material caused a decline in this phase of the limestone industry. Crushed limestone came from 34 counties; Northampton County led in output, with 5.6 million tons, followed in decreasing order by counties producing over 2 million tons—Montgomery, Lawrence, and York. Dimension limestone was produced in Bucks and Lancaster Counties—Bucks County leading. No dimension limestone was produced in Chester County, as was the case in 1957.

Basalt, in contrast with other stone produced in Pennsylvania, showed an increase in tonnage. This rise was due primarily to a greater demand for basalt as concrete aggregate (15 percent); however, all other uses of crushed basalt except riprap showed decreases. The output of dimension basalt dropped, owing to a lower demand for this stone in rough construction. Crushed basalt was produced in

TABLE 13.—Stone sold or used by producers, by uses

Use	1957		1958	
	Short tons	Value	Short tons	Value
Dimension stone:				
Building stone [1]	211,379	$1,580,456	160,067	$1,218,119
Other uses			49,419	3,303,682
Total dimension stone	211,379	1,580,456	209,486	4,521,801
Crushed and broken stone:				
Riprap	(2)	(2)	27,441	23,645
Concrete and road metal	16,686,666	25,185,979	18,537,260	28,025,216
Furnace flux (limestone)	8,958,591	16,151,026	5,443,191	9,806,835
Railroad ballast	1,166,649	1,915,052	749,066	1,181,230
Refractory	306,194	3,838,049	(3)	(3)
Agricultural	856,641	2,756,244	776,764	2,497,005
Other uses [4]	15,071,438	21,662,688	14,305,954	23,637,826
Total crushed and broken stone	43,046,179	71,509,038	39,839,676	65,171,757
Grand total	43,257,558	73,089,494	[5] 40,049,162	[5] 69,693,558

[1] Includes "Curbing and flagging" to avoid disclosing individual company confidential data.
[2] Included with "Concrete and road metal."
[3] Included with "Other uses."
[4] Includes oystershell.
[5] Includes slate.

eight counties and dimension basalt in three counties. The leading county for crushed material was Chester and for dimension stone, Bucks.

Sandstone, third-ranking stone in Pennsylvania, was marketed as both dimension and crushed stone; it decreased 11 percent in tonnage and 14 percent in value. The reduced output resulted principally from a decreased demand for crushed sandstone as refractory material and railroad ballast. Use of sandstone as refractory material decreased 31 percent compared with 1957; effecting an overall decrease of 10 percent in the production of crushed sandstone. Twenty-seven percent less dimension sandstone was marketed with all uses decreasing. Sandstone was prepared as rough construction, rubble, rough architectural, dressed monumental, curbing, and flagging stone. Sandstone was produced in 24 counties, with dimension sandstone in 12 counties and crushed sandstone in 19. Allegheny, Delaware, Lycoming, and Potter Counties produced dimension stone only. Luzerne County was the leading producer of crushed sandstone, followed in decreasing order by Westmoreland, Susquehanna, Wayne, and Lehigh Counties, all producing over 100,000 short tons. A leading county for dimension sandstone was Montgomery.

The output of miscellaneous stone in Pennsylvania decreased 26 percent. Although the demand for dimension miscellaneous stone as flagging material increased slightly, the use of crushed miscellaneous stone as rough construction, rubble, and concrete aggregate decreased sharply. Dimension miscellaneous stone was produced in four counties, of which Delaware and Westmoreland were leaders. Crushed and dimension miscellaneous stone was produced in Montgomery County.

Dimension granite was prepared and marketed from quarries in Pennsylvania for use as rubble, in rough construction, and for architectural material. Sales of granite as rough architectural stone decreased, while sales for other uses increased. Delaware County continued to be the only one where dimension granite was produced.

Oystershell was collected in Berks County and processed for agricultural purposes.

The Pennsylvania slate industry continued to rank first in the United States in value of output despite a 6-percent drop in quantity and a 4-percent decrease in value. Lower demand for slate as flagging material, granules, flour, and roofing material contributed to the decline of the industry. The market for structural slate and blackboard slate increased, but decreases were noted in roofing, electrical, billiard, flagging, granules, and flour. Fifteen operators were active in producing slate—12 in Northampton County and 1 each in Lehigh, Lycoming, and York Counties. Northampton County furnished 40 percent of the tonnage and 79 percent of the value of output. Output from Northampton and York Counties decreased considerably, while production in Lehigh and Lycoming increased slightly.

Slate was exported from Pennsylvania to Canada, South America, Mexico, the Union of South Africa, Cuba, and Costa Rica. Exports,

TABLE 14.—Stone sold or used, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Allegheny	9,030	$30,949	(1)	(1)
Berks	(1)	(1)	2,421,954	$2,871,294
Blair, Huntingdon	(1)	(1)	1,292,864	3,544,709
Bucks	667,519	1,282,113	723,545	1,378,818
Butler	2,197,164	4,224,471	911,054	1,721,255
Carbon	88,255	1,226,700	(1)	(1)
Centre	2,107,910	3,901,388	1,786,483	3,328,604
Chester	1,795,129	3,258,916	(1)	(1)
Cumberland	137,033	282,836	(1)	(1)
Dauphin, Lebanon, Perry	(1)	(1)	3,097,531	5,219,468
Delaware, Chester	(1)	(1)	3,486,163	6,634,978
Fayette, Somerset	(1)	(1)	574,051	1,094,813
Franklin	428,527	718,736	595,540	971,805
Huntingdon	503,048	1,840,389	(1)	(1)
Indiana	300	1,200		
Juniata, Mifflin, Snyder	(1)	(1)	805,623	1,292,431
Lancaster	2,022,971	3,106,309	1,872,585	3,047,407
Lawrence	(1)	(1)	3,102,531	5,361,898
Lebanon	2,861,601	5,226,348	(1)	(1)
Lehigh, Northampton	7,495,121	7,406,528	7,538,588	10,368,901
Luzerne, Susquehanna, Wyoming	413,468	815,311	354,671	717,095
Mercer	4	1,091	11,808	39,944
Monroe, Carbon, Schuylkill	(1)	(1)	397,445	1,854,012
Montgomery	3,797,478	6,625,753	3,644,264	6,151,576
Northumberland	19,600	29,400	58,700	100,950
Potter	5,104	142,072	(1)	(1)
Schuylkill	89,671	594,301	(1)	(1)
Union	249,981	413,413	212,950	356,300
Wayne	190,074	354,142	115,343	246,471
Westmoreland	294,699	658,021	520,904	961,715
York	2,911,603	4,833,049	(1)	(1)
Undistributed [2]	14,972,268	26,116,058	6,524,565	12,429,114
Total [3]	43,257,558	73,089,494	[4] 40,049,162	[4] 69,693,558

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes tonnage and value for counties as indicated by footnote 1 and the following counties: Adams, Armstrong, Bedford, Clinton, Fulton, Lycoming, and Montour.
[3] Includes oystershell.
[4] Includes slate.

in decreasing order, were blackboard slate, flour, slate granules, structural slate, roofing slate, and billiard slate.

Sulfur.—Byproduct sulfur was recovered in the liquid purification of gas obtained from domestic and foreign deposits. Sinclair Refining Co. (Marcus Hook, Delaware County) and Gulf Oil Corp. (Philadelphia) recovered sulfur, using the Claus process. Sun Oil Co., at its Marcus Hook, Delaware County, operation, recovered sulfur, using a two-stage, catalytic oxidation of hydrogen sulfide. The Atlantic Refining Co. (Philadelphia) recovered hydrogen sulfide by the Girdler system, using diethanolamine and monoethanolamine, which was burned for the production of hydrogen sulfide and used at the plant.

Tripoli.—The output of tripoli (rottenstone), was slightly less than in 1957. The crude material was ground at two plants in Lycoming County and marketed principally as a buffing compound and filler.

Vermiculite (Exfoliated).—Crude vermiculite from Western States and foreign countries was exfoliated at plants in Bucks, Clearfield, and Lawrence Counties. The exfoliated vermiculite was used to make cements, insulating refractories and construction insulation and for horticultural uses.

METALS

Cadmium.—Cadmium was recovered from zinc dust collected in the early stages of distillation in the vertical retorts at the St. Joseph Lead Co. Josephtown plant. New Jersey Zinc Co. operated its Palmerton smelter for collecting dust containing cadmium.

Ferroalloys.—Eight major categories of ferroalloys were produced, with a total output of 412,300 short tons. Shipments of ferromanganese, spiegeleisen, chrome-tungsten, nickel-tungsten, ferrotungsten, ferroboron, ferrocolumbium, and ferromolybdenum totaled 378,000 tons, at a value of $95.1 million.

Iron Ore.—The first shipment of concentrated iron ore from the Bethelehem Steel Co. new Grace mine, Berks County, was reported in November, bringing to production a multimillion-dollar project that began in 1948. However, combined shipments of usable iron ore from this mine and the Cornwall mine were less than the output in 1957, chiefly because of lower demand. All ore produced at the underground mines was shipped to the Lebanon concentrator for processing. Iron shipments from the concentrator consisted of sinter and pellet for use in producing pig iron and steel. The copper concentrate produced at the concentrator was shipped to a smelter at Laurel Hill, N. Y., to recover copper, silver, and gold. The pyrite concentrate was shipped to the company plant at Sparrows Point, Md., for roasting out the sulfur, which was used in manufacturing sulfuric acid. The pyrite cinder was shipped from Sparrows Point to Wilmington, Del., for the recovery of the cobalt.

The Grace mine was being developed on the 1,812-, 1,916-, 2,210-, and 2,314-foot levels. The block-caving method of mining was being used to recover the ore. With the mine in full operation, the daily production of raw ore and rock was estimated to be 10,000 to 12,000 tons.

Iron and Steel Scrap.—Ferrous scrap was collected and prepared principally in Allentown, Harrisburg, Norristown, Scranton, Tarentum, Philadelphia, Pittsburgh, and Wilkes-Barre. Of the scrap processed and shipped, the leading varieties were Nos. 1 and 2 heavy-melting steel, No. 1 and electric furnace bundles, No. 2 heavy-melting steel, and cast-iron scrap other than moldings. Of the total scrap available for consumption, 66 percent was home scrap and 34 percent purchased scrap.

Pig Iron.—Steel production dropped sharply. Blast furnaces were operated at approximately 58 percent of capacity and produced 14.5 million tons of pig iron (31 percent less than that produced in 1957). Production of steel was approximately 56 percent of capacity; production fell approximately 31 percent, compared with 1957. Pig iron and B. F. ferroalloy was produced by 14 companies operating 22 plants having 79 stacks. The classes of pig iron produced in 1958 were basic, Bessemer, malleable, foundry, low-phosphorus, and direct casting. More basic and Bessemer pig iron was produced than any other class, totaling 12.2 million short tons for basic and 1.6 million tons for Bessemer, a decrease of 29 and 39 percent, respectively. A total of 9.9 million tons of domestic iron ore, 3.7 million tons of foreign iron ore, 606,000 tons of mill cinder and roll scale, 17,000 tons of flue dust, 8.4 million tons of sinter, and 281,000 tons of other

TABLE 15.—Annual capacity of blast furnaces, January 1, 1959, in short tons

[American Iron and Steel Institute]

Company	Location of plant	Number of stacks	Total annual capacity (short tons)
U.S. Steel Corp. (central operations)	Allegheny County: Braddock	7	2,904,400
Do.	Clairton	3	821,900
Do.	Duquesne	[1] 6	1,473,600
National Tube Division	McKeesport	4	1,308,000
Pittsburgh Coke & Chemical Co.	Neville Island	2	654,000
Jones & Laughlin Steel Corp.	Pittsburgh	6	2,105,000
U.S. Steel Corp. (central operations)	Rankin	6	2,453,400
Jones & Laughlin Steel Corp.	Beaver County: Aliquippa	5	2,090,000
Crucible Steel Co. of America	Midland	3	895,000
Colorado Fuel & Iron Corp.	Berks County: Birdsboro	1	151,200
U.S. Steel Corp. (central operations)	Bucks County: Fairless Hills	3	1,878,000
Bethlehem Steel Co.	Cambria County: Johnstown	[2] 7	2,190,000
New Jersey Zinc Co.	Carbon County: Palmerton	[3] 2	112,000
Bethlehem Steel Co.	Dauphin County: Steelton	3	1,020,000
Barium Steel Corp. (Phoenix Iron & Steel Co.).	Delaware County: Chester	1	200,000
Interlake Iron Corp.	Erie County: Erie	1	271,000
Lavino & Co., E. J.	Lebanon County: Sheridan	[4] 1	56,000
Sharon Steel Corp.	Mercer County: Farrell	2	735,000
Shenango Furnace Co.	Sharpsville	2	445,450
Alan Wood Steel Co.	Montgomery County: Swedeland	2	544,200
Bethlehem Steel Co.	Northampton County: Bethlehem	7	2,720,000
American Steel & Wire Division	Washington County: Donora	2	450,000
Pittsburgh Steel Co.	Westmoreland County: Monessen	3	950,000

[1] Includes 302,500 tons ferroalloys capacity.
[2] Includes 240,000 tons ferroalloys capacity.
[3] Spiegeleisen only.
[4] Ferromanganese only.

agglomerates, and 966,000 tons of pellet was consumed in the blast furnace. Beside metalliferous materials, 439,000 tons of home scrap, 134,000 tons of slag scrap, 342,000 tons of purchased scrap, 1.3 million tons of open-hearth and Bessemer slag, 11.7 million tons of coke, and 4.5 million tons of limestone and dolomite were consumed in the blast furnaces. Scrap produced and flue dust recovered at blast furnaces totaled 216,000 and 1.2 million tons, respectively. Seven million tons of slag also was produced.

Despite the decline in steel production, capacity increased 4 percent and totaled 38,480,000 tons. Of this total, open-hearth capacity was 34,701,000, electric and crucible 2,615,000; and Bessemer and oxygen converting, 1,164,000, (no new open-hearth and Bessemer and oxygen-converting furnaces were put into operation in 1958). The number of open-hearths decreased from 288 to 286 and Bessemer and oxygen furnaces remained at 8. However, 13 new electric crucible furnaces were put into operation, bringing the total to 104. Of the total steel production, open-hearth furnaces produced 90 percent.

Zinc.—Zinc production commenced on January 21 at the Friedensville mine, reviving the zinc-mining industry in Pennsylvania. Concentrate produced at Friendensville, Lehigh County, was shipped by truck to a smelter at Palmerton, a distance of less than 25 miles. According to the company annual report, over $2 million was spent for mine development.

Smelters.—Two zinc smelters were active. The Palmerton plant of New Jersey Zinc Co., using vertical retorts, processed crude ore or

concentrate from company operations at Sterling Hill, N. J.; Austinville, Va.; Eagle, Colo.; Friedensville, Pa.; and Jefferson City, Tenn. Both zinc and lead were produced. The Josephtown smelter of the St. Joseph Lead Co. processed material received from the company Edwards and Balmat, N. Y., mines, as well as material from other States and foreign countries. Vertical retorts were used to recover the zinc.

REVIEW BY COUNTIES

Adams.—Bethlehem Limestone Co. produced and crushed limestone at the Hanover quarry and plant west of Hanover. The crushed stone was used principally as blast-furnace flux, concrete aggregate, roadstone, and stone sand. Quantities of the stone were sold under contract to government agencies for road construction. The company installed three crushers for making sinter flux. Tunnels and service buildings were erected at West Plant Lake for water storage. The Funkhouser Mills quarried basalt at the Charmian quarry and crushed and ground the stone for use as roofing granules and stone flour.

Summit Mining Corp. operated the Heller mine, 3 miles west of Bendersville, to recover sericite schist. The crude sericite schist was trucked to the company plant at Aspers, where it was crushed, screened, and ground for use in asphaltic compounds and joint cements as a filler and in insecticides. Liberty Stone Co. produced soapstone at a pit near Fairfield and shipped the crude material to the company plant at Marriottsville, Md., for processing.

TABLE 16.—Value of mineral production in Pennsylvania, by counties [1 2 3]

County	1957	1958	Minerals produced in 1958 in order of value
Adams	(4)	(4)	Stone, sericite schist, clays.
Allegheny	$59,809,854	$45,620,873	Coal, cement, clays, sand and gravel, stone.
Armstrong	17,486,325	(4)	Coal, sand and gravel, clays, lime, stone.
Beaver	(4)	(4)	Clays, coal, sand and gravel.
Bedford	1,661,061	1,620,266	Stone, coal, lime, sand and gravel.
Berks	9,604,834	9,411,867	Cement, stone, clays, crude iron oxide pigments, sand and gravel, gem stone.
Blair	2,110,450	1,982,391	Stone, coal, clays, sand and gravel, lime.
Bradford	(4)	(4)	Coal, sand and gravel.
Bucks	(4)	(4)	Sand and gravel, stone, clays, gem stone.
Butler	17,027,113	13,648,257	Coal, cement, lime, stone, sand and gravel, clays.
Cambria	71,430,438	53,453,928	Coal, clays, crude iron oxide pigments.
Cameron	(4)	(4)	Coal.
Carbon	10,023,818	(4)	Coal, stone, sand and gravel, gem stone.
Centre	15,044,014	(4)	Lime, coal, stone, clays.
Chester	[5] 4,548,537	5,664,017	Stone, lime, clays, gem stone.
Clarion	12,181,928	10,658,426	Coal, clays.
Clearfield	(4)	(4)	Coal, clays, sand and gravel.
Clinton	2,650,497	2,530,185	Coal, stone, clays.
Columbia	(4)	(4)	Coal, sand and gravel, clays.
Crawford	137,984	154,417	Sand and gravel.
Cumberland	461,640	(4)	Stone, sand and gravel, clays, gem stone.
Dauphin	[5] 4,198,673	3,645,000	Stone, coal, clays, sand and gravel, lime.
Delaware	(4)	(4)	Stone, gem stone.
Elk	1,596,227	1,654,417	Coal, clays, sand and gravel, crude iron oxide pigments.
Erie	(4)	(4)	Sand and gravel, peat.
Fayette	40,836,337	19,646,651	Coal, stone, clays, sand and gravel.
Forest	(4)	(4)	Sand and gravel.
Franklin	925,512	1,183,313	Stone, sand and gravel, lime.
Fulton	(4)	(4)	Do.
Greene	80,300,164	62,201,305	Coal.
Huntingdon	4,333,799	5,065,357	Sand and gravel, stone, coal, clays.
Indiana	(4)	(4)	Coal, clays.

See footnotes at end of table.

TABLE 17.—Value of mineral production in Pennsylvania, by counties [1] [2] [3]—Con.

County	1957	1958	Minerals produced in 1958 in order of value
Jefferson	(4)	(4)	Coal, clays.
Juniata	(4)	(4)	Stone.
Lackawanna	$26,503,139	$19,938,059	Coal.
Lancaster	[5] 5,369,941	(4)	Stone, coal, sand and gravel, clays, lime, gem stone.
Lawrence	22,084,103	(4)	Cement, coal, stone, clays, sand and gravel, peat.
Lebanon	22,039,326	18,967,978	Iron ore, copper, lime, stone, pyrite, gold, coal, silver, gem stone.
Lehigh	(4)	(4)	Cement, zinc, stone (slate), gem stone.
Luzerne	(4)	68,949,149	Coal, sand and gravel, stone, peat, clays, gem stone.
Lycoming	1,708,075	1,555,434	Stone (slate), sand and gravel, coal, tripoli.
McKean	614,601	455,381	Clays, coal, sand and gravel.
Mercer	2,607,174	3,101,323	Coal, sand and gravel, stone, peat.
Mifflin	(4)	(4)	Sand and gravel, stone, lime.
Monroe	(4)	(4)	Stone, sand and gravel, gem stone.
Montgomery	[5] 13,586,798	12,620,278	Stone, cement, lime, clays, sand and gravel, gem stone.
Montour	(4)	(4)	Stone.
Northampton	(4)	(4)	Cement, stone (slate), sand and gravel, coal, gem stone.
Northumberland	(4)	(4)	Coal, clays, stone, sand and gravel, lime.
Perry	(4)	(4)	Stone, gem stone.
Philadelphia	415,045	399,767	Sand and gravel.
Potter	142,072	(4)	Stone.
Schuylkill	74,040,576	(4)	Coal, stone, sand and gravel, clays, gem stone.
Snyder	382,348	477,614	Clays, coal, stone, lime.
Somerset	21,797,665	(4)	Coal, clays, stone, sand and gravel.
Sullivan	(4)	88,755	Coal.
Susquehanna	426,810	(4)	Stone, coal, sand and gravel.
Tioga	(4)	1,465,869	Coal.
Union	413,413	356,300	Stone.
Venango	(4)	(4)	Coal, sand and gravel.
Warren	(4)	(4)	Sand and gravel.
Washington	91,826,557	69,836,603	Coal, clays, sand and gravel.
Wayne	459,780	(4)	Stone, coal, sand and gravel.
Westmoreland	(4)	21,052,979	Coal, stone, clays.
Wyoming	(4)	(4)	Sand and gravel, stone.
York	[5] 14,563,039	14,902,598	Cement, stone (slate), lime, sand and gravel, clays, mica, gem stone.
Undistributed	[5] 421,807,033	408,872,136	
Total	[5] 1,077,157,000	881,181,000	

[1] Pike County is not listed because no production was reported.
[2] Excludes value of production for LP-gases, natural gasoline, petroleum, and some gem stone unspecified by counties, but value is included with "Undistributed."
[3] Excludes values of clays and stone used in manufacturing lime and cement.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Revised figure.

Miscellaneous clay used for building brick and drain tile was recovered from open pits by Alwine Brick Co. (New Oxford) and Gettysburg Drain Tile Works (Gettysburg).

Allegheny.—Underground tonnage comprising 92 percent of the total bituminous coal production was mined at 32 mines, 6 fewer than 1957. A total of 129 cutting machines cut 4.5 million tons of coal; 4.4 million tons of coal was mechanically loaded and 3.4 million tons mechanically cleaned. Twenty-five strip mines, 2 less than in 1957, produced 424,000 tons of coal. Thirty-seven power shovels and 8 draglines were used at the strip mines.

Universal Atlas Cement Co., Division of U. S. Steel Corp., produced air-entrained and non-air-entrained portland cement and Atlas mortar cement by the dry process at its two-kiln cement plant at Universal. Pittsburgh Coke and Chemical Co. (Neville Island) produced portland and masonry cements by the wet process.

Although clay production dropped 8 percent, Allegheny was the leading miscellaneous-clay-producing county for the second consecutive year. Six companies mined clay for making brick and tile.

Bridgeville Brick Co. (Bridgeville) continued as the largest clay producer in the county. Smaller quantities of miscellaneous clay were recovered near Creighton, North Bessemer, Pitcairn, and Wilkinsburg.

McCrady, Inc., previously known as James H. McCrady, Jr. (Harmarville), and Sidwell Loam Sand Co. (Cheswick) produced only molding sand and sand for other uses. Production of sand and gravel continued the steady decline that began in 1954.

Dimension sandstone for use as rubble was quarried at Cuddy by Francis Matesia. The company discontinued operations in July. Malli Mines (Jefferson Borough) produced irregular-shaped dimension sandstone for rough construction.

Panacalite Perlite Co. (Pittsburgh) and Perlite Manufacturing Co. (Carnegie) expanded perlite from crude material obtained from Nevada and New Mexico.

Armstrong.—Bituminous coal was produced from 99 mines—10 less than were active in 1957. Of these, 56 were underground, 37 strip, and 6 auger. Slightly over one-half of the total tonnage was produced from underground mines. A total of 1.1 million tons was cut mechanically, using 46 machines. Twenty-eight percent of the underground tonnage was cleaned mechanically. Fifty-nine power shovels and 17 draglines were active at 37 strip mines.

Armstrong County remained the second-ranking sand-and-gravel-producing county. J. K. Davison and Bros. (operating a dredge along the Allegheny River near Ford City) and Glacial Sand and Gravel (Tarrtown near Kittanning) and Manorville Sand Co. (Manorville), both having stationary plants, were among the 20 leading producers in the State. The output from these plants was used primarily as structural and paving material. Only a small portion of the sand and gravel produced was shipped to the consumer as unprepared material.

Although production and value of clay declined, the county again ranked fifth in clay production and second in total clay value. Clay output from seven underground operations (one each at Adrian, Freeport, New Bethlehem, and Templeton) and three at Kittanning was used to produce firebrick and block and heavy clay products. Clays obtained from two open-pit operations (one near Craigsville, the other near Worthington) were used in manufacturing heavy clay products.

Walter Hershberger, C. D. McCanna, and Robert E. Toy (all near Kittanning) produced and sold hydrated agricultural lime.

Michigan Limestone Division, U. S. Steel Corp., discontinued operation of the Kaylor limestone mine in October 1957. Limestone crushed and used solely in manufacturing lime was produced by two companies, both near Kittanning.

Beaver.—Despite an appreciable decrease in output, Beaver County was the second-ranking clay-producing area. Slightly less than three-fourths of the total clay mined came from open-pit operations, with the remainder from underground mines. Of 11 companies reporting production, the leading producers were Ralph A. Veon, Inc. (Darlington), The Negley Fire Clay Co. (New Galilee), McQuiston Coal Co. (Darlington), Standard Clay Manufacturing Co. (Fallston), and Eastvale Clay Products Co. (Beaver Falls). Plastic

and burley fire clays were sold or used for pottery, refractories, and heavy clay products. Miscellaneous clay was used for pottery and heavy clay products. The Brush Run mine operated by Davis Coal Co. was inactive.

Eighty-six percent of the bituminous coal production came from 13 strip mines, 11 percent from 3 underground mines, and the remainder from 1 auger mine. Two more strip mines were active in 1958 than in 1957. Nineteen power shovels and 8 draglines were used to produce 197,000 short tons of bituminous coal. At the three underground mines two cutting machines were used to cut 22,000 short tons of coal, of which 8,000 tons was mechanically loaded. None of the 229,000 tons of coal produced underground was mechanically cleaned.

Sand and gravel recovered by dredge was further processed as building and paving sand and gravel by the Shippingport Sand and Gravel Co. at its Shippingport plant. Lee Block Co. near Industry produced building sand and gravel and gravel for fill.

Bedford.—Two companies produced and crushed limestone from quarries and plants near Everett and Hyndman, principally for use as concrete aggregate, roadstone, asphalt fill, and agricultural purposes. Crushed and sized ganister rock for use in foundries and steel mills and making ferrosilicon was mined at the Leap No. 1 quarry by Leap Ganister Rock Co. (Madley).

Thirty-two mines (28 underground and 4 strip) were active. Seventy-five percent of the bituminous coal production came from underground mines. A total of 47,000 short tons was mechanically loaded, but none of the coal was mechanically cleaned. Three power shovels and a dragline were used for producing strip-mine coal.

New Enterprise Stone and Lime Co. produced hydrated lime for agricultural use at its Aschom plant near Everett. J. Mason Kerr (Hyndman) operated one kiln, producing quicklime.

Feight Bros. recovered sand from a pit near Everett and processed the sand at an adjacent fixed plant for use as building material.

Berks.—Air-entrained and non-air-entrained portland cement and "Allentown" masonry cement were produced at the five-kiln Evansville No. 1 plant of the Allentown Portland Cement Co.

Four companies operated five limestone quarries and one cement-rock quarry near Evansville, Oley, Kutztown, Sinking Spring, and South Temple, producing crushed and broken stone principally for use as concrete aggregate and roadstone and for manufacturing cement. Some stone was sold to government agencies as road material. The John T. Dyer Quarry Co. recovered basalt from the Clingan quarry (Birdsboro) and crushed and sized the stone at the local plant for use as road material and railroad ballast. The company Birdsboro quarry was not operated during the year. Oystershell was crushed by Reading Poultry Feed Co. (Reading) for use in mineral food and poultry grit.

Miscellaneous clay and shale taken from open pits by the Reading Shale Div. and Shoemakersville Div. of Glen-Gery Shale Brick Corp. was used in manufacturing building brick.

Bethlehem Cornwall Corp., a subsidiary of Bethlehem Steel Co., began commercial production of crude iron ore at its new Grace underground mine near Morgantown. A new mill was being con-

structed for grinding, flotation, and preparation of iron concentrate and pyrites.

Two producers operating fixed plants, one near Sinking Spring and the other near Temple, furnished sand and gravel for building and paving use.

Gem stones and mineral specimens collected in the county near Gibraltor, Morgantown, and Temple included zeolite, magnetite, pyrite, calcite, and hematite.

Blair.—Limestone was recovered from five quarries near Hollidaysburg, Claysburg, and Altoona. The bulk of the output was used as concrete aggregate and roadstone. Basalt Traprock Co. (near Williamsburg) quarried, crushed, and sized quartzite, mainly for railroad ballast and road material. General Refractories Co. operated the Claysburg quarry and plant, producing crushed quartzite for manufacturing silica brick. J. L. Hartman reported that the Sara Furnace quarry (near Sproul) was idle during the year.

Bituminous coal was produced from three underground mines, two strip mines, and one auger mine.

The total output of clay (kaolin, fire clay, and miscellaneous clay) was lower than in the preceding year. Kaolin was produced by Grannas Bros. from the No. 1 mine near Williamsburg for use in manufacturing firebrick and block. Woodbury Clay Co. and Harbison-Walker Refractories Co. produced plastic fire clay at their Oreminea and Butler mines, respectively. Fire clays were used in manufacturing foundry refractories, firebrick, and block. Blair City Products, Inc. (Altoona), produced miscellaneous clay for making building brick. The Garfield Refractories Co. Cresson and Kittanning Point operations were not active in 1958.

Quicklime marketed for agricultural use was produced at a two-shaft kiln by Chimney Rocks Lime and Stone Co. (Hollidaysburg).

Bradford.—One strip coal mine was active.

Towanda Sand and Gravel Co., Inc., operating a fixed plant near Towanda, prepared paving sand and gravel for use by the State highway department and other users.

Bucks.—Despite a decline of nearly 2 million tons from the 5.3 million tons of sand and gravel produced in 1954, Bucks County remained the leading county in sand and gravel production. The Sand and Gravel Division of Warner Co. (Tullytown) was the principal producer in the State. Eight other companies produced sand and gravel from pits in Morrisville, Tullytown, New Hope, and Falls Township in the southeastern section of the county and at Riegelsville and Upper Black Eddy in the northern part of the county. Sand and gravel was processed for use as building and paving material and molding sand. A very small quantity of the total sand and gravel was sold or used as unprepared material. Shipments of sand and gravel by waterway exceeded the combined tonnage hauled by truck and rail.

Three operators of limestone quarries near New Hope, Buckingham, and Rushland produced crushed stone, solely for use as concrete aggregate and roadstone. Edward Karpinski (Langhorne) reported output of irregular-shaped dimension limestone for building material. Samuel M. Yoder Estate produced crushed redstone

and bluestone at the Blooming Glen quarry and crusher, and George Wiley crushed bluestone at Wiley's quarry near Point Pleasant. All the sandstone was sold for road material. George Wiley also produced crushed miscellaneous bluestone for road material. Six basalt quarries were operated in the county near Edison, east of Telford, Quakertown, east of Coopersburg, Langhorne, and Rushland. Both crushed and dimension stone was produced. The crushed material was sold or used as concrete aggregate and roadstone and the dimension stone sold chiefly for surface plates, monuments and mausoleums, and rough architectural stone.

Miscellaneous clay produced by Quakertown Brick & Tile Co., Inc., was used for building brick.

A quantity of sphalerite semiprecious stones was collected in the area near New Galena.

Vermiculite, imported from the Union of South Africa by Hyzer and Lewellen, was processed at the company Southampton plant. The exfoliated material was sold or used mainly for residential and refractory insulation.

Butler.—Bituminous coal was produced from 71 mines—38 strip mines, 31 underground mines, and 2 auger mines. Strip mining yielded 86 percent of output. At the 38 strip mines (7 less than in 1957) 49 power shovels and 33 draglines were used to produce 1.6 million tons. Sixteen cutting machines were used in the underground mines to cut 248,000 short tons of coal. Only 25 percent of the coal was mechanically cleaned, all by jigs.

Penn-Dixie Cement Corp. used captive crushed limestone for manufacturing cement at the West Winfield No. 9 plant. Types I–II, and Type III, air-entrained and non-air-entrained portland cement and some mortar cement were produced by the wet process.

Mercer Lime and Stone Co. produced quicklime and hydrated lime at its plant one-half mile west of Branchton. Quicklime marketed for chemical and industrial uses was the chief product. Hydrated lime for agricultural, chemical, and industrial uses was also produced and marketed.

Four companies produced and crushed limestone from quarries near Harrisville, Branchton, and West Winfield for use as concrete aggregate, roadstone, and blast-furnace flux and for manufacturing cement. One of the companies—Michigan Limestone Division, U. S. Steel Corp.—reported that operation of its Annandale mine near Boyers was discontinued in February. Quantities of roadstone were sold to local Government agencies.

Building sand and gravel was produced and prepared by H. W. Cooper and Highway Sand & Gravel Co., Inc. (both near Slippery Rock). Shipments to contractors and others was made by truck.

Scott Borland Brickyard (Mars) recovered shale from company-owned deposits near the plant site to manufacture building brick. Fire clay produced by Glenn R. Boosel was used as refractory mortar. Pittsburgh & Erie Coal Co. and Chutz Bros. reported no production in 1958.

Cambria.—A total of 131 mines was active, of which 109 were underground, 20 strip mines, and 2 auger. Production from underground mines totaled 7.8 million short tons, of which 7.7 million was mechanically cut and 7.5 mechanically loaded. Forty-one power

shovels and 13 draglines were used to produce 364,000 tons of strip coal. Seventy-four percent of the total production from all mines was mechanically loaded, and 74 percent was cleaned, using wet and pneumatic equipment.

Fire clay was produced from underground mines operated by Harbison-Walker Refractories Co. (Blandburgh) and Patton Clay Manufacturing Co. (Patton), and Hiram Swank's Sons, Inc. (South Fork). Triangle Clay Products Co. (Johnstown) recovered miscellaneous clay from an open pit. Fire clay was used for building brick, vitrified sewer pipe, glass refractories, and other refractories. The miscellaneous clay output was used for building brick. Inactive clay producers were Haws Refractories Co. and Red Ridge Coal Co.

Lanzendorfer Minerals Co. produced crude iron oxide pigments of the yellow sulfur-mud variety at its No. 31 mine near Nanty Glo. The material was sold for the manufacture of paint pigments.

Carbon.—Anthracite was mined from underground mines, strip pits, and culm banks. Leading producers of anthracite were: Coaldale Mining Co., Inc., Pollock Trucking Co., Glen Alden Corp., and Wat-Rap Coal Co.

Silica for making silica brick was recovered and crushed at the Little Gap quarry and plant near Palmerton by North American Refractories.

The Alliance Sand Co., Inc., processing only sand, ranked ninth in the State for total sand produced. Although a large quantity was used as building material, the sand produced also was employed as paving sand, fire or furnace sand, and engine sand. Four other companies produced smaller quantities of sand for paving and building use.

Carnotite and autunite gem stones were recovered near Jim Thorpe and Mauch Chunk.

Panther Valley Coal Co. Inc., gave up its lease and discontinued clay production.

Centre.—Centre County again led in lime output; however, both tonnage and value decreased considerably compared with 1957. The Standard Lime & Cement Co. (Pleasant Gap) and National Gypsum and Warner Co. (both of Bellefonte) produced quicklime and hydrated lime. The principal applications of lime were for metallurgy, miscellaneous chemical and other industrial uses, and the manufacture of paper.

Ninety-three percent of the production of bituminous coal came from 19 strip mines, 6 percent from 17 underground mines, and the rest from 2 auger mines. Of the 60,000-ton underground production, only 13,000 tons of coal was cut by machine and 2,000 tons hand loaded onto conveyors. Forty-six power shovels and 23 draglines were used to produce the strip-mined coal. Pneumatic methods were employed to clean a small quantity of coal.

Crushed and broken limestone was produced at six operations near Bellefonte, State College, Pleasant Gap, and Howard. The output was mainly for use in manufacturing lime and as concrete aggregate, roadstone, and blast-furnace and open-hearth flux. Neideigh Bros. Limestone Co., Inc. (State College), purchased larger hammermills and steel bins with new screens to increase production capacity.

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With the closing of J. H. France Refractories Co. mine near Snow Shoe, Harbison-Walker Refractories Co. became the only active clay producer in the area. General Refractories had discontinued operation in 1957. Plastic fire clay produced was used in manufacturing firebrick and block.

Chester.—Crushed and broken limestone used principally as concrete aggregate and roadstone was produced by Bradford Hills Quarry, Inc. (Downington), and Warner Co. (Paoli). In addition, Valley Forge Stone Co. (Malvern) and Warner Co. (Devault) produced limestone for blast-furnace flux. Warner Co. also utilized crushed limestone at its Cedar Hollow plant (Devault), producing both quick and hydrated lime for sewage and trade-wastes treatment and agricultural use; and hydrated lime for building lime. The lime was shipped to various Northeastern States. All three companies sold roadstone to nearby government agencies. Dimension sandstone (bluestone) was quarried by Albert Rotunno, Rotunno quarry, and Abe Minor, Avon-Grove quarry (both near Avondale). Both companies sold or used the stone as rough construction stone, rubble, rough architectural stone, and flagging stone. John Fecondo & Sons (Avondale) quarried dimension sandstone for rough construction and rubble and a quantity of crushed stone.

Keystone Trappe Rock Co. (Glenmore) and V. DiFrancesco & Son (Devault) quarried and crushed basalt, principally for road material and railroad ballast. Both companies sold road material to local and State government agencies. French Creek Granite Co. produced dimension basalt (black diabase) from a quarry near St. Peters for rough and dressed architectural stone and surface plates. Some of the stone was used on the exterior of the Nassau County Court House, Garden City, Long Island, N. Y., and the City and Municipal Courts Building, New York, N. Y.

Chester County was one of the few counties not showing a decline in clay production during the year. Greater output of miscellaneous clay by McAvoy Vitrified Brick Co. (Phoenixville) explained the increase over the preceding year. The output was used for building brick.

A quantity of mineral specimens and some gem-quality stones were collected in various sections of the county. These stones included pyrite, magnetite, kyanite, garnet, quartz, and sphalerite.

Clarion.—Clarion County ranked second in strip mining of bituminous coal. Twenty-nine strip mines were active, producing 2.7 million tons of coal and using 75 power shovels and 35 draglines. Sixteen underground mines (1 less than was active in 1957) produced 79,000 tons of coal, of which 54,000 was cut by machines and 46,000 mechanically loaded. Forty percent of the total production was mechanically cleaned; 486,000 tons was wet-washed, using jigs, and 611,000 tons using other wet methods.

Clay production and value dropped 39 and 50 percent, respectively, from the preceding year. Plastic fire clay was produced by Harbison-Walker Refractories, Climax Fire Brick Co. (north of Climax), and New Bethlehem Tile Co. (New Bethlehem). Niles Fire Brick Division of Mexico Refractories Co., a previous large producer, did not report production from its underground mine near Lucinda. In addition to plastic fire clay, Climax Fire Brick Co.

produced flint fire clay, and New Bethlehem Tile Co. mined a miscellaneous clay. Producing only flint fire clay were: Frank Pope Co. (New Bethlehem), Lucinda Clay Co., and L. E. Eisworth. Fire clays were used in manufacturing firebrick and block, mortar for refineries, building brick, and other heavy clay products, whereas miscellaneous clay was used to make tile and building brick.

Clearfield.—Clearfield County was the leading county in the production of bituminous coal from strip mines in 1957. One hundred and nine strip mines were active, producing 4.2 million tons of coal, using 221 power shovels and 85 draglines. In all, 89 underground mines also were active in 1958, with a production of 1.3 million tons. Of the coal mined underground, 1.2 million tons was cut by machine, and 856,000 was mechanically loaded. Only 11 percent of the total coal produced in Clearfield was mechanically cleaned. A total of 6,000 tons was wet-washed, using jigs; 528,000, using other wet methods; and 82,000, using pneumatic methods.

Clearfield County was the leading producer of clays. Tonnage dropped 30 percent and value 24 percent compared with 1957. Fifteen companies reported clay-mining activity. Thirteen produced only fire clay; the other two produced both fire and miscellaneous clay. Nine companies reported output of plastic fire clay, three flint fire clay, and three both varieties of fire clay. Of the companies producing plastic fire clay only Hiram Swank's Sons, Inc., and Harbison-Walker Refractories Co. produced from underground mines. W. K. Turner & Sons, Artie K. Baughman, and Geynet Lansberry Coal Co. marketed their entire production of plastic fire clay. Plastic clay was used in manufacturing refractories and for heavy clay products. Flint fire clay was mined and consumed by the producer in manufacturing refractories; some was also sold in the open market. North American Refractories Co. and General Refractories Co. operated underground mines; others produced from open pits. Robinson Clay Product Co. and Williamsgrove Clay Products Co., Inc., operated open-pit mines, producing plastic fire clay and miscellaneous clay and shale for company use in making building brick and vitrified sewer pipe. A total of 11 inactive mines was reported by General Refractories, Harbison-Walker Refractories, and Laclede-Christy Co.

Clearfield Limestone Corp. produced paving gravel from a pit and stationary plant near Clearfield.

Harbison-Walker Refractories Co. (Clearfield) exfoliated vermiculite at its No. 2 works. The exfoliated vermiculite was used for manufacturing insulation brick. The company reported that manufacture of this product was discontinued during the year.

Clinton.—Bituminous coal was mined from seven strip and four underground mines. Fourteen power shovels and 7 draglines were used at the strip mines to produce 614,000 short tons of coal. Only 9 percent of the underground production was cut by machines, and only 20 percent of the total production from all mines was mechanically cleaned.

Lycoming Silica Sand Co. produced crushed and sized limestone at the Salona quarry and plant for use as concrete aggregate, roadstone, and railroad ballast. Some roadstone was sold to the Pennsylvania Department of Highways.

The Kelsey Mining Co. recovered diaspore-type fire clay from an open pit near Gallage and Pine Creek and sold it for manufacturing high alumina brick. Miscellaneous clay mined under contract for Mill Hall Clay Products, Inc., near Castanea was processed and used at the company plant at Mill Hall for producing heavy clay products.

Columbia.—Anthracite was mined from strip pits, underground mines, and culm banks. Leading producers were: Raven Run Coal Co., Locust Dale Mining & Contracting Co., Susquehanna Colliery (Division of the M. A. Hanna Co.), and Jeddo-Highland Coal Co.

Bloomsburg Sand & Gravel Co. produced sand and gravel for use as building material from a pit and fixed plant near Bloomsburg.

The Alliance Clay Product Co. recovered miscellaneous clay from property leased from Lloyd E. Eister. Output was used to produce drain tile and flue liners.

Crawford.—Structural and paving sand and gravel and gravel for fill were processed at five fixed plants near Cochranton, Saegertown, Conneaut Lake, and Titusville.

Cumberland.—Crushed limestone for use as road material was produced by Hempt Bros., Inc. (Camp Hill), and Valley Quarries (Shippensburg). In addition to roadstone, Locust Point Stone Quarries (Mechanicsburg) produced agricultural limestone.

Three companies, two of which operated stationary plants near Mount Holly Springs and the other a fixed plant near Walnut Bottom, produced building and paving sands and other gravel to supply the needs of contractors and local business.

Kaolin used to produce portland and other hydraulic cements was recovered by Philadelphia Clay Co. from an open pit near Mount Holly Springs.

Gem stones were collected near Mount Holly Springs.

Dauphin.—Three companies reported output of limestone crushed at local plants near Swatara, Harrisburg, and Steelton. Chief uses of the stone were blast-furnace flux, concrete aggregate, roadstone, and the manufacture of cement. Hoffman Bros. & Wilson, Inc., sold the equipment and stockpiles at its Elder Quarry and plant near Harrisburg to Hempt Bros., Inc., in May. Faylor Lime & Stone Co. produced crushed basalt at a quarry and plant near Elizabethville solely for use as road material.

Anthracite was mined principally from underground mines with smaller quantities from strip pits and culm banks.

Miscellaneous clay recovered by Bethlehem Limestone Co. at its Steelton quarry was used in making foundry refractories and protective coating for pipes. Two divisions of Glen-Gery Shale Brick Corp. produced and used miscellaneous clay from open pits in Harrisburg and Middletown to manufacture building brick.

Paving sand and gravel produced by Highspire Sand & Gravel Co., Ltd. (Highspire), and Pennsylvania Supply Co. (Amity Hall) was washed, screened or otherwise prepared before delivery by motor truck. Dauphin County was one of only two counties reporting Government-and-contractor operations during the year.

H. E. Millard Lime & Stone Co., at its plant near Hershey, operated eight shaft kilns and one continuous hydrator to produce

hydrated lime for agricultural use and quicklime for use in open-hearth furnaces.

Delaware.—Media Quarry Co. (Media) produced irregular-shaped dimension sandstone for construction. Some of the stone was used as face stone on a dormitory at Swarthmore College, Swarthmore, Pa. V. DiFrancesco & Son (Llanerch) and General Crushed Stone Co. (Glen Mills) produced and crushed basalt for use as concrete aggregate, roadstone, and railroad ballast. The General Crushed Stone Co. acquired a new asphalt-mixing plant, with a 2½-ton mixer capacity. Delaware County was the only source of granite in the State. F. Cantono & Sons Foxcroft quarry (Broomall) quarried dimension granite for rough architectural stone and rubble. Stone from this quarry was used on the exterior of Rosemont College (Rosemont) and Chestnut Hill Hospital (Philadelphia). The Lima Building Stone Co., Inc. (Lima), quarried irregular-shaped dimension granite as construction stone. Dimension miscellaneous stone as rough and dressed building stone was produced by Carl Galantino (Media).

Garnet, apatite crystals, and various other semiprecious stones were collected by hobbyists in the areas near Media, Mineral Hill, and Avondale.

Perlite, expanded at the Primos plant by Perlite Products Corp., was marketed principally as a building-plaster aggregate and as a mix with asphalt for insulating material.

Elk.—A total of 27 mines were active, of which 16 were underground, 8 strip, and 3 auger mines. Slightly more coal was produced from the strip than from underground mines. Of the coal mined underground, 142,000 tons was cut by machine, and 113,000 was mechanically loaded. Eleven power shovels and 5 draglines were used at the eight strip mines. Only 7 percent of the production from all mines was mechanically loaded.

St. Mary's Sewer Pipe Co. remained the only active clay producer mining miscellaneous clay at North Point for sewer pipe. Meyer Clay Mine did not operate.

Stone Haven Mix, operating a portable plant near Johnsonburg, produced paving gravel for use on roads by local and State highway crews.

William DeSalve recovered sulfur mud from the Brandy Camp mine (near Caledonia), which was sold for use in manufacturing paint pigments.

Erie.—The combined output of sand and gravel by four companies operating stationary plants near Fairview, Lake City, Springfield, and Erie remained virtually unchanged from 1957.

Corry Peat Products Co. recovered reed-sedge and humus peat from a bog near Corry.

Fayette.—A total of 56 mines were active in 1958, including 35 underground, 30 strip, and 1 auger. Forty-nine cutting machines were used to undercut 99 percent of the underground production. Thirty-two percent of the total bituminous coal produced in the county was mechanically cleaned, usings jigs and pneumatic methods.

Vesco Corp. produced and crushed limestone for use as road material, as rock dust for coal mines, and for agricultural purposes at the Lake Lynn quarry and plant near Mercersburg. Connellsville

Bluestone Co. quarried and crushed sandstone solely for road material and sold some to local and State government agencies for road construction. General Refractories Co. produced crushed silica at the Childs quarry and plant (Layton) for making silica brick.

The combined clay output of four companies dropped 43 percent below the previous year. Both Big Savage Refractories Division of Mexico Refractories Co. and Robert N. Matthews produced plastic-and flint-type fire clay at their Ohiopyle strip and Getteny strip operations, respectively. Plastic fire clay was also produced by Harbison-Walker Refractories Co. at its Smith mine near Ohiopyle. Fire clay mined was used for manufacturing firebrick and block. Layton Fire Clay Co. produced miscellaneous clay for building brick from an open-pit mine.

McClain Sand Co., operating a dredge near Point Marion, transported a large portion of its prepared building and paving sand and gravel by barge. The remainder was shipped by truck and rail.

Forest.—Tionesta Sand & Gravel, Inc., prepared sand and gravel at its plant near Tionesta.

Franklin.—Crushed limestone for use as concrete aggregate, roadstone, and railroad ballast and for agricultural purposes was reported by six companies operating seven quarries. Quarries were active near Orrstown, Dry Run, Williamson, Shippensburg, Chambersburg, Mercersburg, and Zullinger.

Building sand was screened or otherwise prepared from sand recovered by Mount Cydonia Sand Co., Inc. (Chambersburg), and Caledonia Sand Co. (Fayetteville).

Frank L. Heinbaugh produced and sold quicklime for agricultural use at its Mercersburg plant, using three shaft kilns. Bituminous coal was used as a fuel.

Fulton.—H. B. Mellot Estate, Inc., produced limestone at the Charleston quarry (Warfordsburg) and the Morton Quarry (Big Cove Tannery). The stone was crushed at local plants for use as concrete aggregate, and roadstone and for agricultural purposes. John P. Martz & Son produced and crushed limestone solely for use in manufacturing lime at the Martz Draw Kiln (Hustontown). The lime produced by this company was marketed in Pennsylvania as agricultural lime. Most of the limestone produced in the county was sold to local government agencies for road construction.

H. B. Mellot Estate, Inc., operating a stationary plant near Warfordsburg, supplied consumers with prepared structural and paving sands.

Greene.—Greene County ranked second in the production of bituminous coal from underground mines, with 22 underground mines active. Of the 9.7 million tons of coal mined underground, all but a small fraction was cut by machine and mechanically loaded. A small tonnage was produced at three strip mines. Of the county coal production, 72 percent was mechanically cleaned, using jigs and pneumatic and other wet methods.

Huntingdon.—Huntingdon County continued to be the chief source of specialized sands. In addition to glass, molding, and engine sands, a variety of ground sands and those for other industrial uses was prepared by Pennsylvania Glass Sand at its Keystone Works near Mapleton Depot. Alexandria Fire Clay Co. (Alexandria) and

Warrior Ridge Sand Co. (Huntingdon) produced fire and furnace sand and building sand, respectively. Method of transportation from plants was by railroad and truck.

Three companies quarried and crushed limestone, chiefly as concrete aggregate, roadstone, and railroad ballast and for agricultural uses. Producers were New Enterprise Stone & Lime Co. (New McConnellstown); Tyrone Lime & Stone Co., Stover No. 1 quarry (Tyrone); and Warner Co. (Bellefonte Division), Union Furnace quarry (Union Furnace). Harbison-Walker Refractories Co. (Mount Union) and North American Refractories Co. (Three springs) quarried and crushed silica for making silica brick.

Seven underground and four strip mines, two and one less, respectively, than 1957, produced 45,000 short tons of coal in all. Only 29 percent of the underground tonnage was cut by machines; 6 percent was mechanically loaded. Three power shovels and two draglines were used at the four strip mines.

Alexandria Fire Clay Co. did not operate its mine but sold plastic clay from stock for refractory mortar.

Indiana.—Production from 84 underground coal mines totaled 4.7 million short tons, 4.5 of which was mechanically loaded; virtually all was cut by machine. Production at the 30 strip mines totaled 944,000 tons. Fifty-three power shovels and 24 draglines were used in stripping overburden and loading coal. Over 31,000 tons of coal was produced from five auger mines. Of total production, 68 percent (3.9 million tons) was mechanically cleaned, using jigs, other wet methods, and pneumatic methods.

Plastic fire clay was produced from Swank No. 6 underground mine near Clymer by Hiram Swank's Sons, Inc., and used to make pouring pit refractories.

Jefferson.—Bituminous coal was produced from 39 underground mines, 30 strip mines, and 3 auger mines. Ninety percent of the underground production was cut by machine, using 47 cutting machines, and 74 percent of this production was mechanically loaded. Fifty-three power shovels and 16 draglines produced 902,000 short tons of coal. Production from auger mines totaled over 26,000 tons.

The Brockway Clay Co. and Hanley Co. produced and used plastic fire clay to manufacture building brick, tile, vitrified sewer pipe, flue lining, and other heavy clay products. Henry O'Neill & Co. sold plastic fire clay produced from an underground mine near Brookville for refractory use.

Juniata.—Limestone quarried and crushed at local plants by Juniata Limestone Co. (McAllisterville, Fayette Township) and W. N. Quigley (Mifflintown) was used mainly for concrete aggregate and roadstone. Juniata Limestone Co. added a hammermill with double-deck screen and electric power. Some of the stone was sold to local government agencies for road construction. Silica quarried and crushed at the Van Dyke plant near Thompsontown by National Refractories Division, Mexico Refractories Co., was utilized at the company plant to manufacture silica brick.

Lackawanna.—Production of anthracite decreased considerably compared with 1957, but the county continued to rank fourth in tonnage and value. Anthracite was mined at underground mines, strip pits, and culm banks. Leading producers were: Hudson Coal Co.,

Moffat Coal Co., Inc., Diamond Colliery Co., Village Slope Coal Co., and Turnpike Coal Co.

Lancaster.—Twelve companies recovered limestone from 15 quarries. Leading producers were D. M. Stoltzfus & Son, Inc., operating three quarries, two near Talmage, and one near Quarryville, and Ivan M. Martin, Inc., Blue Ball. Major production was from quarries near Denver, Talmage, Blue Ball, Bareville, and Martindale. The principal uses of the limestone were as concrete aggregate and roadstone and for agricultural purposes. A quantity of irregular-shaped dimension limestone also was produced. Quantities of stone were sold to local State and government agencies as well as government agencies in Delaware and Maryland. Several companies reported improvements at their operations: David M. Burkholder (Martindale) installed conveyor belts in place of chain elevators to the secondary crusher; A. G. Kurtz & Sons, Inc., added a secondary crushing mill; and J. Miller Eshelman & Son, Inc. (near Salunga) constructed a new plant.

Anthracite was recovered from dredging operations only.

Sand processed by Hempt Bros. (Elizabethtown) and Milton Grove Sand, Inc. (Milton Grove), was used as building and paving material. A. T. Harris Sand Co. (Honey Brook) processed sand for fire and furnace use. Trucks and railroads were used to transport sand to consumers.

Miscellaneous clay and shale for building brick were mined and consumed by Lancaster Brick Co. (Lancaster) and Glen-Gery Shale Brick Corp. (Ephrata). A. G. Kurtz & Sons, Inc., sold the clay output recovered from its limestone quarry also for building brick. Whitaker Clay Co. (Narvon) produced fire clay for foundries and steelwork.

Amos K. Stoltzfus produced hydrated lime, chiefly for agricultural use, at a plant 2 miles west of Morgantown. J. E. Baker Co. did not operate its Billmeyer lime plant near Bainbridge.

Mineral specimens and gem-quality stones were collected in the county near Blue Ball, Wakefield, and Neffsville. Included among these specimens and stones were pyrite, chromite, calcite, malachite, marcasite, and hematite.

Lawrence.—In production and value Lawrence County ranked third in the State as a stone-producing area. Five companies produced and crushed limestone and cement rock, principally for use as blast-furnace and open-hearth flux, concrete aggregate, and roadstone and for manufacturing cement. The stone was recovered from quarries near New Castle, Bessemer, Hillsville, Mahoning Township, and Wampum. The major portion of the stone was transported by railroad. Two companies utilized the major portion of the limestone and cement rock produced for manufacturing cement. Medusa Portland Cement Co. (Wampum) produced Types I–II, Type III, portland, and masonry cements. This company changed over to two larger capacity kilns to replace five smaller obsolete kilns. Bessemer Limestone & Cement Co. (Bessemer), operating four kilns, produced mostly Types I–II, air-entrained and non-air-entrained, and Type III non-air-entrained cement and "Bessemer" mortar.

Twenty-four strip mines and two underground mines were active. Thirty-three power shovels and 21 draglines were used at the strip mines to produce 1 million short tons of coal. None of the coal produced was mechanically cleaned.

Fenati Brick Co., Inc. (New Castle), and Metropolitan Brick, Inc. (Bessemer), produced both plastic fire clay and miscellaneous clay for their own use. Fire clay mined and hauled under contract for Natco Corp. was used at their East Palestine, Ohio, plant. Keystone Loam & Clay Co. produced clay for foundry and steel-mill use. During the year Fenati Brick Co. constructed a two-story building housing a laboratory and storeroom adjacent to its yard office.

Superior Sand & Supply Co. recovered paving sand and gravel at its New Castle plant. Mahoning Valley Sand Co. (Taylor Township) produced building and paving sand and gravel.

D. M. Boyd and Moores Peat Humus Co. (both near New Wilmington) recovered humus-type peat from bogs.

Lebanon.—Bethlehem Cornwall Corp., a subsidiary of Bethlehem Steel Co., operated the Cornwall underground mine 5 miles south of Lebanon, mining crude ore by 99 percent block caving and 1 percent open stope. The ore was processed at the company Lebanon concentrator, using magnetic separators and flotation. Sinter and pellet were shipped from the Lebanon concentrator to Steelton, Md.; pyrite concentrate to Sparrows Point, Md.; and copper concentrate to Laurel Hill, N. Y.

North American Refractories reported a quantity of silica for making silica brick from the Womelsdorf quarry. H. E. Millard Lime & Stone Co. operated a lime plant at Annville, using four rotary kilns and one continuous hydrator. Quick and hydrated lime was marketed, chiefly for open-hearth furnaces, water purification, and building lime.

The principal uses of limestone quarried and crushed in Lebanon County were as concrete aggregate, roadstone, blast-furnace and open-hearth flux, and cement and lime manufacture. Leading producers were H. E. Millard Lime & Stone Co. (Annville) and Calcite Quarry Corp. (Cornwall). Quantities of stone were sold to various government agencies for road construction.

Dredging was the only method used to recover anthracite in Lebanon County.

Some gem stones and mineral specimens (serpentine, apophyllite, hematite, and magnetite) were collected near Cornwall.

Lehigh.—Shipments of portland and masonry cements continued to decrease. Coplay Cement Manufacturing Co. (Coplay), The Whitehall Cement Manufacturing Co. (Cementon), Lehigh Portland Cement Co. (Fogelsville and Ormrod), and Giant Portland Cement Co. (Egypt) quarried limestone or cement rock and manufactured cement. The principal types of cement shipped were Types I–II, Type III, air-entrained and non-air-entrained and some mortar cement. The Whitehall Cement Manufacturing Co. acquired a new packing house and two new grinding mills. The Lehigh Portland Cement Co. announced plans for a $2 million dust-control program at its Fogelsville plant. Electrostatic precipitators will be installed to catch dust from kilns, and mechanical bag collectors will be used

to capture dust from stone driers. Several companies were inactive for approximately 2 months due to decreased demand.

New Jersey Zinc Co. mined crude ore for recovering zinc at an underground mine near Friedensville by the open-stope method.

Lehigh Stone Co. (Ormrod) produced crushed limestone for use as concrete aggregate and road material. A quantity was sold to various local and State government agencies. Susquehanna Quarry Co. (Alburtis) quarried and crushed sandstone as road material.

Penn Big Bed Slate Co., Inc., produced slate at its quarry and plant near Slatedale. The slate was processed and sold for various uses but primarily for structural purposes, blackboards and bulletin boards, and roofing. Robert A. Reichard, Inc. (Allentown), reported it no longer crushes oystershell.

Quartz crystals, jasper, sphalerite, unakite, and various other semiprecious stones and mineral specimens were collected near Vera Cruz, Friedensville, and Lehigh Valley.

Crude perlite from mines in Nevada and New Mexico was expanded by Pennsylvania Perlite Corp. at its Allentown plant.

Luzerne.—Luzerne County accounted for 32 percent of anthracite production. Anthracite was mined from underground mines, strip pits, and culm banks. Leading producers were: Glen Alden Corp., Hudson Coal Co., Lehigh Valley Coal Co., and Jeddo-Highland Coal Co. Four companies operating fixed plants sold building and paving sand and gravel under contract to local Government agencies near West Wyoming, Drums, Avoca, and Forty Fort. Coon Certified Concrete (Sweet Valley), North Mountain quarry, General Crushed Stone Co. (White Haven) White Haven quarry, and American Asphalt Paving Co. (Trucksville) produced and crushed sandstone, chiefly for use as concrete aggregate and roadstone. Some of the stone was sold to local and State government agencies for road construction. Hayes Bros. Stone Co. (White Haven) produced dimension sandstone for rough construction, dressed architecture, and flagging. Humus and reed-sedge peat was recovered from bogs near White Haven by Blue Ridge Soil Pep Co. and Pennsylvania Peat Moss, Inc. Miscellaneous clay for building brick was mined by Hazelton Brick Co. Output was less than in 1957. Some mineral specimens (biotite and siderite) were collected.

Lycoming.—Lycoming Silica Sand Co. produced limestone from the Lime Bluff quarry near Muncy and the Pine Bluff quarry near Jersey Shore. The output was crushed and sized at local plants for use as road material and for agricultural purposes. Susquehanna Quarry Co. crushed limestone for road material from a quarry near Jersey Shore. Both companies sold stone to local and State government agencies. John T. Morgan (Slate Run) quarried dimension sandstone as flagging stone. Miscellaneous dimension stone for rubble and flagging use was mined by Callahan & Haines Stone Co. (Slate Run). Keystone Filler & Manufacturing Co. produced crushed and ground slate as flour at the Sheddy quarry and plant near Muncy. The combined production of J. A. Eck & Sons, Inc., and Lycoming Silica Sand Co. in the Montoursville area placed Lycoming County third in total sand and gravel output.

Bituminous coal was produced from three underground and two strip mines. At the underground mines (one less than 1957) 17,600

short tons was produced by hand methods. Three power shovels and two draglines were used to produce 35,000 tons of strip-mined coal. Tripoli was mined by Penn Paint & Filler Co. from the Ramsey quarry near Antes Fort and by Keystone Filler & Manufacturing Co. (Muncy). The rottenstone was crushed, dried, and ground for use as an abrasive and filler.

McKean.—C. L. McGavern, Jr., produced molding sand from a pit at Eldred. Plastic fire clay recovered by Kaul Clay Products Co. near Clermont was used for vitrified sewer pipe and hot tops for the steel industry. Kness Bros. produced two types of fire clay (plastic and burley) for use in foundries and steel mills. Floor and wall tile and building brick were manufactured from shale produced by Hanley Co. near Lewis Run. Three strip mines produced 47,000 short tons of coal. Each mine used one power shovel to strip the coal. None of the coal produced was mechanically cleaned.

Mercer.—Ninety-three percent of the bituminous coal production came from eight strip mines (one less than in 1957). The remainder came from three underground mines. All underground tonnage was cut by machine, and 26 percent was mechanically loaded. Twelve power shovels and 8 draglines were used at the eight strip mines to produce 582,000 tons of coal. None of the coal produced was mechanically cleaned. The sand and gravel industry, keeping pace with the economic growth of industry in the county, reported sizable gains in output over previous years. The increase raised the county to second place in the State as a producer of sand and gravel in western Pennsylvania. Seger Sand & Gravel (West Middlesex), Seidle Sand & Gravel Co. (Mercer), and Transfer Sand & Gravel Co. (South Pymatuning Trap) processed building and paving sand and gravel and fire sand. Trucks transported materials to consumers. White Rock Silica Sand Co. (Greenville) quarried and crushed silica, mainly for use in foundries and steel mills and as road material. Welty M. Smeltzer recovered a quantity of dimension sandstone from the Rock Kastle quarry (north of Volant) for use as dressed or cut architectural stone. A quantity of peat was recovered from bogs in the county.

Mifflin.—Industrial sand produced by Pennsylvania Glass Sand Corp. at its McVeytown plant was sold and used as glass-molding, grinding, polishing, and engine sands and for other miscellaneous uses. In addition to molding and engine sand, Miller Silica Sand Co. (Burnham), along with James R. Kline's Sons (Lewistown), processed structural sand. Railroad and trucks transported material from the plants. Bethlehem Limestone Co. operated the Naginey quarry near Milroy and crushed the limestone, principally for use as concrete aggregate, roadstone, blast-furnace flux, and stone sand. Honey Creek Lime Co. (Reedsville) and Ehrenzeller Limestone Co. (McVeytown) produced and crushed limestone for lime manufacture. Honey Creek Lime Co. produced some quicklime for agricultural use and hydrated lime for refractory material at the Reedsville lime plant by using 10 pot kilns and 1 continuous hydrator. Quicklime produced at the Ehrenzeller Lime Co. plant (McVeytown), using seven draw kilns, was marketed for agricultural use. Quartzite from the Hawstone quarry by Haws Refrac-

tories Co. was crushed and utilized at the local company plant for manufacturing silica brick.

Monroe.—Hamilton Stone Co. (Bossardville) quarried and crushed limestone at a local plant for use as asphalt fill and in lime manufacture. Some of the stone was sold under contract to the Pennsylvania Department of Highways. Building and paving sand and gravel and sand for beaches were prepared at stationary plants operated by Coolbaugh Sand & Stone, Inc. (Gouldsboro), Sheesley Minerals, Inc. (Kunkletown), and Steward White & Clyde White (Stroudsburg). Monroe County was the main source of mineral specimens and gem stones collected in the State. Specimens collected near Stroudsburg and Kresgeville were quartz crystals, and pyrolusite.

Montgomery.—Montgomery County ranked second in production and value among the stone-producing counties. Quick and hydrated lime produced at the company Plymouth Meeting plant by G. & W. H. Corson, Inc., was sold and used principally as building lime. Operation at the plant consisted of six shaft kilns and three continuous hydrators, natural gas was used as fuel. Five companies operating quarries near Norristown, Conshohocken, West Conshohocken, Bridgeport, and Plymouth Meeting produced limestone, chiefly as concrete aggregate, roadstone, and blast-furnace and open-hearth flux, and for cement and lime manufacture and agricultural purposes. Two leading producers were G. & W. H. Corson, Inc. (Plymouth Meeting), and Bethlehem Limestone Co. (Bridgeport). The latter company replaced a hammermill crusher with an Allis-Chalmers crusher at its operation. Fire Stone Products Co. (Glenside) produced dimension quartzite for rough architectural blocks and a quantity of crushed stone for steel-furnace or converter lining. William Bambi & Sons, Inc. (Norristown), produced dimension sandstone for use as rough building stone. R. K. Kibblehouse (Perkiomenville) installed a new crusher at its quarry operation and produced crushed basalt for road material. Montgomery Stone Co., Inc. (Montgomeryville), quarried dimension basalt as dressed building stone and crushed and broken stone for road material. Miscellaneous stone (argillite) was mined at Harleysville by M. & M. Stone Co. and crushed for road material. A. Manero & Sons (Glenside) produced miscellaneous dimension stone for use as rough and dressed construction stone.

Allentown Portland Cement Co. produced limestone and cement rock at its No. 2 quarry for use in the manufacture of cement. Types I–II–III air-entrained and non-air-entrained portland cement and some mortar cement were produced, using three kilns, at the West Conshohocken plant.

Total clay output declined 29 percent. The Robinson Clay Product Co. produced both fire clay and miscellaneous clay at Pottstown, using the clay to make vitrified sewer pipe. Other companies producing only miscellaneous clay for building brick and flowerpots were: Lansdale Brick Products Co. (Landsdale), Harry R. Shaffer (Trappe), The Keller-Whilldin Pottery Co. (North Wales), and Norristown Brick Co. (Norristown).

William Bambi & Sons, Inc. (Norristown), recovered sand for building purposes at its pit and local plant. Gem stones and mineral specimens were collected by individuals, primarily as a hobby.

Calcite, sphalerite, zeolite, quartz crystals, and galena were among the various specimens collected near Bridgeport, Phoenixville, Perkiomenville, and various other locations.

The Philip Carey Manufacturing Co. (Plymouth Meeting) and Refractory & Insulation Corp. (Port Kennedy) expanded crude perlite at company expanding plants. The expanded material was marketed for use as filler in refractory materials.

Montour.—Crushed and sized limestone was produced at a quarry and plant east of Milton by Lycoming Silica Sand Co. for use as road material and for agricultural purposes. Limestone for use as concrete aggregate and roadstone was recovered from a quarry near Danville by Mausdale Quarry Co. Both companies sold road material to nearby government agencies.

Northampton.—Although shipments of portland and masonry cements decreased 33 percent and value 17 percent compared with 1957, Northampton remained the leading cement-producing county in the State. Ten companies operated 11 plants for manufacturing cements from limestone and cement rock, either purchased or produced at local company quarries. Plants were at Nazareth, Bath, Northampton, Martin's Creek, Stockertown, Sandts Eddy, and Bethlehem. Output of cement was comprised of Types I–II air-entrained and non-air-entrained portland, white portland, and some mortar.

Owing to the inclusion of slate production with stone in 1958, Northampton County became the leading stone-producing area in the State. Compared with 1957, the output of each commodity group decreased. Eleven active producers reported an output of limestone and cement rock from 12 quarries. The leading producers were: Penn-Dixie Cement Corp. (Plant No. 4 at Nazareth and Plant No. 6 at Penn Allen), Bethlehem Steel Co. (Bethlehem), Keystone Portland Cement Co. (Bath), and Dragon Cement Co., Inc. (Northampton). Other operations were scattered throughout the county near Martin's Creek, Stockertown, and Sandts Eddy. Most of the limestone and cement rock were utilized at company plants to manufacture cement or crushed and sold as concrete aggregate and roadstone. Quantities of the roadstone were sold to local and State government agencies. Twelve companies reported an output of slate in the county; 11 were active producers, and 1 sold from its stockpile. Slate was recovered from various locations in the county: Six at Pen Argyl; two each at Windgap and Bangor, and one each at East Bangor and Bath. The principal uses of the processed slate were for blackboards and bulletin boards, roofing slate, structural and sanitary, and flagging stone. Valuewise, the five leading producers were D. Stoddard & Sons, Inc., Stephens-Jackson Co., Anthony Dally & Sons, Inc., Parsons Bros. Slate Co., and Diamond Slate Co. Several companies exported slate to Canada. Owing to lack of demand for its products, the American Bangor Slate Co., Inc. (Bangor), suspended operation in December 1957. General Slate Co. (Windgap) also ceased operation of its quarry in early 1958.

The combined output of structural and paving sand and gravel prepared by Houdaille Construction Materials, Inc. (Portland), and W. J. Lowe & Sons (Bangor) was transported to consumers by truck. Dredging was the only method used for recovering anthracite in the

county. Gummite, limonite, talc, graphite, molybdenite, and several other gem stones and mineral specimens were found near Easton and Hellertown by stone collectors as a hobby.

Northumberland.—Northumberland continued to rank third among the anthracite-producing counties, although output decreased 23 percent and value 26 percent compared with 1957. Underground mines and strip pits yielded the major portion of anthracite, with smaller quantities from culm banks. The principal producers were: Reading Anthracite Co., Susquehanna Collieries Division of The M. A. Hanna Co., Sayre Contracting Co., and Stevens Coal Co. Glen-Gery Shale Brick Corp., Watsontown Brick Co., and Watsontown Mineral Products Co. recovered miscellaneous clay from open pits near Watsontown for use in making building brick and as a filler in linoleum and phonograph records. Crushed and sized limestone as concrete aggregate and roadstone and for agricultural purposes was produced at Meckley's quarry and plant near Herndon by Eugene Meckley. Some of the road material was sold under contract to local government agencies. Susquehanna Quarry Co. (Dalmatia) quarried and crushed sandstone for road material. Molding sand recovered by M. E. Wallace Co. near Riverside and building and fill sand produced by Wilson's Sand Plant were shipped by railroad and trucks. Agricultural lime was produced and marketed by Clyde Starook (Northumberland) operating a one-pot kiln and using anthracite as fuel.

Perry.—Bradford Hills Quarry, Inc. (Newport), quarried and crushed limestone at its local plant for use as road material. Some of the stone was sold to local government agencies for road construction. A small quantity of gem stones was found near Landisberg.

Philadelphia.—The Liberty Corp., with dredging operations near Philadelphia, recovered and processed building sand and gravel. Shipments to consumers were made by barge. Although its output was slightly below that in the preceding year, The Liberty Corp. ranked as the fourth-ranking producer in the State.

Potter.—Dimension sandstone, for use as rough construction stone, rough architectural blocks, and flagging stone, was quarried at Wharton by Penn Kress Flagstone Co., Inc.

Schuylkill.—Schuylkill County ranked first in output of anthracite, producing 38 percent of the State total tonnage and 37 percent of the total value. Underground mines, strip pits, and culm banks were operated during the year. The five leading producers were: Reading Anthracite Co., Coaldale Mining Co., Inc., Gilberton Coal Co., Newkirk Mining Co., and Valley Stripping Co.

Limestone, used entirely as concrete aggregate and roadstone, was quarried and crushed at the Andreas quarry and plant by Huss Contracting Co. The Andreas quarry, operated by Harbison-Walker Refractories, yielded quartzite that was crushed and ground for manufacturing silica brick. Refractory Sand Co., Inc., operating a fixed plant near Andreas, was the leading producer of fire and furnace sand in the State. Sand for use in paving also was produced.

The output of miscellaneous clay by Auburn Brick Co. and Coaldale Mining Co., Inc., was 15 percent greater than in 1957. Clay mined by Auburn Brick Co. was used at a local plant for building brick, whereas clay mined by Coaldale Mining Co., Inc., was sold for use in making lightweight aggregate. Calcite, quartz, siderite,

pyrite, and several other minerals were found near St. Clair and south of Berwick.

Snyder.—Paxton Brick Co. (Paxtonville) and Glen-Gery Shale Brick Corp. produced miscellaneous clay and shale for making building brick.

Anthracite was produced by dredging.

National Limestone Quarry (near Paxtonville) quarried and crushed limestone for road material and agricultural use. Carton L. Comfort crushed limestone at a local plant for manufacturing agricultural lime. "Lump" lime and quick lime from four pot kilns were sold and delivered to farmers in the State. Coal was used to burn the lime.

Somerset.—Somerset County led in the number of active underground bituminous coal mines, having 115. Underground production totaled 1.6 million short tons of coal, of which 1.3 million was cut by machine and 749,000 mechanically loaded. Eighty-seven power shovels and 33 draglines were used to produce 1.2 million tons of strip-mined coal at the 59 active mines. Three auger mines also were active in 1958. Twenty-five percent of the total county production was mechanically cleaned—77,000 tons by jigs, 480,000 by other wet methods, and 160,000 by pneumatic methods.

General Refractories Co. produced flint fire clay from both underground and open-pit operations at Fort Hill for firebrick and block. Hiram Swank's Sons, Inc. (Holsopple), Harbison-Walker Refractories Co. (Garret mine), and Otto Brick & Tile Works (Springs) recovered plastic-type fire clay for manufacturing refractories such as sleeves, nozzles, stoppers, firebrick and block, and heavy clay products, such as building brick and tile. W. S. Compton Brick Co., Inc. (Salisbury) and Louis M. Weld (Myersdale) were inactive during the year.

Keystone Lime Co. (Springs) quarried and crushed limestone at its local plant as concrete aggregate, and roadstone and for agricultural use. The company built a new crushing unit for roadstone at its original plant. Somerset Limestone Co., Inc. (Bakersville), quarried and crushed limestone, solely as road material.

Small quantities of sand for various uses were produced by Boswell Sand Co. and Robert D. Shaulis, both of Boswell.

Sullivan.—Anthracite, the only mineral produced in the county, was mined from an underground mine, a strip pit, and culm banks. The leading producer of anthracite was Bliss Coal Co., operator of the Bliss strip mine.

Susquehanna.—Six of the seven sandstone-producing companies in the county reported output of dimension stone (mostly bluestone), chiefly as flagging stone and some for rough construction. Quarries were near Lakeside, Lenoxville, Rural, Brooklyn Township, and Harford. Crushed sandstone for road material was recovered from Bennett's quarry near Clifford by Keelor Supply Co., Inc. Some of the stone was sold to contractors and various State and government agencies.

Tioga.—There were five underground coal mines compared with seven in 1957 and three strip mines compared with five in 1957. Fourteen power shovels and three draglines were used to produce strip-mined

coal. None of the underground tonnage was cut by machine, mechanically loaded or mechanically cleaned by jigs.

Union.—Faylor Lime & Stone Co. produced and crushed limestone for road material and agricultural use at its quarry and plant near Winfield. John L. Iddings quarried and crushed limestone for road material. The company installed an impeller-type primary crusher. Most of the stone was sold to local government agencies for road construction.

Venango.—Fourteen strip mines (4 more than were active in 1957) produced. Twenty power shovels and 13 draglines were used at the strip mines. Forty-six percent of the coal was mechanically cleaned.

Sand for industrial uses was produced near Utica by Industrial Silica Corp. Material recovered by dredge and processed at a fixed plant enabled the Oil City Sand & Gravel Co. (Oil City) to supply the demands for building and paving sand and gravel required by an accelerated Federal and State highway program.

Warren.—General Concrete Products Corp. washed, screened, or otherwise prepared building and paving sand and gravel obtained from its dredging operation near Starbrick.

Washington.—Washington County was the leading county in total output of bituminous coal. Twenty-four underground mines were active, producing a total 9.5 million tons, most of which was cut by machines and mechanically loaded. Forty-six power shovels and 8 draglines were used at the 25 strip mines to produce 1.2 million tons. Ninety-eight percent of the coal produced was mechanically cleaned; 1.5 million tons was wetwashed, using jigs, and 8.9 million tons, using other wet methods. Coal was also produced from one auger mine.

Three companies—Donley Brick Co. (Washington), Monongahela Clay Products Co. (Monongahela), and Westmoreland Clay Products Co. (Washington)—made building brick from miscellaneous clay produced at local open pits.

Wayne.—Wayne Concrete & Sand Works, Inc. (Lake Ariel), produced and crushed sandstone for concrete aggregate and roadstone. The company acquired the A. W. Hindman plant at Damascus but did not plan to resume operations until 1959. W. R. Strong & Son and Paul Thompkins Estate produced dimension sandstone, chiefly for use as flagging stone and dressed or cut architectural stone. Three companies (two operating near Lake Ariel and the other near Tanners Falls) supplied building and paving sand and gravel.

Westmoreland.—Sixty-six (2 more than in 1957) underground mines, 17 (18 less than in 1957) strip mines, and 1 (1 less than in 1957) auger mine were active. Production from underground mines totaled 3.4 million short tons of coal, of which 3.3 million was mechanically loaded. A total of 22 power shovels and 2 draglines were used at the strip mines to produce strip-mined coal. Sixty-eight percent of the coal produced was mechanically cleaned; 484,000 wet-washed with jigs and 1.6 million with other wet methods; and 348,000 with pneumatic methods.

Dimension sandstone as rubble in retaining walls and flagging stone was quarried by Ray Branthoover (Smithton). John C. Beaumont (Smithton) reported output of dimension sandstone for use as rubble. Eidemiller Enterprises, Inc. (near Whitney), recovered

and crushed sandstone at the Blue Rock quarry for use as road material. Latrobe Construction Co. (Ligonier) reported output of crushed basalt for use as concrete aggregate and roadstone. Some of the stone was sold or used under contract to local and State government agencies. Lynn's Quarry (Smithton) yielded dimension miscellaneous stone for flagging stone. Westmoreland Clay Products Co. (Youngwood), producing miscellaneous clay, was the only active clay producer. Regional Refractories, Inc., leased a property near Derry but did not produce.

Wyoming.—Reduced demand for sand and gravel for highway construction was responsible for one-third less production in 1958, compared with 1957. Building and paving sand and gravel, engine sand, and fire sand and gravel were produced by Wyoming Sand & Stone Co. (Falls), East Falls Sand & Gravel Corp. (Falls), and Griffin Bros. (Tunkhannock). J. G. Robinson, Inc., produced and sold or used dimension sandstone (bluestone) as flagging stone.

York.—Medusa Portland Cement Co., York, produced Types I–II, waterproof white, gray portland, and "Brikset" and "Stoneset" mortar. Nine companies reported output of crushed limestone. The chief uses of the stone were for concrete aggregate, roadstone, blast-furnace and open-hearth flux, agricultural purposes, and cement and lime manufacture. Leading producers were Lincoln Stone, Inc., and Thomasville Stone & Lime Co. (both near Thomasville). Seventy-two percent of the stone produced was transported by trucks and 17 percent by railroad. The Funkhouser Mills, Division of the Ruberoid Co. (Delta), quarried, crushed, and ground slate at a local plant for use as natural granules and flour. Slate was exported to Canada and Venezuela. J. E. Baker Co. produced and sold dead-burned refractory dolomite from the York plant.

After a decline in 1957, the sand and gravel industry, comprised of Pennsylvania Supply Co. (York Haven) and Neuman Sand and Supply Co. (York), supplied paving sand and gravel, building sand, and sand for miscellaneous uses equal to the high demands made on the industry in 1956. Two divisions of Glen-Gery Shale Brick Corp. (Spring Garden and York Colonial) recovered miscellaneous clay for use at company plants to manufacture building brick. General Mining Association operated the Hokes mine 2 miles from Glenville to recover scrap mica. The mica was ground at the company local processing plant. Marlyn L. Fahs collected pyrite and limonite mineral specimens near York. The stone was kept as a collector's item and sold as gem material.

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The Mineral Industry of the Commonwealth of Puerto Rico, the Panama Canal Zone, and the Virgin Islands

The Puerto Rico section of this chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Mineralogy and Geology Section, Economic Development Administration, Commonwealth of Puerto Rico.

By W. G. Diamond [1] and Leovigildo Vazquez [2]

PUERTO RICO

MINERAL production in Puerto Rico in 1958 was valued at $17.7 million, nearly $2.6 million less than in 1957 and the first decrease in value since 1953.

Oil and gas wildcat exploration was reported. Cataract Mining Corp. acquired an oil and gas concession of nearly 356,000 acres. The metal-working industry continued to grow. New metal plants included Electronic Conductors, Inc., P. L. Robertson Manufacturing Co., Ltd., Girard Metal Furniture Manufacturing Corp., Anvil Metal Products, Inc., and Phelps Dodge Copper Products Corp. The Phelps Dodge plant equipment cost $1 million; output will include insulated building wires, cables, and appliance cords. Puerto Rico's

TABLE 1.—Mineral production in Puerto Rico [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement---376-pound barrels	5,552,357	$17,231,623	4,747,976	$15,175,498
Clays	158,813	139,813	165,489	82,745
Salt (common)	9,755	104,324	1,400	14,440
Sand and gravel	496,978	753,951	475,752	762,546
Stone	2,452,019	3,505,223	1,985,802	2,767,574
Value of items that cannot be disclosed: Certain nonmetals		180,204		272,191
Total Puerto Rico [2]		20,265,000		17,689,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] The total has been adjusted to eliminate duplication in value of clays and stone.

[1] Commodity-industry economist, Region IV, Bureau of Mines, Bartlesville, Okla.
[2] Geologist, Mineralogy and Geology Section, Economic Development Administration, Commonwealth of Puerto Rico.

first steel mill, Industrial Siderurgica, Inc., began producing concrete reinforcing steel bars late in 1957, and obtained a loan for expansion to meet the increasing local demand. No commercial mining of metals was reported in Puerto Rico in 1958.

REVIEW BY MINERAL COMMODITIES

Cement.—The cement industry operated at 81 percent of capacity. All cement was produced by the wet process. Value of shipments accounted for nearly 86 percent of the total value of mineral production in 1958. About 52 percent was shipped in bulk and 48 percent in paper bags. The United States received 32 percent of the shipments and other countries 3 percent.

TABLE 2.—Portland cement produced and shipped in Puerto Rico, in 376-pound barrels

Year	Production (barrels)	Shipments	
		Barrels	Value (thousands)
1949–53 (average)	3,478,833	3,458,428	$9,103
1954	3,600,064	3,682,187	9,663
1955	4,193,592	4,116,739	12,507
1956	4,234,284	4,254,701	14,065
1957	5,500,553	5,552,357	17,232
1958	4,861,862	4,747,976	15,175

Clays.—In addition to the clay used in cement manufacture, miscellaneous clay was produced near Carolina in San Juan District for manufacturing heavy-clay products and near Hato Rey for studio pottery. Output of miscellaneous clay was slightly greater than in 1957.

Lime.—Production of lime was less than in 1957. The principal market for lime was the raw-sugar industry. Limestone for making lime was quarried as calcareous sand from Cayo Hicaco on the northeast coast of Puerto Rico. Lime was produced in Humacao and Mayaguez Districts.

Salt.—Salt output was much less than in 1957. Inclement weather and labor problems contributed to the decrease. Salt was produced by evaporating sea water in Mayaguez District.

Sand and Gravel.—Large quantities of sand and gravel were produced from rivers and beaches in all parts of Puerto Rico, including the beach area east of San Juan and two large beach pits at Ramey Air Force Base. It was used chiefly for concrete aggregate. Silica sand was produced for use by the glass and ceramic industries and as an abrasive in polishing imported marble.

Stone.—Crushed limestone was produced in six of the seven districts and used principally for aggregate. Dimension limestone was quarried in three districts and used in rough construction and as rubble. Crushed miscellaneous stone was produced in one district for concrete aggregate.

TABLE 3.—Stone sold or used by producers in Puerto Rico

Year	Dimension limestone		Crushed limestone [1]		Miscellaneous stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value (thousands)
1954	99,889	$211,476	1,639,684	$2,252,812	12,423	$28,539	[2] 1,751,996	[2] $2,493
1955	86,077	187,842	1,697,833	2,327,918	----------	----------	1,783,910	2,516
1956	75,168	142,626	2,001,285	2,412,959	----------	----------	2,076,453	2,556
1957	178,619	356,132	2,225,139	3,084,743	48,261	64,348	2,452,019	3,505
1958	148,146	281,058	1,777,656	2,351,516	60,000	135,000	1,985,802	2,768

[1] Includes limestone for cement and lime.
[2] Excludes crushed sandstone.

MINERAL FUELS

Petroleum.—Caribbean Refining Co. increased the capacity of its refinery to 15,000 barrels per day, and Commonwealth Oil Refining Co., Inc., increased its refinery capacity to 65,000 barrels per day.[3] Latin-American crude was processed. Gonzalez Chemical Industries, Inc., manufactured anhydrous ammonia and ammonium sulfate from crude oil at its plant near Guanica. Construction of an ethylene oxideglycol plant was begun by Union Carbide Chemicals Co.[4]

REVIEW BY DISTRICTS

Aguadilla.—Rafael Falcon and General Builders Supplies, Inc., quarried and crushed limestone for concrete aggregate and roadstone. Eugenio Natali quarried dimension limestone. Production of sand was reported by F. J. Rosello; U.S. Army Corps of Engineers; and Department of Public Works, Commonwealth of Puerto Rico.

Arecibo.—Limestone was quarried and crushed for concrete aggregate and roadstone by Cantera de Casanovas.

Guayama.—Planta de Grava Del Turabo, Inc., produced paving sand and gravel.

Humacao.—Limestone was quarried by Planta de Cal "Hicaco," Inc., for use in manufacturing hydrated lime. Building sand was also produced.

Mayaguez.—Juan De Toro Seda, Cantera Bravo, Eugenio Natali, and Jose A. Vallejo quarried and crushed limestone for concrete aggregate and roadstone. Antonio Santos, Jr., produced crushed and dimension limestone. Liborio Lopez Sanchez produced crushed limestone, paving sand, and paving gravel. Conrado Forestier crushed miscellaneous stone for concrete aggregate and roadstone. Lime was manufactured by South Puerto Rico Sugar Works. Carlos M. Ramirez Acosta and Salinas del Papayo, Inc., recovered salt by evaporating sea water.

Ponce.—Ponce Cement Corp. manufactured portland cement. Limestone was quarried and crushed for concrete aggregate and roadstone by Cement Products Corp. and Ismaro Torruellas. Ponce Aggregates Corp. and the Department of Public Works, Commonwealth of Puerto Rico, mined sand and gravel from local deposits.

[3] Oil and Gas Journal, vol. 57, No. 14, Mar. 30, 1959, p. 142.
[4] Oil and Gas Journal, vol. 56, No. 35, Sept. 1, 1958, pp. 136–137.

TABLE 4.—Value of mineral production in Puerto Rico, by districts

District	1957	1958	Minerals produced in 1958 in order of value
Aguadilla	$223,897	$136,414	Stone, sand and gravel.
Arecibo	87,433	21,136	Stone.
Guayama	57,021	19,200	Sand and gravel.
Humacao	411,118	501,031	Lime, sand and gravel.
Mayaguez	549,662	294,907	Stone, sand and gravel, salt, lime.
Ponce	12,238,479	10,824,274	Cement, stone, sand and gravel.
San Juan	6,697,857	5,892,529	Cement, stone, sand and gravel, clays
Total	20,265,000	17,689,000	

San Juan.—Puerto Rico Cement Corp. produced portland cement at its Guaynabo plant. Undressed dimension limestone was quarried for rough construction and rough architectural use and for use as rubble by Cantera Diaz, Cantera Ferrer, and Federico Gonzalez. Limestone was crushed for use as concrete aggregate and roadstone by Ramos Hermanos, Inc., Cantera Diaz, Compania de Ing y Contratistas, Venancio Morales, and Ramon Lopez Rodriguez. Puerto Rico Clay Products, Inc., mined shale for manufacturing heavy-clay products. Paving sand and gravel was produced by Las Vegas Sand & Gravel Corp. and the Department of Public Works, Commonwealth of Puerto Rico.

PANAMA CANAL ZONE

Sand and gravel and stone were produced in the Canal Zone in 1958. Value of mineral production was much greater than in 1957 owing to the increased output of stone and the reporting of sand and gravel output. No sand and gravel production was reported for 1957.

TABLE 5.—Mineral production in the Panama Canal Zone and Virgin Islands [1]

Mineral	1957		1958	
	Short tons	Value	Short tons	Value
Canal Zone:				
Sand and gravel			41,006	$34,616
Stone (crushed) [2]	59,407	$98,897	140,464	236,848
Total Canal Zone		99,000		271,000
Virgin Islands: Stone (basalt)	11,500	31,000	25,296	81,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Includes basalt.

REVIEW BY MINERAL COMMODITIES

Basalt.—Basalt was quarried and crushed for concrete aggregate and roadstone by the Panama Canal Co.

Sand and Gravel.—Panama Sand Co. produced building and paving sand from local deposits.

Stone.—The United States Army—Caribbean quarried and crushed miscellaneous stone for concrete aggregate, roadstone, and riprap.

TABLE 6.—Crushed basalt and miscellaneous stone sold or used by producers in the Panama Canal Zone

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	95,122	$148,510	1956	177,250	$229,750
1954	187,446	245,170	1957	59,407	98,897
1955	169,485	239,280	1958	140,464	236,848

TABLE 7.—Sand and gravel sold or used by producers in the Panama Canal Zone

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	47,103	$49,600	1956	40,095	$48,673
1954			1957		
1955	35,910	47,229	1958	41,006	34,616

VIRGIN ISLANDS

Stone output in the Virgin Islands was more than double that in 1957. No other minerals were produced.

REVIEW BY MINERAL COMMODITIES

Basalt.—Basalt for concrete aggregate, roadstone, and riprap was quarried and crushed by the Government of the Virgin Islands, Hams Bay Crushing plant, Springfield Crushing plant, and Monserrate Garcia. All production was on St. Croix Island.

TABLE 8.—Crushed basalt sold or used by producers in St. Croix Island, Virgin Islands

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	[1] 6,506	$21,241	1956	11,591	$31,983
1954	3,939	17,134	1957	11,500	31,000
1955	875	4,900	1958	25,296	80,856

[1] Includes miscellaneous stone.

The Mineral Industry of Rhode Island

By Joseph Krickich [1]

THE VALUE of mineral production in Rhode Island in 1958 exceeded $2 million and was the highest ever recorded. The increase was due primarily to accelerated highway construction calling for more sand and gravel and stone production.

TABLE 1.—Value of mineral production in Rhode Island by counties,[1] in thousand dollars

County	1957	1958	Minerals produced in 1958 in order of value
Kent	$493	$951	Sand and gravel.
Newport	(2)	(2)	Sand and gravel, stone.
Providence	761	1,058	Sand and gravel, stone, graphite.
Washington	(2)	(2)	Sand and gravel.
Undistributed	115	240	
Total	1,369	2,249	

[1] No production was reported from Bristol County.
[2] Figure withheld to avoid disclosing individual company confidential data, included with "Undistributed."

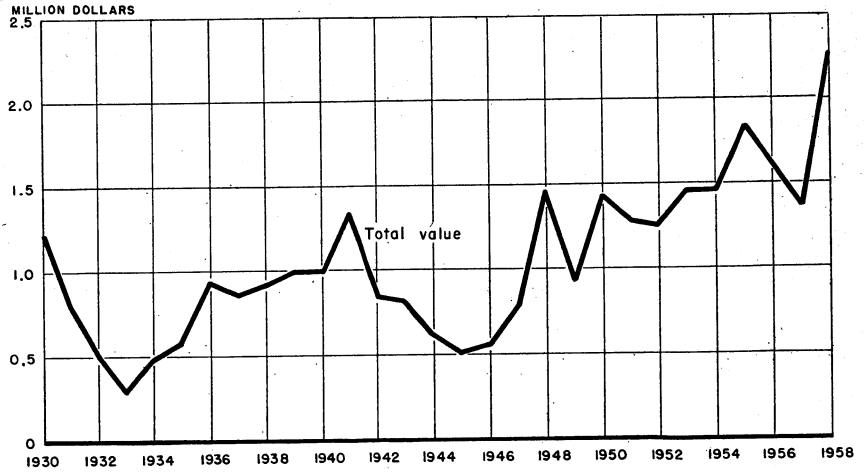

FIGURE 1.—Total value of mineral production in Rhode Island, 1930–58.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Graphite.—Decreased demand for graphite used in preparing foundry facings and as a paint pigment caused sales of Rhode Island's natural amorphous graphite to decline in 1958. The graphite was recovered from a former meta-anthracite mine in Providence County.

Sand and Gravel.—Sand and gravel continued as the leading mineral commodity produced in the State. Production in 1958 totaled 2,038,000 short tons valued at $1,883,000, 93- and 78-percent increases over 1957. The substantial increase was due primarily to a greater demand for paving material for highway and airport construction and maintenance. Output of sand and gravel used exclusively for paving purposes by Government-and-contractor operations in 1958 composed 23 percent of the total output, compared with only 2 percent in 1957. Contract work for the State was particularly active in Kent County, where large quantities of paving sand and gravel were produced.

In addition to paving sand, quantities of building, molding and fire sand, and sand and gravel used for fill and other miscellaneous applications were produced. However, all uses except molding sand increased; the output of molding sand dropped because of decreased demand by Rhode Island's foundry industry.

The total number of reporting commercial producers remained at 19, and 18 of them were stationary operations. The average value per ton of total commercial sand and gravel dropped from $1.01 in 1957 to $0.97 in 1958. In 1958, 67 percent of the State's total output was washed, screened, or otherwise prepared, compared with 79 percent in 1957.

Stone.—Limestone, granite, and miscellaneous stone, in decreasing order of value, were quarried in the State in 1958. Total stone tonnage and value increased 37 and 28 percent, respectively. The increase was due primarily to greater demand for granite for riprap, concrete aggregate, and roadstone. Output of limestone, used mostly for agricultural purposes, and of miscellaneous stone, used entirely as concrete aggregate and roadstone, dropped during the year. Stone production was reported from three quarries, two in Providence County and one in Newport County.

METALS

Foundries.—Numerous foundries throughout the State were active in 1958, producing primarily aluminum, brass, bronze, grey iron, and malleable castings.

Iron and Steel.—Washburn Wire Co. produced steel at Phillipsdale and utilized four basic open-hearth furnaces with an annual capacity of 93,000 tons of steel ingots. Raw materials consumed at the plant were pig iron, scrap iron and steel, primary metals, and ferro-alloys. Most of the raw materials consumed at the plant were shipped from outside the State. In addition to this plant, two steel rolling mills at Pawtucket had a combined capacity of 28,000 tons of cold rolled strip steel.

Iron and Steel Scrap.—Ferrous scrap dealers were active in Providence, Newport, Westerly, and Pawtucket. Shipments from yards

during the year consisted mainly of No. 1 and No. 2 Heavy Melting steel, bundles, and cast-iron scrap other than borings.

Metal Smelters and Refiners.—Nonferrous scrap was smelted and refined at Providence to produce pig tin, pig lead, solder, babbitts, and caulking leads.

REVIEW BY COUNTIES

Compared with 1957, mineral valuation increased in all counties. The greatest increase was in Kent County, due to larger production of sand and gravel for highway construction. Paving sand and gravel was produced under contract in Kent and Providence Counties for the Division of Roads and Bridges, Department of Public Works, of the State of Rhode Island.

Kent.—Kent County replaced Providence County as the leading sand-and-gravel-producing area and supplied 49 percent of State's total output. Production of sand and gravel in Kent County increased from 466,000 tons in 1957 to 997,000 in 1958. Of the 1958 total, 46 percent was produced by Government-and-contractor operations. Commercial production was reported from four producers in 1958 compared with five in 1957. Most of the output was used for paving and building purposes. Molding sand was produced by Whitehead Brothers Co. at a stationary plant near Washington. Other producers who operated stationary plants were Rhode Island Sand & Gravel Co. and Luigi Vallone, Inc., both near Warwick, and Barber Sand & Gravel, Coventry.

Newport.—The county ranked third in valuation among the State's four mineral-producing counties. Callan Construction Corp. produced paving sand and gravel near Portsmouth. E. R. Viera produced limited quantities of sand for paving and ice control. Both granite and conglomerate stone were quarried near Middletown by Peckham Bros., Inc. Total stone output was crushed for use as concrete aggregate and roadstone.

Providence.—Output of sand and gravel by commercial producers in the county increased 65 percent in 1958 compared with the previous year. In addition, the number of active reporting commercial producers increased from 9 in 1957 to 10 in 1958. Most producers in the county washed, screened, or otherwise prepared their material chiefly for paving and building purposes. One company reported production of sand and gravel for use in airport construction at Hillsgrove. Producers were: A. Cardi Construction Co., Inc., Del Bonis Sand & Gravel, and M. A. Gammino Construction Co., all of Cranston; L. Romano Construction Co., East Providence; Courtois Sand & Gravel Co., Providence; Tasca Sand & Gravel Co., Smithfield; Town Line Sand & Gravel, Slatersville; and General Road Trucking, Pawtucket Sand & Gravel, and R. A. Bergesson & Sons.

Output of crushed limestone from the Lincoln quarry of Conklin Limestone Co., Inc., dropped in 1958 owing to adverse weather conditions. A large part of the limestone was used for agricultural purposes; the remainder was used as blast-furnace flux and roofing gravel. Crushed limestone was not sold for use in manufacturing cement, as in previous years. Fanning & Doorley Construction Co., Inc. (Berkeley), produced crushed and broken granite for riprap,

concrete aggregate, and road material. Providence Granite Co. fabricated building and architectual granite at its yard in Providence. The company utilized granite quarried in Massachusetts and Maine by subsidiary companies. Graphite Mines, Inc., operated its natural amorphous graphite mine and crusher near Cranston.

Washington.—Production and value of sand and gravel in Washington County increased 33 and 32 percent, respectively. The material was used primarily for paving and building purposes, as well as for ice control and fill material. Producers were South County Sand & Gravel Co. and Louis B. Schaffer, both of Peace Dale, and J. Romanella & Sons.

The Mineral Industry of South Carolina

This chapter has been prepared under a cooperative agreement for collecting mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior and the South Carolina Geological Survey.

By Lawrence E. Shirley [1] and Laurence L. Smith [2]

MINERAL production in South Carolina attained a record value in 1958 for the fourth consecutive year.

South Carolina led the States in producing rare-earth metals and ranked second in output of kaolin, kyanite, vermiculite, and zircon and fourth in mica output. The principal industries were manufacturing cement, mining and processing clays, and mining crushed stone. Leading companies were Carolina Giant Division of Carolina Giant Cement Co. (portland, masonry cement, clays, and marl), Campbell Limestone Co. (crushed granite and limestone), and J. M. Huber Corp. (kaolin).

TABLE 1.—Mineral production in South Carolina [1]

Mineral	1957		1958	
	Thousand short tons (unless otherwise stated)	Value (thousand)	Thousand short tons (unless otherwise stated)	Value (thousand)
Clays	937	$5,161	929	$5,157
Gem stones			(2)	(3)
Mica (sheet)—pounds	2,278	12	1,144	8
Peat—short tons			4,865	(4)
Sand and gravel	2,647	2,571	2,946	2,858
Stone [5]	3,413	4,581	3,637	5,229
Zirconium concentrate—short tons	(4)	(4)	141	5
Value of items that cannot be disclosed: Barite, cement, kyanite, scrap mica, rare-earth-metal concentrates, staurolite, stone (dimension granite—1957, marl, and limestone), titanium, vermiculite, and values indicated by footnote 4		10,491		9,586
Total South Carolina [6]		22,168		22,412

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $1,000.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Excludes dimension granite (1957), marl, and crushed limestone, included with "Value of items that cannot be disclosed."
[6] Total adjusted to eliminate duplicating the value of clays and stone.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Knoxville, Tenn.
[2] State geologist, South Carolina Geological Survey, Columbia, S.C.

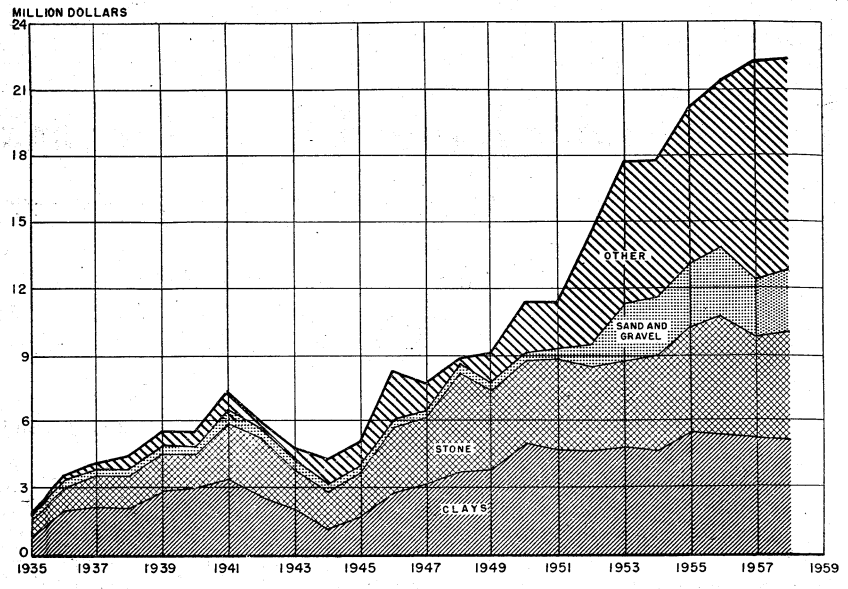

FIGURE 1.—Value of clays, stone, sand and gravel, and total value of minerals produced in South Carolina, 1935–58.

Trends and Developments.—Three ports, Charleston, Port Royal, and Georgetown, were expanded in a $21-million program to insure handling the increasing volume of foreign shipping.

The U.S. Atomic Energy Commission joined with the Carolinas-Virginia Nuclear Power Associates, Inc., in building a 17,000-kw., pressurized-water, nuclear powerplant at a total estimated cost of $37 million. The plant is on the Broad River, northwest of Columbia,

TABLE 2.—Employment and injuries in the mineral industries

Industry	1957						
	Active operations	Men working daily	Average active days	Man-days worked	Fatal injuries	Nonfatal injuries	Injuries per million man-days
Nonmetal mines	31	936	238	223,086	----------	31	139
Quarries and mills	12	614	268	164,603	----------	36	219
Sand and gravel mines	27	258	216	55,843	----------	11	204
Metal mines	1	38	296	11,250	----------	1	89
Total	71	1,846	246	454,782	----------	79	174
	1958 [1]						
Nonmetal mines	34	841	242	203,940	1	31	157
Quarries and mills	16	659	255	168,116	----------	22	131
Sand and gravel mines	26	275	241	66,213	----------	13	196
Total	76	1,775	247	438,269	1	66	153

[1] Preliminary figures.

and is part of a company program to study the economics of nuclear energy.

A $100-million, multipurpose development by the U.S. Corps of Engineers was underway in the Hartwell Dam project on the Savannah River as part of a federally sponsored, long-range program for comprehensive development of the Savannah River Basin. The dam consists of a 900,000-yard concrete dam and spillway flanked by earth embankments, a reservoir, and a powerplant. Its purposes are to reduce flood damage, generate hydroelectric power, and regulate river flow to facilitate barge transportation.

Exploration for aluminum ore declined. Piedmont Properties, Inc., Spartanburg, organized by the Aluminum Co. of America to search for alumina-bearing materials, stopped its investigation; Kaiser Aluminum & Chemical Corp., Greenville, closed its land acquisition office and stopped obtaining prospecting options.

Legislation and Government Programs.—The South Carolina General Assembly took several actions to promote industrial development: (1) State corporate tax laws were amended to remove raw-materials inventory from property-tax assessments and eliminate the cost of raw materials in computing income tax. This action came as a result of a recommendation from a legislative tax-study committee. (2) A joint resolution dedicated the General Assembly to maintaining a governmental atmosphere favorable to business expansion. (3) Legislation was enacted creating a Business Development Corporation through which private funds may be used to assist new industry.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Industrial Minerals, Inc., Cherokee County, the only barite producer in the State, decreased output 14 percent. The crude barite was ground for use by the rubber industry as a filler and was shipped out of State.

Cement.—Carolina Giant Division of Giant Portland Cement Co. produced masonry and portland cement at Harleyville (Dorchester County). Masonary production increased 84 percent, and portland production decreased slightly. The company began marketing mortar cement in addition to four other types of cement.

Plant expansion in 1957–58 increased capacity approximately fourfold. New equipment included a third kiln 350 feet long, ten 10,000-barrel concrete storage silos each 100 feet high, and a 11½- by 17-foot cylindrical finish mill in closed circuit with an air separator. It was estimated that the marl reserve on the company's Harleyville property would last 75 years and the usable clay reserve 15 or 20 years, based on enlarged productive capacity.

Clays.—Total production of clays was approximately the same as in 1957. Kaolin production increased 7 percent in quantity and 2 percent in value; miscellaneous-clay output and value declined 5 and 14 percent, respectively. Kaolin was produced at 13 mines in Aiken and Richland Counties and miscellaneous clay for cement and heavy-clay products at 10 mines in Dorchester, Fairfield, Greenwood, Lancaster, Lexington, Marion, and Marlboro Counties. The leading kaolin pro-

TABLE 3.—Kaolin sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Rubber	216,104	$2,855,153	$13.21	202,373	$2,704,814	$13.37
Insecticides and fungicides	23,974	309,356	12.90	25,938	341,409	13.16
Whiteware	(1)	(1)	(1)	12,863	169,074	13.14
Exports	(1)	(1)	(1)	3,798	49,374	13.00
Chemicals	1,572	20,766	13.21	1,600	21,792	13.62
Plaster and plaster products	1,100	14,531	13.21	1,200	16,344	13.62
Floor and wall tile				150	1,950	13.00
Other uses [2]	110,948	1,390,376	12.53	129,613	1,359,606	10.49
Total	353,698	4,590,182	12.98	377,535	4,664,363	12.35

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[2] Includes firebrick and block, saggers, pins, stilts, and other refractories; paper filling, linoleum and oil cloth, paint, fertilizers, and other fillers; absorbent and other miscellaneous uses.

ducer was J. M. Huber Corp., and the leading miscellaneous-clay producer was Carolina Giant Division of Giant Portland Cement Co. South Carolina ranked second among the States in production of kaolin. In 1957–58 Guignard Brick Co., Richland County, completed an expansion program that included constructing buildings for a machineroom and a kiln-drier unit. A color-development program also was undertaken. Columbia Brick & Tile Co., a division of the Richland Shale Products Co., Richland County, had underway an expansion program providing for ultimate installation of duplicate facilities. Southern Brick Co., Greenwood County, completed an expansion and modernization program begun in 1956; new installation included a 325-foot tunnel kiln with automatic controls, an aluminum-sheeted-pipe and frame building to house the productive unit, and production-management offices. A brick and tile plant was constructed by the Eastern Brick & Tile Co. at Conway, Horry County.

Gem Stones.—Sillimanite crystals from Oconee County were sold to collectors and to tourists as souvenirs.

Kyanite.—The quantity and value of kyanite output decreased 25 and 41 percent, respectively. Commercialores, Inc., Henry Knob mine, York County, was the only producer in the State. Material was shipped out of State to producers of refractory products.

Mica.—Sheet and scrap mica were recovered from pegmatite deposits in Abbeville, Anderson, Greenville, Lancaster, Oconee, and Spartanburg Counties. Production of full-trimmed sheet mica came from 11 operations in five counties and declined 6 percent in quantity and 37 percent in value from 1957. Sheet mica was sold to the GSA Materials Purchasing Depot, Spruce Pine, N.C., at an average price of $6.58 per pound. Southern Mining Co., Anderson County, was the leading producer of sheet mica. Mineral Mining Corp., Lancaster County, recovered scrap mica from mica schist at the Kershaw mine and operated a dry-grinding mill for producing ground mica, which was used for paint, pipeline enamel, and welding rods.

Sand and Gravel.—Increased sand and gravel production was attributable to new State and Federal highway programs, building,

TABLE 4.—Sand and gravel sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Aiken	106,337	$116,808	(1)	(1)
Anderson	1,110	470	3,099	$1,147
Chester	3,308	1,323	4,185	1,674
Dorchester	23,221	17,923	22,584	16,623
Greenville	100,127	51,612	48,922	27,543
Horry	(1)	(1)	245,430	212,700
Kershaw	1,000	420	(1)	(1)
Lexington	459,635	225,521	472,973	229,582
Marion	4,381	4,381	(1)	(1)
Oconee	17,440	17,300	6,294	2,329
Pickens	400	170		
Spartanburg	2,475	1,238	12,159	11,855
Union	2,500	1,250		
York	600	250	1,775	657
Undistributed [2]	1,924,846	2,142,494	2,128,890	2,354,042
Total	2,647,380	2,571,160	2,946,311	2,858,152

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes production from the following counties: Charleston, Cherokee, Chesterfield, Florence, Jasper, Marlboro, Richland, and Sumter, also values indicated by footnote 1.

and construction of a flood-control dam in a nearby State by the U.S. Army Corps of Engineers. Sand and gravel was produced at 27 operations in 20 counties; leading producing counties were Marlboro, Lexington, and Horry, in that order. Structural sand was produced in 15 counties by 22 operations, paving sand in 4 counties by 4 producers, engine sand in 3 counties by 4 producers, and filter sand in 2 counties by 3 operators. Structural and paving gravel was produced by two operators. The South Carolina State Highway Department produced 34,295 tons of paving sand valued at $13,988 from 12 counties, compared with 50,000 tons valued at $22,000 from 15 counties in 1957. Shipments of sand by railroad decreased 25 percent and shipments of gravel 20 percent; shipments by truck increased 44 and 18 percent, respectively, above 1957. Washed sand and gravel increased 8 percent in tonnage and 10 percent in value

TABLE 5.—Sand and gravel sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Structural sand	784,454	$395,316	$0.50	1,137,136	$592,628	$0.52
Paving sand	361,545	134,432	.37	425,781	189,941	.45
Engine sand	35,344	32,087	.91	22,233	21,596	.97
Filter sand	4,312	15,585	3.61	(1)	(1)	(1)
Other sand and gravel [2]	1,461,725	1,993,740	1.36	1,361,161	2,053,987	1.51
Total	2,647,380	2,571,160	.97	2,946,311	2,858,152	.97

[1] Figure withheld to avoid disclosing individual company confidential data. Included with "Other sand and gravel."
[2] Includes glass, blast, fire or furnace, filter, and railroad-ballast sands and structural, paving and railroad-ballast gravel.

over 1957. Leading producers of sand and gravel were Becker County Sand and Gravel Co., Marlboro County; Perry Minerals Co., Aiken County; and J. F. Cleckley Co., Horry County.

Whitehead Bros. Co., Kershaw County, completed construction of an industrial sand plant at Lugoff, said to be the first operation of its kind in South Carolina. The plant consisted of two major sections, a washing and sizing plant and a drying plant; other facilities include four large storage silos, a warehouse, and an office building. Capacity of the washing plant was 50 tons per hour; that of the drying plant was 30 tons per hour. Products included four basic grades of sand, which can be blended to fit a variety of specifications, particularly those for molding sand.

Staurolite.—Output of staurolite sand recovered as a coproduct of monazite, increased. It was used in portland-cement manufacture and as a sand-blasting material.

Stone.—Stone production increased 5 percent in quantity and value. Crushed granite rose 6 percent in tonnage and 7 percent in value, setting an alltime peak for production in the State; dimension granite decreased 13 percent in tonnage but increased 16 percent in value owing to a rise in the unit price; limestone and marl decreased 1 percent in tonnage and increased 7 percent in value.

Crushed granite was produced in seven counties (Fairfield, Greenville, Lexington, Oconee, Pickens, Richland, and Spartanburg), dimension granite in two counties, and crushed limestone and marl in two counties. Campbell Limestone Co., Pickens County, Palmetto Quarries, Inc., Richland County, and Weston & Brooker Co., Lexington County, were the three largest producers of crushed granite. Dimension granite, sold as rough monumental stone, was produced by Comolli Granite Co. and Winnsboro Granite Co., Fairfield County, and Kershaw Granite Co., Kershaw County. Crushed limestone was used for concrete, roadstone screenings, and fertilizer filler. Campbell Limestone Co., Cherokee, County, and Volunteer Portland Cement Co., Dorchester County, were the only two producers of crushed limestone. Carolina Giant Division of Carolina Giant Cement Co., Dorchester County, produced marl for use in cement manufacture.

TABLE 6.—Crushed granite sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roadstone	2,957,570	$4,254,876	$1.44	2,922,265	$4,229,973	$1.45
Railroad ballast	225,600	176,300	.78	421,167	482,999	1.15
Other [1]	230,259	149,335	.65	281,357	171,869	.61
Total	3,413,429	4,580,511	1.34	3,624,789	4,884,841	1.35

[1] Includes riprap, stone sand, and other uses.

An information circular [3] described methods employed at the Liberty quarry in producing a million tons of granite annually.

Vermiculite.—Output of crude vermiculite did not change appreciably from that recorded in 1957. Zonolite Co., Spartanburg County, was the principal producer; Alabama Vermiculite Co., Laurens County, mined a smaller tonnage. Zonolite Co. operated its exfoliating plant at Travelers Rest and shipped crude ore to out-of-State exfoliating plants.

METALS

Rare-Earth-Metal Concentrates.—Monazite concentrate was produced by Heavy Minerals Co., Aiken County, as a coproduct of rutile and zircon. Output decreased 71 percent in tonnage and 76 percent in value from 1957.

Titanium Concentrates.—Rutile production declined 91 percent in tonnage and 94 percent in value from 1957. Heavy Minerals Co., Aiken County, was the sole producer. No output of ilmenite was reported.

Zirconium.—Zircon-sand production declined considerably from 1957. Heavy Minerals Co., Aiken County, was the sole producer. Orefraction Minerals, Inc., Andrews, Georgetown County, completed and began operating a $600,000 grinding plant. The plant is automatic, using a conical ballmill in closed circuit with a gyroclassifier. Capacity of the mill is 2 tons per hour when grinding to 200-mesh and 1 ton per hour when grinding to 400-mesh. Another mill with approximately half this capacity was being installed. Zircon was ground for foundry use and the ceramics industry. The plant is near the major domestic zircon sources and the port of Charleston.

REVIEW BY COUNTIES

Mineral production was recorded in 27 of the 46 counties in the State. Dorchester and Aiken, for the third consecutive year, furnished more than 50 percent of the total mineral-production value. Fairfield, Lexington, Marlboro, Richland, and Spartanburg each produced more than $1 million; other important producers were Pickens, Greenville, Cherokee, Sumter, and York Counties.

Abbeville.—Harold B. King, Sr., produced sheet mica from Clinkscales No. 2 mine.

Aiken.—Aiken was the second most important mineral-producing county in the State for the third consecutive year. Seven companies at 11 mines produced 344,000 tons of kaolin valued at $4,582,000, as follows: Bell Kaolin Co. (Batesburg mine), Dixie Clay Co. (McNamee mine), J. M. Huber Corp. (Barden and Paragon mines), International Clay Co. (International mine), National Kaolin Products Corp. (Aiken mine), Southeastern Clay Co. (Flock, Johnson, Rodgers, and Toole mines), and United Clay Mines Corp. (No. 7 mine) Heavy Minerals Co. mined monazite, rutile, staurolite, and zircon at Horse Creek mine. Mining was suspended in March. Perry Minerals Co., Inc., operating the Horse Creek Heavy Minerals Co. prop-

[3] Alfred, Robert, and Schroeder, H. J. Methods and Practices for Producing Crushed Granite, Campbell Limestone Co., Pickens County, S.C.; Bureau of Mines Inf. Circ. 7857, 1958, 24 pp.

TABLE 7.—Value of mineral production in South Carolina, by counties[1]

County	1957	1958	Minerals produced in 1958 in order of value
Abbeville		$177	Mica.
Aiken	(2)	(2)	Kaolin, sand and gravel, monazite, staurolite, rutile, zircon.
Anderson	$5,482	4,069	Mica, sand and gravel.
Charleston	(2)	(2)	Sand and gravel.
Cherokee	(2)	(2)	Limestone, barite, sand and gravel.
Chester	1,323	1,674	Sand and gravel.
Chesterfield	(2)	(2)	Do.
Colleton		(2)	Peat.
Dorchester	(2)	(2)	Cement, marl, miscellaneous clay, limestone, sand and gravel.
Fairfield	(2)	(2)	Granite, miscellaneous clay.
Florence	(2)	(2)	Sand and gravel.
Greenville	653,205	660,647	Granite, sand and gravel, mica.
Greenwood	83,000	86,130	Miscellaneous clay.
Horry	(2)	212,700	Sand and gravel.
Jasper	(2)	(2)	Do.
Kershaw	420	(2)	Granite, sand and gravel.
Lancaster	(2)	(2)	Mica, miscellaneous clay.
Laurens	(2)	(2)	Vermiculite.
Lexington	(2)	(2)	Granite, sand and gravel, miscellaneous clay.
Marion	(2)	(2)	Miscellaneous clay, sand and gravel.
Marlboro	(2)	(2)	Sand and gravel, miscellaneous clay.
Oconee	7,666	(2)	Granite, sand and gravel, mica, gem stones.
Pickens	(2)	(2)	Granite.
Richland	725,107	(2)	Granite, kaolin, sand and gravel.
Spartanburg	(2)	(2)	Vermiculite, granite, sand and gravel, mica.
Sumter	(2)	(2)	Sand and gravel.
Union	1,250		
York	(2)	(2)	Kyanite, sand and gravel.
Undistributed	20,690,609	21,446,503	
Total	22,168,000	22,412,000	

[1] The following counties are not listed because no production was reported: Allendale, Bamberg, Barnwell, Beaufort, Berkeley, Calhoun, Clarendon, Darlington, Dillon, Edgefield, Georgetown, Hampton, Lee, McCormick, Newberry, Orangeburg, Saluda, and Williamsburg.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

erty, was the second largest producer of sand and gravel in the State; production and value increased 54 and 40 percent, respectively, over 1957. South Carolina State Highway Department mined paving sand for its own use.

Anderson.—Stokes Buchanan (Buchanan and Emma mines), Frank Holland (Holland mine), and Southern Mining Co. (Gilliard mine) mined sheet mica. Paving sand was produced by the State highway department for its own use; tonnage and value more than doubled over 1957.

Charleston.—Edisto Sand & Gravel Co. (Edisto mine) and Sandrying Co. (North Charleston mine) produced structural sand for concrete and mortar, also engine sand.

Cherokee.—Industrial Minerals, Inc. (Kings Creek mine), produced barite; tonnage and value decreased slightly from 1957. Campbell Limestone Co. (Blacksburg quarry) crushed limestone for concrete aggregate, roadstone, and agricultural use; production increased 33 percent in tonnage and 24 percent in value over 1957. Jobe Sand Co. (Blacksburg mine) and the State highway department mined engine and paving sand.

Colleton.—Ti-Ti Humus Co., Inc., produced 4,865 tons of peat for use as a soil conditioner. This output of humus peat was the first reported from the State.

Dorchester.—Dorchester County led the State in value of mineral production.

Carolina Giant Division of Carolina Giant Cement Co. produced miscellaneous clay and shale and mined marl for use in cement. The company mnaufactured portland and masonry cement; portland production decreased slightly from 1957 and masonry output increased 84 percent over 1957. The completion of a plant-expansion program raised productive capacity fourfold. Salisbury Brick Corp. (Salisbury mine) mined 22,000 tons of miscellaneous clay for use in its brick plant.

Volunteer Portland Cement Co. (Agstone Division) produced crushed agricultural limestone.

The State highway department mined paving sand. Hayes Sand Co. and Murray Sand Co. (Murray mine) produced structural sand.

Fairfield.—Rion Crushed Stone Corp. (Rion quarry) and Palmetto Quarries Co. (Blair quarry) crushed granite for concrete aggregate, roadstone, and screenings. Winnsboro Granite Co. (Winnsboro quarry) and Comolli Granite Co. (Carolina Mahogany quarry) produced dimension granite for the monument industry. Richland Shale Products Co. (Richtex mine) mined miscellaneous clay and shale for use in its brick and tile plant.

Florence.—Coastal Sand Co. (Johnsonville mine) produced structural and paving sand; output and value increased 47 and 32 percent, respectively, over 1957.

Greenville.—Sheet mica was mined in small quantities by Joe L. Dunn (Knight No. 1 mine) and Ralph Burdette (Knight No. 2 mine). R. G. Garrison (Garrison mine) and James F. Zupan (Greenville mine) mined structural sand; the State highway department mined paving sand. Campbell Limestone Co. crushed 454,000 tons of granite from Lakeside quarry, which was used in the construction of roads, runways, etc.

Greenwood—Southern Brick Co. and Angus Brick & Tile Co. produced miscellaneous clay and shale for making brick from the Ninety-Six mine; production increased slightly over 1957.

Horry.—The Dobbs Co. (Dobbs mine) and E. P. Pitts Sand Corp. (Pitts mine) produced sand; J. F. Cleckley Corp. (Conway mine), a new operation, ranked third in the State in sand and gravel output, producing 200,000 tons of paving sand. Total sand production for the county increased 80 percent over 1957, owing to the new mine. Eastern Brick & Tile Co. constructed a new brick and tile plant at Conway.

Kershaw.—Kershaw Granite Co. Inc. (Kershaw quarry), produced dimension granite for the monument industry. Whitehead Bros. Co. completed construction of an industrial sand plant at Lugoff. Kershaw County Sand Co. produced more than 50 percent of the county output of structural sand. The State highway department mined paving sand.

Lancaster.—Mineral Mining Corp. (Kershaw mine) mined scrap mica, which was processed by dry grinding and used for paint, pipeline enamel, and welding rods. Ashe Brick Co. (Van Wyck mine) produced miscellaneous clay and shale for use in building brick.

Laurens.—Alabama Vermiculite Co. (Patterson mine) mined crude vermiculite.

Lexington.—Guignard Brick Co. (Columbia mine) produced miscellaneous clay and shale for use in manufacturing building brick.

Weston & Brooker Co. (Columbia quarry), the third largest producer of crushed granite in the State, crushed granite for concrete, road stone, screenings, railroad ballast, and stone sand. Columbia Silica Sand Co. (Columbia mine) and Foster Bros. Dixiana Sand Co. (Dixiana mine) produced structural, paving, furnace, engine, filter, and fertilizer-filler sand. Capitol Sand Co. (Capitol mine) and the State highway department mined 180,000 tons of paving sand. Southeastern Sand Co. (Cayce mine) produced structural sand.

Marion.—J. D. Murchison (Pee Dee mine) mined miscellaneous clay and shale for use in making building brick. Sandy Bluff Sand Co. (Snipes mine) produced building sand.

Marlboro.—Cheraw Brick Works, Inc. (Cheraw mine), and Palmetto Brick Co. (Irby mine) mined 91,000 tons of miscellaneous clay and shale for use in their respective brick plants. Becker County Sand & Gravel Co. (Marlboro mine), the leading producer of sand and gravel in the State, mined building sand, building and road gravel, and railroad-ballast gravel. Lawrence Stone & Gravel Co. (Blenheim mine) mined building sand for manufacturing concrete block.

Oconee.—Oconee County Granite Co. crushed granite for roadstone. Parks Brendle (Kerr mine) sold sheet and scrap mica. Benny Mason (Shirley mine) mined a few pounds of sheet mica. The State highway department produced paving sand. Bob Daniel, Toccoa, mined a small amount of gem-quality sillimanite crystals for sale to gem collectors and the tourist trade.

Pickens.—Campbell Limestone Co. (Beverly quarry), the only mineral producer in the county, produced broken and crushed granite for riprap, concrete, roadstone, screenings, and railroad ballast.

Richland.—Clay production increased considerably over 1957. Columbia Pipe Co. (Ridgewood mine), R. M. Stork Fire Brick Works (Stork mine), and Carolina Ceramics, Inc. (Pontiac mine), mined kaolin for refractories. Palmetto Quarries Co. (Columbia quarry) crushed granite for concrete, roadstone, screenings, railroad ballast, and stone sand. Strickland Sand Pits (Columbia mine) produced building and paving sand; Harrison Sand Corp. (Harrison mine) mined building and fertilizer-filler sand.

Spartanburg.—Spartanburg County ranked third in the State in value of mineral production. Vermiculite was mined and exfoliated by Zonolite Co. (Southern mine) at the same rate as in 1957. Campbell Limestone Co. (Pacolet quarry) produced broken and crushed granite for riprap, concrete, roadstone, screening, railroad ballast, and stone sand.

Shaffer's Sand Co. and State highway department mined building and paving sand. Joe Young (Pigeon mine) and J. E. Wilson mined and sold sheet mica to GSA Mica Purchasing Depot.

Sumter.—Becker County Sand & Gravel Co., the leading producer of sand and gravel in the State, mined sand and gravel for building and railroad ballast.

York.—Commercialores, Inc. (Henry Knob mine), mined kyanite for firebrick and tile; production decreased slightly from 1957. The State highway department mined paving sand.

The Mineral Industry of South Dakota

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the South Dakota State Geological Survey.

By D. H. Mullen [1] and Allen F. Agnew [2]

MINERAL production from the mines, quarries, and wells of South Dakota in 1958 was valued at $41.5 million, a 4-percent rise above 1957, and approached the record total of 1956. Substantial gains were recorded in the value of production of columbium-tantalum concentrate and sheet mica and shipments of cement. The value of the output of silver, gem stones, sand and gravel, and petroleum advanced moderately, but the value of gold recovered was only slightly higher. Interest increased in petroleum, and one new field was discovered in Harding County.

Employment.—The mineral industries employed an average of 2,475 workers throughout the year, compared with 2,612 in 1957. Average weekly wage was $88.59 for an average workweek of 44.7 hours, compared with $85.70 for a workweek of 44.6 hours in 1957. The general and contract construction industry, which includes much of the output of sand and gravel and crushed stone used in road building and heavy construction, employed an average of 9,325 workers; average weekly wage was $109.61 and average workweek 42.3 hours. In 1957 the totals were 9,125, $95.21, and 42.7, respectively. The weekly wage included base pay, overtime, and night differentials but did not represent take-home pay or wage rates.

Legislation and Government Programs.—Sheet and hand-cobbed mica, beryllium concentrate (beryl), and columbium-tantalum concentrate were purchased by the Federal Government through the General Services Administration (GSA) buying station at Custer for the strategic stockpile. The hand-cobbed mica was processed at the station by a contractor operating for GSA. Beryllium and columbium-tantalum concentrates and the sheet mica recovered at the station were shipped to stockpiles.

The Office of Mineral Exploration (OME) was established within the Department of the Interior to replace the Defense Minerals Exploration Administration (DMEA). No contracts were approved during the year; DMEA contracts in force continued to be serviced.

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TABLE 1.—Mineral production in South Dakota [1]

Mineral		1957		1958	
		Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Beryllium concentrate	gross weight	268	$145	240	$129
Clays [2]	thousand short tons	176	176	155	155
Coal (lignite)	do	21	79	20	78
Columbium-tantalum concentrate	pounds	2,311	6	4,294	10
Feldspar	long tons	41,316	267	23,229	145
Gem stones		[3]	15	[3]	16
Gold (recoverable content of ores, etc.)	troy ounces	568,130	19,885	570,830	19,979
Gypsum	thousand short tons	13	53	12	49
Mica:					
Scrap	pounds	1,626	43	1,003	24
Sheet		9,093	46	16,772	68
Sand and gravel	thousand short tons	14,758	8,001	14,705	9,179
Silver (recoverable content of ores, etc.)	thousand troy ounces	135	122	153	138
Stone	thousand short tons	1,718	5,068	1,395	4,095
Uranium ore		69,800	760	35,489	530
Value of items that cannot be disclosed: Cement, clays (bentonite), iron ore (1957), lime, lithium minerals (1958), and petroleum			6,090		7,555
Total South Dakota [4]			[5] 39,997		41,534

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite; value included with "Items that cannot be disclosed."
[3] Weight not recorded.
[4] Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.
[5] Revised figure.

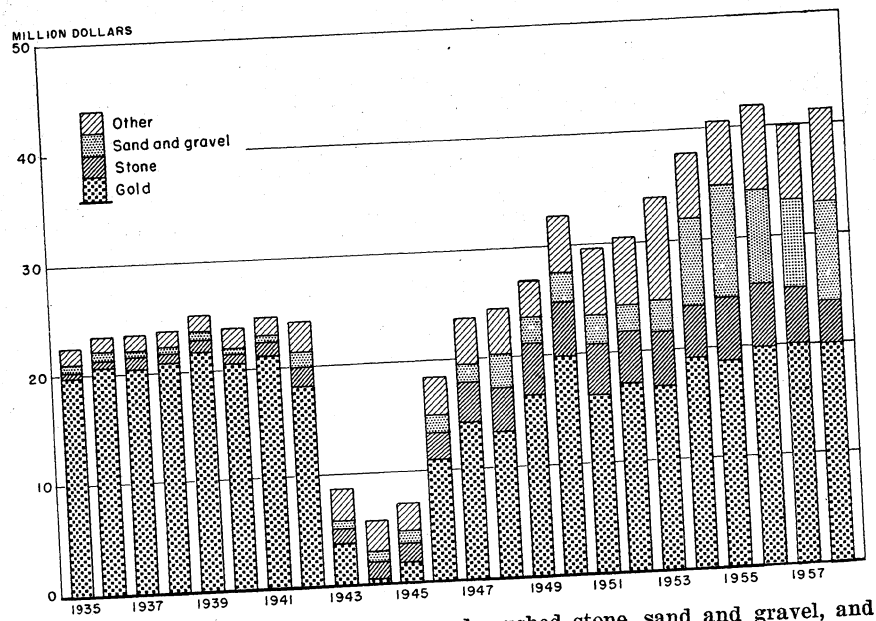

FIGURE 1.—Value of gold, dimension and crushed stone, sand and gravel, and total value of mineral production in South Dakota, 1935–58.

REVIEW BY COMMODITIES

METALS

Beryllium.—Beryllium concentrate (beryl) was produced hand-sorted in Custer and Pennington Counties as a coproduct of feldspar and mica mining. Output was 240 tons, 10 percent less than in 1957. The output was sold to the Government at the GSA purchase depot at Custer and to buyers who purchased small lots for resale to consumers.

Research on recovery of beryllium oxide from sintered products by leaching, fractional precipitation, and solvent extraction was continued at the Federal Bureau of Mines Experiment Station, Rapid City.

Columbium-Tantalum.—Columbium-tantalum concentrate was produced as a coproduct of mining feldspar and mica in Custer and Pennington Counties. The output was nearly double that of 1957. Except for a small quantity sold to a buyer for resale to consumers, the concentrate was sold to the Government (GSA) purchase depot at Custer.

Gold and Silver.—Gold and silver were produced at three mines in Lawrence County. Output of gold increased only slightly, whereas that of silver rose 13 percent over 1957. Homestake Mining Co. continued to be the Nation's leading gold producer.

Iron Ore.—The Colorado Fuel & Iron Corp. completed plans for extensive development of iron-ore deposits in the Black Hills, and planned a beneficiation plant.

TABLE 2.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)		Total value (thousand)
	Lode	Placer		Troy ounces	Value (thousand)	Troy ounces (thousand)	Value (thousand)	
1949–53 (average)	4	1	1,318	501,654	$17,558	132	$120	[3] $17,684
1954	2	--	1,601	541,445	18,951	151	137	19,088
1955	2	--	1,665	529,865	18,545	154	140	18,685
1956	2	--	1,743	568,523	19,898	136	123	20,021
1957	2	--	1,779	568,130	19,885	135	122	20,007
1958	3	--	1,824	570,830	19,979	153	138	20,118
1876–1958	--	--	[4]	27,118,406	730,741	11,286	8,346	[5] 739,252

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore or old tailings shipped directly to smelters during the year indicated.
[2] Does not include gravel washed.
[3] Includes 15 short tons of lead valued at $4,286 and 6 tons of zinc valued at $1,543.
[4] Data not available.
[5] Includes 106 short tons of copper valued at $36,466, 497 tons of lead valued at $71,752, and 265 tons of zinc valued at $56,406 produced before 1954.

Uranium.—Uranium ore was produced principally from mines in Fall River County, with a small output from Custer and Butte Counties. Production was 35,489 tons, a 49-percent decline from 1957. The average grade of ore increased from 0.17 percent uranium oxide per ton in 1957 to 0.20 percent in 1958. The capacity of the 300-ton-a-day processing plant at Edgemont, which operated the entire year,

was increased to 400 tons a day upon authorization of the Atomic Energy Commission (AEC), and process improvements also were completed. Most of the ore processed at the plant came from deposits in Wyoming.

A study begun by AEC to determine the adequacy of milling facilities in various producing areas was completed early in 1958. On the basis of this study a tentative allocation of 600 tons a day was assigned to the uraniferous lignite deposits in North and South Dakota. Proposals to construct a plant were under consideration, but none had been approved at yearend.

NONMETALS

Cement.—Shipments of masonry and portland cements increased 30 percent over 1957. The average price per barrel was the same as in 1957—$3.76 for masonry cement and $3 for portland cement.

Clays.—Miscellaneous clay was produced in Butte County for manufacturing building brick, sewer tile, and other heavy clay products and in Pennington County for making cement and lightweight aggregate. Production dropped 12 percent from 1957. Bentonite was produced and processed by one company in Butte County, and two companies processed bentonite from Wyoming deposits in mills at Belle Fourche.

Feldspar.—Production of feldspar in Custer and Pennington Counties declined 44 percent in quantity and 46 percent in value compared with 1957 because of lack of an outlet during the last half of the year. Of the total production, 96 percent came from 32 mines in Custer County. With the exception of a small quantity shipped to a mill in Illinois, the entire output was processed at the grinding plant at Custer. The ground product was marketed in Eastern and Midwestern States for use in manufacturing pottery, glass, enamel, soap and abrasives, and welding-rod coating. The grinding plant at Custer, destroyed by fire in July, was rebuilt, and operations were resumed late in the year although construction was not entirely complete.

Gem Stones.—Agate, petrified wood, gem varieties of beryl, tourmaline, garnet and apatite, rose quartz, and specimens of ore minerals were collected by individuals, gem shops, and gem societies for polishing, for sales to processors, and to meet an extensive tourist demand for gem and decorative stones and specimens. The total quantity of material of this type marketed each year ranges from 15 to 20 tons. Much was used to decorate novelty table lamps, vases, and similar objects. The bulk of the output came from Custer and Pennington Counties, although specimens of various types were found in most western counties.

Gypsum.—Gypsum from deposits in the Spearfish formation, Pennington County, was mined by the South Dakota State Cement Commission for making cement. Production declined 8 percent compared with 1957.

Lime.—High-calcium limestone mined in Custer County was used for producing quicklime at a plant near Pringle. The entire output of the plant was consumed within the State for metallurgical uses. Production was 4 percent below 1957.

Mica.—Mica (including hand-cobbed and scrap) was produced at 62 mines by 68 operators in Custer and Pennington Counties. Most hand-cobbed mica and trimmed mica came from Custer County and the bulk of the scrap mica from Pennington County. Production of scrap mica declined 38 percent in quantity and 44 percent in value, whereas production of hand-cobbed and sheet mica increased 72 and 84 percent in quantity and 49 percent in value compared with 1957. The proportion of block mica recovered from the hand-cobbed mica increased from 6.07 percent in 1957 to 6.49 percent in 1958. Recovery of Stained-quality mica rose from 53.36 to 57.26 percent, but recovery of Good-Stained and better quality mica remained the same—2.82 percent. The increase in the percentage recovery of Stained mica and the lack of a comparable percentage increase in the higher valued Good-Stained and better quality mica accounted for the lower overall value per pound of the block mica. The output of hand-cobbed mica was sold to the GSA buying station at Custer for processing.

TABLE 3.—Production of hand-cobbed mica and yield of sheet mica

Year	Hand-cobbed mica	Total block mica recovered		Stained quality recovered		Good Stained and better quality recovered	
	Pounds	Pounds	Percent of hand-cobbed	Pounds	Percent of total block	Pounds	Percent of total block
1954	207,221	15,967	7.71	8,381	52.49	477	2.99
1955	64,673	4,633	7.16	1,856	40.06	259	5.59
1956	216,802	12,238	5.64	7,420	60.63	253	2.07
1957	149,163	9,048	6.07	4,828	53.36	255	2.82
1958	257,198	16,681	6.49	9,552	57.26	471	2.82

TABLE 4.—Mica sold or used by producers

	1954	1955	1956	1957	1958
Hand-cobbed mica, total: [1] Pounds	207,221	64,673	216,802	149,163	257,198
Sheet mica: [1]					
Full trimmed:					
Pounds	332	221	256	45	94
Value	$3,056	$1,980	$2,010	$756	$1,393
Average per pound	$9.20	$8.96	$7.85	$16.80	$14.82
From hand-cobbed mica:					
Pounds	15,967	4,633	12,238	9,048	16,678
Value	$62,166	$19,403	$65,043	$44,751	$66,489
Average per pound	$3.89	$4.19	$5.31	$4.95	$3.99
Total:					
Pounds	16,299	4,854	12,494	9,093	16,772
Value	$65,222	$21,383	$67,053	$45,507	$67,882
Average per pound	$4.00	$4.41	$5.37	$5.00	$4.05
Scrap mica, total:					
Short tons	1,510	1,322	1,268	1,626	1,003
Value	$26,943	$26,853	$31,224	$43,142	$24,241
Average per ton	$17.84	$20.31	$24.62	$26.53	$24.17
Total sheet and scrap mica:					
Short tons	1,518	1,324	1,274	1,631	1,011
Value	$92,165	$48,236	$98,277	$88,649	$92,123

[1] Sold to the Government through GSA.

Sand and Gravel.—Production of sand and gravel was reported in 64 of the State's 67 counties at 209 operations, of which 79 were commercial and 130 Government-and-contractor. Commercial sand and gravel, which represented 18 percent of the total production, was used for building (22 percent), paving (67 percent), molding and filter sand, railroad ballast, fill material, and roofing gravel. Sixty percent of the commercial sand and gravel was washed, screened, or otherwise prepared.

Although production of sand and gravel decreased less than 1 percent compared with 1957, value gained 15 percent.

Most Government-and-contractor operations were undertaken by contractors for the State department of highways. Contracts were awarded in 63 counties. Production for repairs and maintenance by county and municipal crews was reported in 35 counties. Contracts by counties and municipalities were awarded in 22 counties. Government-and-contractor production represented 82 percent of the total output of sand and gravel. Of this quantity, 83 percent was washed, screened, or otherwise prepared.

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1957		1958	
	Thousand short tons	Value (thousand)	Thousand short tons	Value (thousand)
COMMERCIAL OPERATIONS				
Sand:				
Building	328	$343	346	$366
Filter	(1)	(1)	88	88
Molding			(2)	2
Paving	133	101	266	237
Railroad ballast	(1)	(1)		
Other	42	24	15	8
Total	503	468	715	701
Gravel:				
Building	78	97	234	291
Paving	1,363	836	1,517	921
Railroad ballast	(1)	(1)	181	151
Other	74	44	29	16
Total	1,515	977	1,961	1,379
Total sand and gravel	2,018	1,445	2,676	2,080
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building			49	49
Paving	375	254	475	310
Total	375	254	524	359
Gravel:				
Building	10	5		
Paving	12,355	6,297	11,505	6,740
Total	12,365	6,302	11,505	6,740
Total sand and gravel	12,740	6,556	12,029	7,099
ALL OPERATIONS				
Sand	878	722	1,239	1,060
Gravel	13,880	7,279	13,466	8,119
Grand total	14,758	8,001	14,705	9,179

[1] Figures withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Less than 1,000 tons.

According to a report [3] by the Bureau of Public Roads, U.S. Department of Commerce, 7.2 miles of the National System of Interstate and Defense Highways was completed during the year. At yearend 52.2 miles of highway was under construction compared with 27.5 miles at the close of 1957.

Counties producing more than 500,000 tons were: Lincoln (882,900), Pennington (699,700), Minnehaha (687,200), Brown (587,700), Codington (563,700), and Gregory (550,100). The bulk of the output in these counties was produced by contractors for the State department of highways and used in road construction.

Stone.—Production of dimension granite in Grant County declined 5 percent compared with 1957. The mahogany- and russet-colored stone was used for monuments and building facings. Crushed and broken stone comprising limestone, sandstone, and miscellaneous stone was produced in 27 counties. Crushed limestone produced in Custer, Fall River, Lawrence, Pennington, and Todd Counties was used for road construction, concrete aggregate, and railroad ballast; for manufacturing cement and lime; and in sugar factories. Crushed sandstone, produced in Hanson and Minnehaha Counties, was used for road construction and as a refractory stone in foundries and steel plants. Miscellaneous stone, all of which was produced by contractors for the State department of highways for road construction, was mined in 22 counties. Total output of stone declined 19 percent in quantity and value compared with 1957.

MINERAL FUELS

Coal (Lignite).—Production from a strip mine in Dewey County was 7 percent below 1957. The entire output was sold in Dewey and adjoining counties. Other mines producing less than 1,000 tons a year, all for local consumption, were operated in Dewey, Corson, and Perkins Counties.

Petroleum.—Petroleum production from the Buffalo field, Harding County, and the Barker field, Custer County, increased 7 percent over 1957. Exploratory drilling, although not as extensive as in 1957, was more rewarding. One discovery was made 4 miles west of the Buffalo field in Harding County. A successful development well also was completed in the Buffalo field. Other wells in Butte, Custer, Fall River, Jackson, Lincoln, and Meade Counties were dry and were abandoned. Data collected by the State geologist show that 14 wells were completed and that drilling totaled 40,875 feet.

REVIEW BY COUNTIES

Butte.—American Colloid Co. produced bentonite, all of which was processed at its mill at Belle Fourche. Eastern Clay Products Department, International Minerals & Chemical Corp., processed bentonite from deposits in Wyoming at its mill at Belle Fourche. Black Hills Clay Products Co. produced miscellaneous clay for manufacturing building brick, draintile, and other heavy clay products. Uranium ore was produced at the Kling No. 1 mine by Rogers & Osborne and at

[3] Bureau of Public Roads, Status of Federal-Aid Highway Programs, Dec. 31, 1958; BPR 59–2.

the Kling No. 2 mine by H. W. McDonald. The ore was processed at the Mines Development, Inc., plant at Edgemont. Contractors produced miscellaneous stone for the State highway department; paving sand and gravel was produced for the State and county highway departments.

TABLE 6.—Value of mineral production in South Dakota, by counties

County	1957	1958	Minerals produced in 1958 in order of value
Aurora	(1)	$84,300	Sand and gravel.
Beadle	$87,800	339,200	Sand and gravel, stone.
Bennett	4,800	29,900	Sand and gravel.
Bon Homme	175,600	142,800	Sand and gravel, stone.
Brookings	329,000	217,000	Sand and gravel.
Brown	325,800	345,800	Sand and gravel, stone.
Brule	41,100	42,800	Do.
Buffalo	16,400	65,900	Do.
Butte	(1)	1,572,189	Clays, sand and gravel, uranium ore, stone.
Campbell	70,000	11,500	Sand and gravel.
Charles Mix	172,600	230,800	Sand and gravel, stone.
Clark	123,700	135,600	Sand and gravel.
Clay	116,900	53,900	Do.
Codington	291,100	531,800	Sand and gravel, stone.
Corson	101,800	65,800	Sand and gravel.
Custer	610,874	488,653	Feldspar, uranium ore, lime, mica (sheet), beryllium concentrate, stone, sand and gravel, gem stones, columbium-tantalum concentrate, petroleum, mica (scrap).
Davison	243,000	118,000	Sand and gravel.
Day	171,100	157,100	Sand and gravel, stone.
Deuel	12,000	64,500	Do.
Dewey	109,318	130,484	Coal, sand and gravel.
Douglas	58,800	118,700	Sand and gravel.
Edmunds	22,800	119,600	Do.
Fall River	872,048	617,021	Uranium ore, sand and gravel, gem stones, stone.
Faulk	52,900	115,900	Sand and gravel.
Grant	2,779,095	2,303,762	Stone, sand and gravel.
Gregory	69,100	284,000	Sand and gravel.
Haakon	----------	184,600	Do.
Hamlin	98,900	98,700	Do.
Hand	53,400	93,200	Do.
Hanson	349,200	392,300	Stone, sand and gravel.
Harding	(1)	(1)	Petroleum, sand and gravel.
Hughes	56,600	173,100	Sand and gravel.
Hutchinson	154,300	143,000	Do.
Hyde	38,300	90,400	Do.
Jackson	205,100	195,600	Sand and gravel, stone.
Jerauld	28,700	114,400	Do.
Jones	180,900	2,300	Stone.
Kingsbury	78,600	111,300	Sand and gravel.
Lake	138,100	170,300	Do.
Lawrence	20,129,244	20,238,118	Gold, silver, sand and gravel, stone.
Lincoln	116,500	525,400	Sand and gravel.
Lyman	341,100	86,300	Sand and gravel, stone.
Marshall	158,300	158,800	Sand and gravel.
McCook	83,400	32,100	Do.
McPherson	73,700	157,000	Do.
Meade	623,700	225,200	Sand and gravel, stone.
Mellette	131,500	15,300	Sand and gravel.
Miner	12,600	32,100	Do.
Minnehaha	778,200	854,900	Sand and gravel, stone.
Moody	132,300	130,300	Sand and gravel.
Pennington	6,823,401	7,933,023	Cement, stone, sand and gravel. clays, beryllium concentrate, gypsum, mica (scrap), mica (sheet), feldspar, columbium-tantalum concentrate, gem stones.
Perkins	6,928	137,000	Sand and gravel.
Potter	61,600	96,000	Do.
Roberts	108,900	197,500	Sand and gravel, stone.
Sanborn	29,400	11,500	Do.
Shannon	75,900	----------	
Spink	180,400	266,400	Sand and gravel.
Stanley	98,400	95,300	Do.
Sully	87,700	55,300	Do.
Todd	10,400	18,600	Stone.
Tripp	55,800	94,900	Sand and gravel, stone.
Turner	46,100	57,300	Sand and gravel.

See footnotes at end of table.

TABLE 6.—Value of mineral production in South Dakota, by counties—Con.

County	1957	1958	Minerals produced in 1958 in order of value
Union	$102,300	$41,300	Sand and gravel, stone.
Walworth	46,400	118,300	Sand and gravel.
Washabaugh	9,500	25,000	Do.
Yankton	1,450	45,300	Sand and gravel, stone.
Ziebach	200	22,400	Sand and gravel.
Undistributed [2]	2,191,800	323,000	Lithium minerals, gem stones, sand and gravel.
Total [3]	[4] 39,997,000	41,534,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes value of mineral production that cannot be assigned to specific counties and values indicated by footnote 1.
[3] Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.
[4] Revised figure.

Custer.—Beryllium concentrate (beryl), produced from pegmatite deposits at 82 mines, represented 38 percent of the total value of Custer County mineral production. Major producers were: George Bland who operated at 15 locations (principal production was from the Bull Moose and Tin Mountain mines); Walter Clifford at the Red Bird lode; Leonard E. Wood at the Lucky Strike; Henry Kautzsch at the Townsite; and Maywood Chemical Works at the Tin Mountain mine. Large producers sold their product directly to GSA at Custer. Other producers of smaller quantities sold to Gladys Wells at Custer for resale to GSA. Output of Columbium-tantalum concentrate, recovered from pegmatite deposits, increased more than threefold over 1957. The major producer was George Bland at the Helen Beryl mine. Three other operators also reported production. The entire output was sold to GSA at Custer. Feldspar, the major product of the pegmatite deposits in quantity, was produced at 32 mines. Abingdon Potteries, Inc., operated the Townsite mine and shipped the crude material to its grinding plant in Illinois. Consolidated Feldspar Department, International Minerals & Chemical Corp., operated the Ballard Dyke and other deposits and purchased the output of other producers for grinding at its plant at Custer. The plant was completely destroyed by a fire, caused by lightning, on July 30. It was replaced by a modern fireproof mill that resumed operation in December. The new mill was equipped with the latest machinery for crushing, grinding, and air classification. Five different grades were produced, primarily for use in making pottery, enamelware, and glass. Adequate storage silos for crude and finished material were provided at the new plant.

Full-trimmed, hand-cobbed, and scrap mica, important coproducts in the recovery of feldspar from pegmatite deposits, were produced at 52 mines. One operator produced only full-trimmed sheet mica. Hand-cobbed mica was produced at 21 mines, 2 of which also yielded full-trimmed sheet mica and scrap mica. Scrap mica was produced at 33 mines. The full-trimmed sheet mica and hand-cobbed mica were sold to GSA at Custer for processing. Scrap mica was sold to grinding plants in Colorado and Eastern and Midwestern States. A small quantity was stockpiled by one producer for processing at its plant in Vermont. Principal producers of hand-cobbed mica were York Min-

erals, at the Red Deer mine, and Glenn Ventling, at the New York mine. Carl Roseberry, operating the Elkhorn mine, and Mont Heumphreus, operating the Heumphreus mine, were the largest producers of scrap mica.

High-calcium limestone was produced for manufacturing quicklime at a plant near Pringle. The entire output was used within the State for metallurgical purposes. Crushed limestone and miscellaneous stone was used in highway construction. Uranium ore, produced from three mines by Triangle Enterprises and Giant Cycle Corp., was shipped to the mill at Edgemont. A small quantity of petroleum was produced from the Barker field. Gem stones and mineral specimens, such as agate, beryl, rose quartz, tourmaline, and similar materials, were recovered from various pegmatite deposits by Scott's Rose Quartz Co. and numerous individuals for polishing and sale as specimens and curios. Sand and gravel for road construction was produced for the State department of highways.

Fall River.—Sand and gravel and uranium ore comprised principal mineral output of the county, which ranked sixth in the State in value of mineral production. Sand and gravel for building and highway construction was produced by four operators and by contractors for the State department of highways. The Fall River Sand & Gravel Co. was the major producer. Uranium ore, produced at 23 operations, was shipped to the mill at Edgemont. Major producers were Giant Cycle Corp. producing at five operations, and Pictograph Mining & Uranium Co., Inc., operating the Dexter No. 4 mine. Mines Development, Inc., operated its processing plant at Edgemont the entire year. Capacity of the plant was increased from 300 to 400 tons of crude ore a day. The resin-in-pulp process for recovering uranium oxide from the leach liquors was changed to a solvent-extraction system. Since the mill began operations in mid-1956, 300,000 tons of ore from deposits in South Dakota and Wyoming has been processed. AEC required that the stockpile at Edgemont, purchased by the Government before construction of the mill, be absorbed by 1962 within the daily ore-processing capacity.

Grant.—Output of dimension granite, from 10 quarries near Milbank and Big Stone City, declined slightly compared with 1957. The deep-red and brown-mahogany granites in the Big Stone City-Milbank area, were used extensively for building facings, interior decoration, and monuments. The rough quarry blocks from five operations were finished at plants in Minnesota. Sand and gravel for road construction was produced by contractors for the State department of highways and the Grant County Highway Commission. The county ranked third in the State in value of mineral production.

Harding.—Petroleum production, from two fields, increased slightly over 1957. One new field was discovered 4 miles west and slightly south of the Buffalo field when the No. 1 Government well was completed at a depth of 8,645 feet. Initial production was 12 barrels an hour on pump from the Red River formation at a depth of 8,434 to 8,484 feet. One development well, a southwest extension of the Buffalo field, was completed at a depth of 8,657 feet. Production was 173 barrels of oil a day on pump from the Red River formation at a

depth of 8,522 to 8,574 feet. Output of sand and gravel for the State Department of highways was more than double that of 1957.

Lawrence.—The county contributed nearly half the value of South Dakota's mineral production. Output of gold increased only slightly, whereas that of silver increased 13 percent over 1957. The Homestake Mining Co. in the Lead-Deadwood area continued to be the leading producer of gold in the United States. The value of sand and gravel produced by contractors for the State department of highways increased 30 percent although the quantity declined 12 percent compared with 1957, reflecting the more rigid specifications required for material used in highway construction. Crushed limestone used for road construction and sugar refining, produced by Cole Construction Co., declined 44 percent in quantity and 20 percent in value from 1957.

TABLE 7.—Ore milled, receipts, and dividends, Homestake mine [1]

Year	Ore milled (thousand short tons)	Receipts for bullion product		Dividends (thousand)
		Total (thousand)	Per ton	
1954	1,485	$18,410	$12.40	$4,019
1955	1,550	18,055	11.65	4,019
1956	1,628	19,354	11.89	4,019
1957	1,660	19,479	11.74	4,019
1958	1,725	19,611	11.37	4,019

[1] From 1876 to 1958, inclusive, this mine yielded bullion and concentrates that brought a net return of $658.4 million and paid $202.9 million in dividends.

Homestake Mining Co. operated its Homestake mine and amalgamation-cyanidation mill at Lead the entire year. Ore milled totaled 1.7 million tons. Percentage recovery declined slightly from 97.18 to 97.13. Mining and milling costs per ton declined because of the greater quantity of material handled. A diamond-drilling program on the 5300 and 5600 levels was completed in May. The results were disappointing. Some ore of good grade was found, but there was less continuity of the ore bodies between levels than anticipated. No new ore blocks were added to the reserve, which was 13.2 million tons on December 31, 1958—a decline of 950,000 tons from the preceding yearend. The difference of 775,000 tons between ore mined in 1958 (1.725 million tons) and the decline in reserve estimates (950,000 tons) represents the excess recovered over conservative engineering and geological estimates. When the diamond-drilling program was completed, work was resumed at the No. 4 winze below the 5000 level, and at yearend the winze was at a depth of 6170 feet. Development of two deeper levels, the 5900 and 6200 from the winze, will proceed as planned. Rock temperature at the 6170 level of the winze was 111° F. and confirmed the need for completing the deep ventilation shaft that was begun in 1957. The program continued as planned and was expected to be completed in 1960.

Bald Mountain Mining Co. operated the Clinton, Portland, Decorah, Dakota, Folger, and Gold Bug group of mines and its 350-ton all-slime cyanide plant at Trojan. The tonnage of milled ore was 16 percent below 1957. Recovery of gold declined 10 percent; however, recovery of silver more than doubled. The average value of the ore

increased 14 percent. Ray Coppo produced a little gold ore at the Summit mine.

Minnehaha.—Production of crushed sandstone for use as refractory stone (ganister), riprap, concrete aggregate, and road construction declined 28 percent compared with 1957. Concrete Materials Co. was the leading producer. Output of sand and gravel for building and paving and for railroad ballast and fill more than doubled over 1957. Concrete Materials Co. and L. G. Everist, Inc., were the leading producers.

Pennington.—Various minerals and mineral products were produced from the mines, quarries, and mills in Pennington County, which continued to rank second in the State in value of mineral production. The value of beryllium concentrate (beryl), columbium-tantalum concentrate, feldspar, and mica, all products of pegmatite deposits, declined 29 percent compared with 1957. The destruction by fire of the feldspar grinding plant at Keystone in January 1957 made the production of feldspar (the principal product of pegmatite deposits) more difficult because of greater shipping distance to the grinding plant at Custer. The destruction of the plant at Custer by fire in July 1958 completely eliminated the local market for feldspar, and production declined sharply. At most pegmatite deposits the feldspar must be mined to expose smaller quantities of the more valuable minerals. Activities were confined to deposits where beryl, columbite-tantalite, and mica could be recovered without extensive mining of feldspar. Beryl was produced at 26 mines. The major operators were Consolidated Feldspar Department, International Minerals & Chemical Corp., at the Hugo mine; McCarty-Pullen Mines, at the Whitecap; Keystone Feldspar & Chemical Co., at the Peerless; Pete Lien & Sons, at the High Climb; and Myler & Sackett, at the Sackett Fraction lode. Columbium-tantalum concentrate was produced at three mines. Major producers were George Bland, at the High Climb and Whitecap mines and Black Hills Keystone Corp., at the Bob Ingersoll.

Output of scrap mica declined 30 percent, whereas that of hand-cobbed mica increased 47 percent. Increased activity was directed toward producing hand-cobbed mica to replace, partly, the loss of the local outlet for feldspar. The county continued to be the principal source of scrap mica, accounting for 90 percent of the State's production. Major producers were Keystone Feldspar & Chemical Co. at the Peerless mine; Consolidated Feldspar Department, International Minerals & Chemical Corp., at the Hugo; McCarty-Pullen Mines, at the Whitecap; and Montana Chemical & Milling Co., at the Cracker Jack. Hand-cobbed mica was produced at three mines. Principal producers were McCarty-Pullen Mines and Hardesty & Simpson, both at the Whitecap mine.

Shipments of portland and masonry cements by the South Dakota State Cement Commission at Rapid City increased 30 percent over 1957. The State-owned plant produced the limestone, shale, sand, and gypsum used from deposits near Rapid City. Iron ore used in the process came from a stockpile accumulated in previous years. A new 375-foot kiln was installed, together with necessary auxiliary equipment. Operation of the new kiln, which was begun in Novem-

ber, increased the annual capacity of the plant to 3 million barrels. Cement clinker was used as a base for manufacturing masonry cement. Shipments were made to consumers throughout South Dakota, to adjoining States, and to Colorado and Illinois.

Miscellaneous clay was mined from the Pierre formation near Rapid City for making lightweight aggregate. The county ranked second in the State in output of sand and gravel. Five operators produced building and paving sand and gravel and railroad ballast. Carlson Lien Co. and Birdsall Sand & Gravel Co. were the major producers. The Black Hills Silica Sand Corp. produced molding sand. Limestone for riprap, road construction, concrete aggregate, and railroad ballast was crushed by four operators. Principal producers were Hills Materials Co. and Pete Lien & Sons. Miscellaneous stone was crushed by contractors for the State department of highways.

Gem stones and mineral specimens were collected by gem societies and individuals from pegmatite deposits and mine dumps for polishing and sale to tourists. Agate and petrified-wood specimens were collected in the Badlands in the eastern part of the county.

The Mineral Industry of Tennessee

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Tennessee Division of Geology.

By Avery H. Reed, Jr.,[1] William D. Hardeman, Jr.,[2] and Mildred E. Rivers[3]

RECORD production of crushed limestone, mica, phosphate rock and zinc, and decreased coal production characterized the mineral industry of Tennessee in 1958. Tennessee led the Nation in output of ball clay, dimension marble, pyrite, and zinc; ranked second in phosphate rock; third in fuller's earth; and fifth in mica.

Leading activities were stone quarrying, cement manufacture, copper and zinc production, and phosphate rock mining and processing

TABLE 1.—Mineral production in Tennessee[1]

Mineral	1957		1958	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Cement:				
Masonry thousand 376-pound barrels	639	$2,214	697	$2,439
Portland do	6,776	20,592	7,678	23,969
Clays	1,154	4,228	935	4,210
Coal	7,955	31,147	6,785	25,969
Copper (recoverable content of ores, etc.) short tons	9,790	5,894	9,109	4,791
Gem stones			[2]	1
Gold (recoverable content of ores, etc.) troy ounces	172	6	124	4
Lime	94	1,134	[3]	[3]
Manganese ore (35 percent or more Mn) gross weight	12,938	1,007	5,935	452
Natural gas million cubic feet	38	6	54	9
Phosphate rock thousand long tons	1,812	12,514	1,903	13,041
Sand and gravel	5,617	6,641	5,612	6,671
Silver (recoverable content of ores, etc.) troy ounces	54,407	49	44,592	40
Stone[4]	15,354	24,155	16,850	26,814
Zinc (recoverable content of ores, etc.) short tons	58,063	13,470	59,130	12,062
Value of items that cannot be disclosed: Barite, fluorspar (1957), iron ore (1957), mica, petroleum, pyrite, and stone (granite, 1957, dimension limestone, 1958, and crushed sandstone), and minerals indicated by footnote 3		8,029		6,878
Total Tennessee[5]		[6] 128,739		124,928

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Quantity not recorded.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Incomplete figures, excludes certain stone, value of which is included with "Items that cannot be disclosed."
[5] Total adjusted to eliminate duplicating value of clays and stone.
[6] Revised figure.

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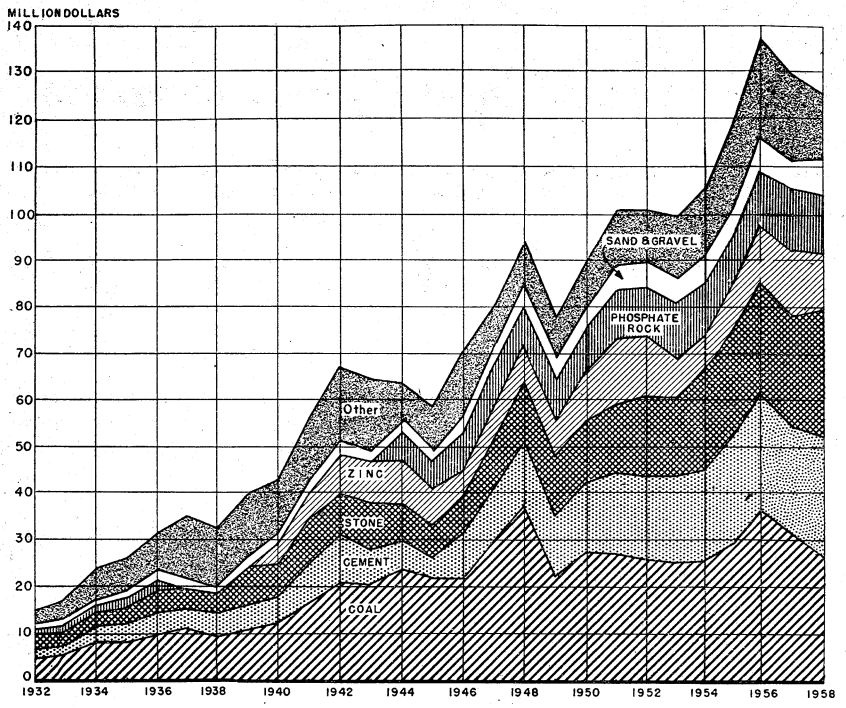

FIGURE 1.—Value of mineral production in Tennessee, 1932–58.

which together furnished 87 percent of the total value of production, compared with 85 percent in 1957. Leading companies were: Tennessee Copper Co. (gold, silver, copper, pyrite, zinc), Penn-Dixie Cement Corp. (cement, clay, limestone), Marquette Cement Mfg. Co. (cement, clay, limestone, sand and gravel), Volunteer Portland Cement Co. (cement, clay, limestone), and American Zinc Co. of Tennessee (limestone, zinc).

Total value of mineral production decreased 3 percent below 1957 and was 9 percent below the record of 1956.

Employment and Injuries.—Total employment declined 5 percent below 1957, owing mainly to a drop of 22 percent in coal-mining employment. Employment declined 20 percent in metal mines and increased 50 percent at sand and gravel mines. Many companies operated a regular 5-day week, but coal mines averaged 3 days a week, and cement mills, coke ovens, and smelters operated continuously.

Injury experience improved over 1957 as the frequency rate decreased 12 percent. The frequency rate was less for all industries except coal mining, which increased 7 percent. There were 21 fatalities, compared with 14 in 1957, and 14 in 1956.

The leading causes of injuries in the mineral industries, excluding coal mines, were in handling materials, falls of persons, and operating machinery. Causes of fatalities were falls of persons, haulage, falls of roof, and gas explosions.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-days worked	Fatal injuries	Nonfatal injuries	Injuries per million man-days
	1957						
Coke ovens and smelters	3	7,265	361	2,620,938	2	85	33
Quarries and mills	123	3,399	253	859,929	3	190	224
Coal mines	634	6,175	154	951,377	8	276	299
Metal mines	11	1,804	238	428,891	1	92	217
Nonmetal mines	32	966	255	246,461		40	162
Sand and gravel mines	31	535	234	125,185		20	160
Total	834	20,144	260	5,232,781	14	703	137
	1958 [1]						
Coke ovens and smelters	3	7,234	360	2,607,083		82	31
Quarries and mills	131	3,397	251	853,244	1	158	186
Coal mines	674	5,024	148	743,497	16	223	321
Metal mines	23	1,474	233	343,960	4	65	201
Nonmetal mines	43	1,041	250	260,277		30	115
Sand and gravel mines	40	693	272	188,389		26	138
Total	914	18,863	265	4,996,450	21	584	121

[1] Preliminary figures.

TABLE 3.—Injuries in the mineral industries by causes [1]

Cause	Coke ovens and smelters	Quarries and mills	Metal mines	Nonmetal mines	Sand and gravel mines	Total
	1957					
Handling materials	28	39	17	5	7	96
Falls of persons	19	24	14	7	1	65
Machinery	11	[2] 28	5	6		50
Hand tools	3	19	9	6	2	39
Haulage	[3] 6	5	8	5	1	25
Falling objects	3	10	5			18
Falls of face		4	2		1	7
Falls of roof		1	[3] 11			12
Electricity		4	4			8
Explosions						
Explosives		9	4			13
Miscellaneous	[3] 17	[3] 35	13	6	1	72
Undetermined		15	1	5	7	28
Total	87	193	93	40	20	433
	1958 [4]					
Handling materials	28	35	12	4	2	81
Falls of persons	18	12	[3] 9	5	5	49
Machinery	11	14	15	5	3	48
Hand tools		38	5	2	1	46
Haulage		[3] 11	10	3	6	30
Falling objects		12	[3] 4	3		19
Falls of face		7	4			11
Falls of roof		1	[3] 5			6
Electricity		4				4
Explosions			[3] 2			2
Explosives						
Miscellaneous	14	17	3	3	2	39
Undetermined	11	8		5	7	31
Total	82	159	69	30	26	366

[1] Excludes coal mines.
[2] Two fatalities.
[3] One fatality.
[4] Preliminary figures.

Legislation and Government Programs.—Office of Minerals Exploration (OME) activity consisted of eight projects for zinc. Metallurgical-grade manganese ore was sold to General Services Administration (GSA) stockpiles.

The Bureau of Mines maintained and worked on a wide variety of research projects at the Electrotechnical Experiment Station at Norris.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—National Lead Co. and McMinn Barium Corp. mined crude barite at four mines in Monroe and McMinn Counties for oil well drilling. Production declined 74 percent below 1957 and was 87 percent below the record of 1941. Total cumulative production of crude barite since 1899 was 1,511,000 tons valued at $11,400,000.

Cement.—Four companies produced masonry cement at five plants in five counties. The leading producer was Marquette Cement Mfg. Co. Shipments increased 9 percent over 1957 but were 12 percent below the record of 1955.

Four companies produced portland cement at six plants in six counties. The leading producer was Penn-Dixie Cement Corp. Shipments increased 13 percent over 1957 but were 5 percent below the record of 1956. Raw materials used in cement included limestone and cement rock (86 percent), clay and shale (9 percent), gypsum (3 percent), and other (2 percent). Cement was shipped to the following States: Tennessee (39 percent), North Carolina (25 percent), Georgia (18 percent), South Carolina (5 percent), Florida (5 percent), Alabama (3 percent), Kentucky (1 percent), other Southern States (4 percent).

TABLE 4.—Defense Minerals Exploration administration zinc contracts in force during 1958

Operator	Property	County	Amount [1]
American Zinc Co. of Tenn.	Strawberry Plains	Knox	$768,167
New Jersey Zinc Co.	do.	Jefferson	[2] 355,850
Do.	Independence area	Hancock	[2] [3] 214,300
Do.	Little War Creek area	do.	106,780
Do.	Big War Creek area	do.	107,150
Do.	Cedar Springs area	Grainger	105,950
B. H. Putnam	Puncheon Camp Creek	do.	170,125
Do.	Luttrell	Union	86,975

[1] Government participation, 50 percent.
[2] Revised figure.
[3] Completed.

At Knoxville Volunteer Portland Cement Co. completed expanding and improving its plant; new equipment included a new crushing plant, a screening plant, a belt conveyor system, and a fourth kiln that increased the plant's capacity 35 to 40 percent.

Clays.—Six companies mined ball clay at seven mines in Henry and Weakley Counties. The leading producer was H. C. Spinks Clay Co., Inc. Production decreased 3 percent below 1957 and was 13 percent below the record of 1956. Tennessee led in production of ball clay.

Three companies mined fuller's earth in Henry County for absorbent uses. The leading producer was Southern Clay Co., Inc. Production declined 25 percent below 1957 and was 44 percent below 1956, the record year. Tennessee ranked third in production of fuller's earth.

Eleven companies mined miscellaneous clay at 13 mines in 9 counties for floor and wall tile, cement, lightweight aggregates, and heavy clay products. Leading producers were General Shale Products Corp. and W. G. Bush & Co., Inc. Production declined 24 percent below 1957 and was 37 percent below the record of 1956.

During the year at Nashville, W. G. Bush & Co., Inc., completed a new $500,000 tunnel kiln, which doubled the capacity of the original plant.

Feldspar.—The Feldspar Corp. ground crude feldspar from North Carolina at a plant in Erwin.

TABLE 5.—Finished portland cement produced, shipped, and in stock, in 376-pound barrels, in thousands

Year	Production, barrels	Shipment from mills		Stocks at mills on Dec. 31, barrels
		Barrels	Value	
1949–53 (average)	6,980	6,905	$16,172	393
1954	7,524	7,569	19,734	540
1955	8,110	8,017	21,176	362
1956	8,386	8,050	23,014	476
1957	7,181	6,776	20,592	684
1958	7,923	7,678	23,969	665

TABLE 6.—Ball clay sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value	Average unit value	Short tons	Value	Average unit value
Whiteware, etc.	164,033	$2,195,546	$13.38	162,234	$2,235,155	$13.78
Floor and wall tile	45,284	638,158	14.09	45,825	657,206	14.34
Heavy clay products	3,575	35,750	10.00	2,963	29,630	10.00
Other uses [1]	46,509	677,290	14.56	41,411	619,054	14.95
Total	259,401	3,546,744	13.67	252,433	3,541,045	14.03

[1] Includes art pottery, enameling, firebrick and block, glass refractories, exports, saggers, pins, stilts, and wads, and other uses.

Gem Stones.—Ben T. Traywick collected a small quantity of gem stones (flint, fossils, barite, fluorite, sandstone, and geodes) near Sweetwater. The miscellaneous gem materials that P. H. Moore collected in eastern Tennessee were tumbled to produce baroque jewelry at Bean Station and sold to tourists and department stores.

Lime.—At Knoxville Standard Lime & Cement Co. and Williams Lime Mfg. Co. produced quick and hydrated lime for building, chemical, and industrial uses. Production declined 18 percent below 1957, 38 percent below 1956. Lime was shipped mainly to North Carolina, Tennessee, Georgia, Kentucky, New York, Florida, and Ohio.

Mica.—International Minerals & Chemical Corp. recovered scrap mica at Greenville from silt deposits in Davy Crockett Lake. Produc-

tion, four times that of 1957 established a new record. Tennessee ranked fifth in production of mica. International Minerals installed additional grinding equipment, which increased plant capacity from the pilot plant stage of 24 tons to 120 tons a day.[4]

Perlite.—Tennessee Products & Chemical Corp. expanded crude perlite from Western States at a plant in Nashville.

Phosphate Rock.—Tennessee ranked second in the Nation in phosphate rock production. Ten companies mined and processed marketable phosphate rock at 12 mines in 5 counties. Leading producers were Monsanto Chemical Co. and Victor Chemical Works. Marketable production increased 5 percent over 1957, the preceding record year.

TABLE 7.—Phosphate rock sold or used by producers, by uses, in thousands

Use	1957		1958	
	Long tons	Value	Long tons	Value
Elemental phosphorus	1,446	$10,182	1,609	$11,443
Fertilizer filler and other fertilizers	93	457	114	623
Ordinary and triple superphosphate	132	647	100	544
Direct application to the soil	84	415	96	522
Other	23	156	[1] 4	[1] 28
Total	1,778	11,857	1,923	13,160

[1] Includes a small quantity of pig-iron blast furnace.

Pyrite.—Tennessee led the Nation in producing pyrite. Tennessee Copper Co. recovered pyrite concentrate from sulfide ore mined in Polk County. Production decreased 12 percent below 1957, the record year.

Sand and Gravel.—Thirty-six companies mined sand and gravel at 43 mines in 24 counties. Leading producers were Memphis Stone & Gravel Co., Inc. (Benton and Shelby Counties), and Sangravl Co., Inc. (Humphreys County). Production was about the same as in 1957.

Stone.—Blue Ridge Stone Co. crushed granite in Carter County for concrete and roads. Production declined 19 percent below 1957, the record year.

Seventy-three companies crushed limestone at 99 quarries in 52 counties. Leading producers were Lambert Bros. Division of Vulcan Materials Co. (Blount, Davidson, Hawkins, Humphreys, Knox, Roane, Sevier, Sullivan, and Williamson Counties), Chattanooga Rock Products Division of Vulcan Materials Co. (Hamilton and Marion Counties), and American Zinc Co. of Tennessee (Jefferson and Knox Counties). Production increased 9 percent over 1957 and was 8 percent above the 1956 record, mainly because use of crushed stone for highway construction increased. Vulcan Materials Co. bought Rockwood Slag Products, Inc., of Rockwood; Brooks Sand & Gravel Co. and Tennessee Equipment Co., Kingsport; Asphalt Paving Materials Co., Chattanooga Rock Products Co., Wesco Materials Inc., and Wesco Contracting Co., Chattanooga; these companies will continue to operate as divisions of Vulcan Materials Co.

[4] Mining Congress Journal, IMC Works Unusual Mica Deposit: Vol. 4, No. 9, September 1958, p. 80.

TABLE 8.—Sand and gravel sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Benton	568,309	$1,083,904	650,173	$1,033,617
Decatur	50,000	50,000	45,000	45,000
Fayette	(1)	(1)	58,185	58,000
Giles	113,000	114,000	55,000	50,000
Haywood			98,000	90,000
Henderson			(1)	(1)
Humphreys	548,651	434,185	(1)	(1)
Lake	(1)	(1)		
Lauderdale	143,200	112,046	49,000	40,000
Loudon	31,265	34,391	18,741	33,884
Macon			16,854	16,854
McMinn	(1)	(1)		
Monroe	14,240	19,421	14,615	18,799
Obion	136,000	50,470	140,000	51,999
Perry			25,000	10,000
Roane	(1)	(1)		
Shelby	1,281,370	1,146,171	1,697,668	1,565,975
Sullivan	2,010	3,000		
Sumner	101,000	37,500	101,000	37,500
Unicoi	278,270	343,305	272,522	349,424
Williamson	120,756	150,945		
Undistributed [2]	2,229,359	3,061,137	2,369,851	3,269,873
Total	5,617,430	6,640,475	5,611,609	6,670,925

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes Davidson, Franklin, Greene, Hamilton, Knox, McNairy, Tipton, Wayne, and counties indicated by footnote 1.

TABLE 9.—Sand and gravel sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value	Average unit value	Short tons	Value	Average unit value
Sand:						
Structural	1,233,890	$1,469,085	$1.19	1,218,132	$1,489,945	$1.22
Paving	460,019	657,235	1.43	583,737	776,077	1.33
Engine	1,300	1,625	1.25	1,045	1,306	1.25
Fire or furnace	967	1,160	1.20	(1)	(1)	(1)
Railroad ballast	1,352	1,690	1.25			
Filter	572	715	1.25			
Other [2]	405,380	1,002,643	2.47	387,029	1,013,841	2.62
Total sand	2,103,480	3,134,153	1.49	2,189,943	3,281,169	1.50
Gravel:						
Paving	2,147,645	1,906,549	.89	2,196,140	1,828,368	.83
Structural	1,246,081	1,480,735	1.19	1,034,475	1,392,671	1.35
Railroad ballast	(1)	(1)	(1)	82,306	80,000	.97
Other	120,224	119,038	.99	108,745	88,717	.82
Total gravel	3,513,950	3,506,322	1.00	3,421,666	3,389,756	.99
Total sand and gravel	5,617,430	6,640,475	1.18	5,611,609	6,670,925	1.19

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes glass, molding, grinding and polishing, fire or furnace, and other sands.

TABLE 10.—Crushed limestone sold or used by producers, by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Campbell	(1)	(1)	347,269	$396,600
Clay	(1)	(1)		
Cocke	13,170	$20,200	54,060	80,076
Cumberland	248,880	388,360	(1)	(1)
Davidson	(1)	(1)	1,634,560	1,971,422
Decatur			120,000	144,000
De Kalb	36,000	19,000	26,620	26,620
Fayette			9,500	18,690
Fentress	109,258	149,882	178,000	222,000
Franklin	(1)	(1)	627,266	700,879
Grainger			14,369	17,272
Greene	195,013	200,773	(1)	264,500
Grundy	24,500	25,675	22,000	25,000
Knox	1,975,228	2,477,573	1,794,665	2,249,095
Lincoln	77,500	96,900	(1)	(1)
Loudon	(1)	(1)		
Marion	(1)	(1)	1,055,418	1,447,210
Monroe	93,102	114,836	103,065	145,000
Overton	(1)	(1)		
Perry	(1)	(1)		
Putnam	(1)	(1)		
Rhea			104,000	142,000
Rutherford	245,000	266,000	381,796	477,245
Sequatchie	(1)	(1)	107,175	150,936
Sumner	303,514	375,049	261,138	334,020
Union			38,900	37,440
Washington	189,696	239,017	199,674	249,592
White	(1)	(1)	341,956	482,131
Undistributed [2]	11,721,048	14,514,600	9,234,739	12,119,998
Total	15,231,909	18,887,865	16,656,170	21,701,726

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes Anderson, Bedford, Blount, Bradley, Cannon, Carter, Coffee, Dickson, Giles, Hamblen, Hamilton, Hawkins, Humphreys, Jefferson, Johnson, Macon, Marshall, Maury, McMinn, Meigs, Montgomery, Roane, Robertson, Sevier, Smith, Sullivan, Warren, Williamson, Wilson, and counties indicated by footnote 1.

TABLE 11.—Crushed limestone sold or used by producers, by uses

Use	1957			1958		
	Short tons	Value	Average unit value	Short tons	Value	Average unit value
Concrete and roads	11,304,989	$13,870,606	$1.23	13,076,145	$16,701,133	$1.28
Cement and lime	1,904,820	2,279,600	1.20	2,067,835	2,382,821	1.15
Agstone	751,395	1,002,832	1.33	651,283	928,568	1.43
Railroad ballast	755,090	842,262	1.12	368,215	436,717	1.19
Glass	5,000	8,750	1.75	(1)	(1)	(1)
Stone sand	226,441	328,973	1.45	50,046	77,648	1.55
Fluxing stone	101,753	151,603	1.49	(1)	(1)	(1)
Riprap	8,191	11,061	1.35	7,014	7,108	1.01
Other [2]	174,230	392,178	2.25	435,632	1,167,731	2.68
Total	15,231,909	18,887,865	1.24	16,656,170	21,701,726	1.30

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes mineral food, glass, poultry grit, rock dust for coal mines, fluxing stone, whiting, paper, other uses, and uses indicated by footnote 1.

McCoy Bros., Bureau of Public Roads, and Davidson County Highway Department quarried considerably more dimension limestone (used for building stone) than in 1957.

Four companies crushed marble at 10 quarries in Blount and Knox Counties for terrazzo and other uses. The leading producer was John J. Craig Co. (Blount County). Production increased 37 percent over 1957 but was 33 percent below 1948, the record year.

Tennessee led the Nation in output of dimension marble. Six companies quarried dimension marble at 13 quarries in 4 counties. The leading producer was John J. Craig Co. Production decreased 5 percent below the record of 1957.

Three companies crushed considerably less sandstone at three quarries in three counties for refractories, concrete and roads, abrasives, and cement than in 1957. The leading producer was Silica Sand Co., Inc. (Campbell County).

Fourteen companies quarried dimension sandstone at 14 quarries in 4 counties for rough architectural, sawed, and dressed building stone, and for flagging. Production increased 36 percent over 1957 but was 10 percent below 1955, the record year.

Vermiculite.—Zonolite Co. exfoliated vermiculite from South Carolina at its plant in Nashville.

TABLE 12.—Dimension marble sold or used by producers, by uses

Use	1957			1958		
	Cubic feet	Value	Average unit value	Cubic feet	Value	Average unit value
Building stone:						
Interior, rough	122,803	$380,199	$3.10	191,775	$582,208	$3.04
Interior, sawed, dressed	123,980	1,023,097	8.25	119,429	984,449	8.24
Interior, cut, dressed	(1)	(1)	(1)	101,326	1,775,264	17.52
Exterior, rough	18,858	64,634	3.43			
Other uses [2]	366,489	2,442,023	6.66	187,874	145,814	.78
Total	632,130	3,909,953	6.19	600,404	3,487,735	5.81

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[2] Includes exterior sawed and cut building stone and dressed, cut, monumental stone, and uses indicated by footnote 1.

MINERAL FUELS

Coal.—Coal production declined 15 percent below 1957, 23 percent below the record of 1956. The decline was more pronounced in the northern part of the State (16 percent) than in the southern part (11 percent). Tennessee coal was consumed mainly by the Tennessee Valley Authority steamplants, this market is nearer the southern part of the State. Coal was mined at 500 mines in 18 counties, compared with 491 mines and 17 counties in 1957. Leading counties were Marion, Anderson, and Campbell. Leading producers were the Dean mine (Wind Rock Coal & Coke Co.), the Coal Valley mine (Tennessee Consolidated Coal Co.), and the Reels Cove mine (Tennessee Products & Chemical Corp.).

In the northern part of the State (District 8), 304 mines in 10 counties mined 4,516,000 tons, compared with 293 mines, 9 counties, and

5,394,000 tons in 1957. Average production per mine decreased from 18,400 to 14,900 tons. Average unit value decreased from $3.77 to $3.72. Of the total production, 54 percent was mined underground, 36 percent, by open pit; and 10 percent, by auger. Fifty-two percent was shipped by rail or water and 48 percent, by truck, mostly for sale in the open market. Of the total underground production, 82 percent was cut by machine, and 18 percent was shot from solid. Eighty-five percent was drilled by power drills.

In the southern part of the State (District 13), 196 mines in 8 counties mined 2,268,000 tons, compared with 198 mines, 8 counties, and 2,561,000 tons in 1957. Average production per mine decreased from 12,900 to 11,600 tons. Average unit value decreased from $4.23 to $4.04. Of the total production, 84 percent was mined underground, 15 percent was mined by open pit, and 1 percent was mined by auger. Seventy-four percent was shipped by rail or water and 26 percent, by truck, mostly to be sold in the open market.

TABLE 13.—Coal production by counties

County	1957		1958	
	Short tons	Value	Short tons	Value
Anderson	1,481,025	$5,319,227	1,302,324	$4,847,254
Bledsoe	27,137	78,165	30,546	133,312
Campbell	975,908	3,998,932	805,910	2,671,363
Claiborne	451,775	1,749,440	280,216	1,105,165
Cumberland	115,024	525,262	85,789	293,964
Fentress	122,863	382,481	78,971	204,967
Grundy	182,575	675,901	148,131	516,079
Hamilton	159,043	540,097	84,182	257,441
Marion	1,612,200	7,887,771	1,385,514	6,412,252
Morgan	684,203	2,712,204	692,205	2,807,526
Overton	(1)	(1)	75,421	236,067
Putnam	(1)	(1)	395,463	1,669,333
Rhea	54,105	162,315	189,715	445,830
Roane			2,500	10,350
Scott	961,825	3,287,573	797,653	2,951,486
Sequatchie	273,391	762,761	338,915	1,106,463
Van Buren	58,418	192,886	75,482	241,680
White	193,926	528,046	15,663	58,654
Undistributed	601,670	2,343,580		
Total	7,955,088	31,146,641	6,784,600	25,969,186
Earliest record to date	375,800,000	(2)	382,585,000	(2)

[1] Figure withheld to avoid disclosure of individual company confidential data; included with "Undistributed."
[2] Data not available.

Coke.—Tennessee Products & Chemical Corp. produced metallurgical coke at slot-type coke ovens in Chattanooga.

Natural Gas.—Marketed production of natural gas (Morgan and Scott Counties), was 42 percent more than 1957 production and only 20 percent more than 1956 production.

Petroleum.—Production of crude petroleum declined 29 percent below 1957 and 69 percent below the record of 1953. During the year 25 wells were drilled; one well produced a small quantity of oil; and two small gas wells were discovered. At the end of the year 35 wells were producing. Production by counties was as follows: Clay, 306 barrels; Fentress, 293 barrels; Morgan-Scott, 4,255 barrels; and Pickett, 146 barrels.

METALS

Copper.—Tennessee Copper Co. recovered copper concentrate from sulfide ore mined in Polk County. Production decreased 7 percent below 1957 and 14 percent below the record of 1930. The company closed the Burra-Burra mine which had been opened as an open-cut in 1850. The shaft sinking, started in 1899, eventually reached a depth of 2,400 feet. This mine has been the chief source of ore for the company since it started, producing about 16 million tons of crude ore, from which gold, silver, copper, lead, zinc, and pyrite were recovered. In 1958 Tennessee Copper consolidated all its flotation milling at the London mill.

TABLE 14.—Mine production of recoverable gold, silver, copper, lead, and zinc

Year	Gold		Silver		Copper		Lead		Zinc		Total
	Troy ounces	Value	Troy ounces	Value	Short tons	Value	Short tons	Value	Short tons	Value	Value
49–53 (average)	195	$6,811	46,651	$42,222	7,172	$3,402,000	82	$24,944	36,048	$10,590,839	$14,066,816
54	218	7,630	60,759	54,990	9,087	5,361,861	------	--------	30,326	6,550,345	11,974,826
55	221	7,735	66,619	60,294	9,911	7,393,569	------	--------	40,216	9,893,136	17,354,734
56	189	6,615	64,878	58,718	10,449	8,881,650	5	1,570	46,023	12,610,302	21,558,855
57	172	6,020	54,407	49,241	9,790	5,893,580	------	--------	58,063	13,470,616	19,419,457
58	124	4,340	44,592	40,358	9,109	4,791,334	------	--------	59,130	12,062,520	16,898,552
50–1958 (total)	23,300	(1)	3,681,700	(1)	483,300	(1)	27,100	3,176,000	1,325,100	(1)	435,759,000

[1] Included with total value.

Ferroalloys.—Shipments of ferromanganese, silicomanganese, ferrosilicon, ferrochromium, chromic silicide, and ferrophosphorus totaled 177,300 tons valued at $34.9 million, compared with 213,000 tons valued at $57.6 million in 1957, a decline of 17 percent.

Gold.—Tennessee Copper Co. recovered gold as a byproduct from smelting copper and zinc concentrates. Production declined 28 percent below 1957, 82 percent below the record of 1930.

Iron Ore.—Tennessee iron ore mines were idle during the year. Table 15 shows shipments of iron ore, 1800–1958.

Lead.—No lead was recovered in 1958. Table 16 shows the mine production of recoverable lead, 1850–1958.

Manganese Ore.—Metallurgical-grade manganese ore was mined by eight producers in Carter, Johnson, and Unicoi Counties. Leading producers were Valley Mining Co., Ltd., and T. E. Turner, Johnson County. Shipments declined 54 percent below 1957 and 67 percent below 1956.

Pig Iron.—Tennessee Products & Chemical Corp. (Rockwood and Wrigley plants) produced foundry, basic, low phosphorus, and malleable pig iron. Shipments declined 41 percent below 1957 and 52 percent below 1956. There were no imports of foreign ores.

Silver.—Tennessee Copper Co. recovered silver as a byproduct from smelting copper and zinc concentrates produced in Polk County. Production decreased 18 percent below 1957, 59 percent below the record of 1913.

TABLE 15.—Shipments of iron ore, 1800–1958

Year	Long tons	Value	Year	Long tons	Value	Year	Long tons	Value
1800–1870	500,000	$250,000	1901	789,494	$915,813	1931	8,717	$36,156
1871	50,000	25,000	1902	874,542	1,123,527	1932		
1872	94,000	45,000	1903	852,704	1,075,619	1933	24,912	47,824
1873	96,000	50,000	1904	500,982	566,109	1934	3,040	6,080
1874	108,000	55,000	1905	734,770	918,463	1935	14,219	29,909
1875	63,000	32,000	1906	870,734	1,309,799	1936	27,617	73,720
1876	55,000	28,000	1907	813,690	1,325,134	1937	28,359	89,761
1877	58,000	30,000	1908	635,343	876,007	1938	12,823	32,036
1878	52,000	26,000	1909	657,795	908,980	1939	23,848	53,792
1879	92,000	50,000	1910	732,277	1,048,736	1940		
1880	158,000	85,000	1911	469,728	632,339	1941		
1881	194,000	120,000	1912	416,885	564,443	1942		
1882	306,000	200,000	1913	364,092	493,556	1943		
1883	298,000	200,000	1914	330,214	466,523	1944		
1884	300,000	200,000	1915	283,841	408,204	1945		
1885	358,000	285,000	1916	467,741	736,397	1946		
1886	442,000	400,000	1917	520,460	1,235,718	1947		
1887	556,000	555,000	1918	408,954	1,184,546	1948	50	181
1888	595,000	655,000	1919	282,988	817,549	1949	517	2,120
1889	473,294	588,398	1920	373,012	1,355,217	1950	89	395
1890	465,695	591,433	1921	25,220	68,726	1951	35,908	142,447
1891	543,923	520,000	1922	159,473	418,578	1952	7,990	47,240
1892	406,578	505,359	1923	266,175	677,753	1953	12,751	82,499
1893	372,996	392,771	1924	179,293	431,682	1954	20,252	116,823
1894	292,831	286,974	1925	164,073	369,144	1955–58	(1)	(1)
1895	513,085	441,253	1926	138,307	312,109			
1896	534,684	433,094	1927	121,220	274,620	Total to date	23,480,863	32,230,626
1897	604,497	477,553	1928	128,478	286,524			
1898	593,227	480,514	1929	101,796	234,827			
1899	632,046	695,250	1930	27,384	76,089			
1900	594,171	671,413						

[1] Figure withheld to avoid disclosing individual company confidential data.

TABLE 16.—Mine production of recoverable lead, 1850–1958

Year	Short tons	Value	Year	Short tons	Value
1850–1900	5,750	$388,500	1931	215	$15,900
1901	100	8,000	1932	430	25,800
1902	225	18,200	1933	296	21,900
1903	610	51,200	1934	340	25,200
1904	780	71,800	1935	190	15,200
1905	1,120	125,400	1936	805	74,100
1906	415	48,500	1937	405	47,800
1907	85	6,300	1938	553	51,300
1908			1939	517	48,600
1909			1940	573	57,300
1910			1941	23	2,622
1911			1942	238	31,892
1912			1943	200	30,000
1913			1944		
1914			1945	54	9,288
1915	1	78	1946	125	27,250
1916	16	2,274	1947	22	6,336
1917	2,531	435,326	1948		
1918	1,705	242,139	1949	257	81,212
1919	2,188	231,928	1950	113	30,510
1920	1,979	316,560	1951	14	4,844
1921			1952	18	5,796
1922	732	80,520	1953	9	2,358
1923	1,250	175,000	1954		
1924	937	149,920	1955		
1925	448	77,952	1956	5	1,570
1926	800	128,000	1957		
1927			1958		
1928					
1929			Total to date	27,087	3,175,675
1930	13	1,300			

Titanium.—At New Johnsonville E. I. du Pont de Nemours & Co. began constructing a $20-million titanium dioxide plant, which will use ilmenite from its Florida operations; it also leased about 3,000 acres, which it will explore for ilmenite, near the new plant. Cramet, Inc., closed its titanium sponge plant at Chattanooga, releasing it for Government use; cause for the shutdown was given as "drastically reduced requirements for titanium for national defense purposes."

Zinc.—For the first time in history, Tennessee led the Nation in production of zinc. American Zinc Co. of Tennessee (North Friends Station, Young, Coy, and Mascot No. 2 mines), New Jersey Zinc Co. (Jefferson City mine), and Tennessee Coal & Iron Division of United States Steel Corp. (Zinc Mine Works) recovered zinc from zinc ore mined at Mascot and Jefferson City, and Tennessee Copper Co. recovered zinc from copper-zinc ore mined at Copperhill. Production increased 2 percent over the preceding record of 1957. New Jersey Zinc Co. maintained its new Flat Gap mine at Treadway in standby condition and planned to begin full-scale production January 1, 1959. American Zinc Co. of Tennessee completed a 66-inch-diameter ventilation shaft, using a Calyx drill, at the Young mine. American Zinc Co. of Tennessee announced that its ore reserve in Tennessee totaled 85 million tons that was expected to yield 4,750,000 tons of 60 percent zinc concentrate.

Development at zinc and copper-zinc mines included: Diamond drilling 73,935 feet, long hole drilling 30,804 feet, drifting 20,527 feet, raising 6,699 feet, churn drilling 3,605 feet, and sinking 203 feet.

REVIEW BY COUNTIES

Production was reported from 75 counties in the State, compared with 76 in 1957; the leading producers were Knox, Marion, Polk, Jefferson, and Maury Counties. In addition to the commodities listed in table 17, small quantities of oil, gas, and gem stones were produced; county origin was undetermined.

Anderson.—The Dean mine (Wind Rock Coal & Coke Co.), the Moore mine (Pocahontas Fuel Co.), and the No. 1 Strip mine (Tennco, Inc.) were the leading producers of the 52 active coal mines. Ralph Rogers & Co. (Oak Ridge quarry) and Anderson County Highway Department (Taylor No. 1 quarry) crushed limestone for concrete aggregate, roadstone, and stone sand.

Bedford.—Shelbyville Limestone Co. and Bedford County Highway Department crushed limestone for concrete aggregate, roadstone, and agstone.

Benton.—Seven mines produced glass, molding, paving, grinding and polishing, and fire or furnace sand, and paving gravel. The leading producers were Memphis Stone & Gravel Co. (Memphis mine) and Hardy Sand Co. (Silica and Camden mines).

Bledsoe.—The No. 1 mine (I. E. & Landon Brown Coal Co.) was the leading producer of the four active coal mines.

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TABLE 17.—Value of mineral production in Tennessee, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value [2]
Anderson	(3)	(3)	Coal, limestone.
Bedford	(3)	(3)	Limestone.
Benton	$1,083,904	$1,033,617	Sand and gravel.
Bledsoe	78,165	133,312	Coal.
Blount	2,327,938	(3)	Marble, limestone.
Bradley	(3)	(3)	Limestone.
Campbell	4,440,870	3,149,753	Coal, limestone, sandstone.
Cannon	(3)	(3)	Limestone.
Carter	702,901	(3)	Limestone, manganese ore, granite, sandstone.
Claiborne	1,749,973	1,105,165	Coal.
Clay	(3)	----------	
Cocke	(3)	80,076	Limestone.
Coffee	(3)	(3)	Do.
Cumberland	1,970,118	2,451,973	Sandstone, limestone, coal.
Davidson	5,857,915	6,364,960	Cement, limestone, sand and gravel, phosphate rock, miscellaneous clay.
Decatur	50,000	189,000	Limestone, sand and gravel.
De Kalb	19,000	26,620	Limestone.
Dickson	(3)	(3)	Do.
Fayette	(3)	76,690	Sand and gravel, limestone.
Fentress	582,169	429,592	Limestone, coal, sandstone.
Franklin	(3)	(3)	Cement, limestone, sand and gravel, miscellaneous clay.
Giles	1,126,247	1,370,935	Phosphate rock, limestone, sand and gravel.
Grainger	47,690	39,583	Marble, limestone.
Greene	260,273	(3)	Limestone, mica, sand and gravel.
Grundy	701,576	541,079	Coal, limestone.
Hamblen	(3)	(3)	Limestone.
Hamilton	6,973,875	7,572,873	Cement, limestone, sand and gravel, coal, miscellaneous clay.
Hawkins	(3)	(3)	Limestone.
Haywood	----------	90,000	Sand and gravel.
Henderson	(3)	(3)	Do.
Henry	(3)	(3)	Ball clay, fuller's earth.
Hickman	(3)	(3)	Phosphate rock.
Humphreys	(3)	(3)	Limestone, sand and gravel.
Jefferson	(3)	(3)	Zinc, limestone.
Johnson	538,596	666,071	Limestone, manganese ore.
Knox	14,245,631	14,273,157	Cement, zinc, limestone, marble, lime, sand and gravel, miscellaneous clay.
Lake	(3)	----------	
Lauderdale	112,046	40,000	Sand and gravel.
Lincoln	96,900	(3)	Limestone.
Loudon	294,972	35,434	Sand and gravel, miscellaneous clay.
Macon	(3)	(3)	Limestone, sand and gravel.
Marion	(3)	(3)	Coal, cement, limestone.
Marshall	(3)	(3)	Limestone.
Maury	9,846,672	9,327,547	Phosphate rock, limestone.
McMinn	448,500	(3)	Limestone, barite, gem stones.
McNairy	(3)	(3)	Sand and gravel.
Meigs	(3)	(3)	Limestone.
Monroe	455,349	(3)	Barite, limestone, sand and gravel, gem stones.
Montgomery	(3)	(3)	Limestone.
Morgan	[4] 2,712,204	2,807,526	Coal.
Obion	50,470	51,999	Sand and gravel.
Overton	(3)	236,067	Coal.
Perry	(3)	10,000	Sand and gravel.
Polk	(3)	(3)	Pyrite, copper, zinc, silver, gold.
Putnam	(3)	1,669,338	Coal, gem stones.
Rhea	171,059	729,977	Coal, limestone, sandstone, miscellaneous clay.
Roane	1,273,697	(3)	Limestone, coal.
Robertson	(3)	(3)	Limestone.
Rutherford	266,000	477,245	Do.
Scott	3,287,573	2,951,486	Coal.
Sequatchie	(3)	1,257,399	Coal, limestone.
Sevier	(3)	(3)	Limestone, sandstone.
Shelby	1,189,801	1,602,475	Sand and gravel, miscellaneous clay.
Smith	(3)	(3)	Limestone.
Sullivan	(3)	(3)	Cement, limestone, miscellaneous clay.
Sumner	412,549	371,520	Limestone, sand and gravel.
Tipton	(3)	(3)	Sand and gravel.
Unicoi	(3)	(3)	Sand and gravel, manganese ore.
Union	(3)	(3)	Marble, limestone.
Van Buren	192,886	241,680	Coal.
Warren	(3)	(3)	Limestone, gem stones.
Washington	(3)	(3)	Limestone, miscellaneous clay.
Wayne	(3)	(3)	Sand and gravel.
Weakley	(3)	(3)	Ball clay.
White	787,339	540,785	Limestone, coal.
Williamson	(3)	(3)	Phosphate rock, limestone.

See footnotes at end of table.

TABLE 17.—Value of mineral production in Tennessee, by counties [1]—Continued

County	1957	1958	Minerals produced in 1958 in order of value [2]
Wilson	(3)	(3)	Limestone.
Undistributed [5]	[4] $64,384,142	$62,988,066	
Total	[4] 128,739,000	124,928,000	

[1] The following counties are not listed because no production was reported: Carroll, Cheatham, Chester, Crockett, Dyer, Gibson, Hancock, Hardeman, Hardin, Houston, Jackson, Lawrence, Lewis, Madison, Moore, Pickett, Stewart, and Trousdale.
[2] Petroleum and natural gas not listed by counties as data are not available; value included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Revised figure.
[5] Includes value of petroleum and natural gas and values indicated by footnote 3.

Blount.—John J. Craig Co. (Marmor, Hamil, Crisp, and Lee quarries), Gray Knox Marble Co. (Brown and French Pink quarries), and Endsley Marble Co. quarried dimension marble for rough and dressed building stone and dressed monumental stone. John J. Craig Co. and Gray Knox Marble Co. crushed marble for terrazzo and other uses. Lambert Bros. Division of Vulcan Materials Co. (Maryville quarry) crushed limestone for concrete aggregate and roadstone.

Bradley.—Bradley Limestone Co. (Welch quarry) and McMinnville Rock Co., Inc. (McMinn quarry), crushed limestone for concrete aggregate, roadstone, and agstone.

Campbell.—Eighty-six coal mines were active; the leading producers were the No. 1 Auger mine (Price Coal Co.), the No. 1 Strip mine (White Oak Coal Co.), and the No. 1 Strip mine (Cofer Coal Co.). Key Limestone Division, Jellico Stone Co., Inc., and Campbell County Highway Department crushed limestone for concrete aggregate, roadstone, and agstone. One producer crushed sandstone for abrasives, cement, concrete aggregate, and roadstone.

Cannon.—Woodbury Stone Co. crushed limestone for concrete aggregate and roadstone at the Norvell quarry.

Carter.—Watauga Stone Co. crushed limestone for concrete aggregate, roadstone, railroad ballast, and stone sand. Blue Ridge Stone Co. crushed granite for concrete aggregate and roadstone. Virginia Iron, Coal, & Coke Co. (Stoney Creek mine) and Lewis Mining Co. (Miller & Perkins mine) mined Metallurgical-grade manganese ore. Major Sand Co., Inc., began crushing sandstone for concrete aggregate and roadstone.

Claiborne.—Twenty-six coal mines were active; leading producers were the No. 2 Strip and the Dippel Auger mines (Dippel & Dippel Coal Co.) and the No. 1 mine (Harrison Bros. Coal Co.).

Cocke.—Cocke County Highway Department crushed limestone for concrete aggregate and roadstone at the Briar Thickett and the Smith quarries.

Coffee.—Ralph Rogers & Co., Inc. (Coffee quarry), crushed limestone for concrete aggregate, roadstone, agstone, and stone sand.

Cumberland.—Eleven companies quarried dimension sandstone for rough architectural, sawed building stone, and flagging. The leading producers were Crab Orchard Stone Co., Inc. (Peck quarry), A. L. Reed Sandstone Co., and Tennessee Stone Co., Inc. (McGuire quarry).

Turner Bros. Stone Co., Inc., crushed sandstone for refractory uses. Southern States Lime Mfg. Co. (Crab Orchard quarry) and Cumberland County Road Commission crushed limestone for fluxing stone, concrete aggregates, roadstone, railroad ballast, agstone, glass, paper, rock dust for coal mines, and mineral food. Seventeen coal mines were active; leading producers were the No. 1 Strip mine (Waters Coal Co.), the Cox mine (H & H Coal Co.), and the Potter No. 1 mine (Potter Bros.).

Davidson.—Marquette Cement Mfg. Co. produced masonry and portland cements at the Nashville mill throughout the year. Lambert Bros. Division of Vulcan Materials Co. (Hermitage, Danley, and Old Hickory quarries), Eller & Olson Crushed Stone Co., Menefee Crushed Stone Co., and Davidson County Highway Commission produced limestone for riprap, concrete aggregate, roadstone, agstone, and other fillers. Cumberland River Sand & Gravel Co. and T. L. Herbert & Sons mined structural and paving sand and gravel. Harsh Phosphate Co. mined 13,000 tons of marketable phosphate rock. W. G. Bush & Co., Inc., mined miscellaneous clay for heavy clay products. Davidson County Highway Commission quarried 200 tons of dimension limestone for building stone. Tennessee Products & Chemical Corp. (Nashville plant) expanded crude perlite from deposits in the Western States. Zonolite Co. exfoliated crude vermiculite at the Nashville mill from South Carolina and Montana.

Decatur.—Western Materials, Inc., crushed limestone for concrete aggregate and roadstone. Tinker Sand & Gravel Co. mined structural and paving sand and gravel.

De Kalb.—De Kalb County Highway Department crushed limestone for concrete aggregate and roadstone.

Dickson.—Duke Lime & Stone Co. (Duke quarry) crushed limestone for concrete aggregate, roadstone, agstone, and stone sand.

Fayette.—Fayette County Highway Department crushed limestone for concrete aggregate and roadstone and also mined paving gravel.

Fentress.—Frogge & Williams, Inc. (Wright quarry), crushed limestone for concrete aggregate, roadstone, and agstone. Twenty-two coal mines were active; the leading producers were the East Fork No. 2 mine (Tipton Coal Co.), the No. 2 mine (McGhee Coal Co.), and the Barnes No. 2 mine (Walter Hall Coal Co.). Kentucky-Tennessee Stone Co. quarried 150 tons of dimension sandstone for building stone.

Franklin.—Marquette Cement Mfg. Co. produced masonry and portland cements at the Cowan mill throughout the year. Cowan Stone Co. (Anderson and Cowan quarries), Marquette Cement Mfg. Co. and Franklin County Highway Department (Bostick quarry) produced limestone for riprap, fluxing stone, concrete aggregate, roadstone, railroad ballast, agstone, cement, glass, and other uses. Estill Springs Sand-Gravel Co. mined structural and paving sand and structural gravel. Marquette Cement Mfg. Co. mined miscellaneous clay for use in cement.

Giles.—Monsanto Chemical Co. and International Minerals & Chemical Corp. (Wales mine) mined marketable phosphate rock for use in agriculture, pig-iron blast furnaces, and elemental phosphorus. Cedar Grove Lime Co. crushed limestone for concrete aggregate,

roadstone, and agstone. Giles County Highway Department mined paving gravel.

Grainger.—Imperial Black Marble Co. quarried 550 tons of dimension marble for rough and dressed interior building stone. Grainger County Highway Department (Mitchell quarry) crushed limestone for concrete aggregate and roadstone. B. H. Putnam (Puncheon Camp Creek Area) and New Jersey Zinc Co. (Cedar Springs Area) continued DMEA projects, begun in 1957, for zinc ores.

Greene.—Malone Bros. Co., Agricultural Lime Co., Inc., and Greene County Highway Department (Ratcliffe quarry) crushed limestone for concrete aggregate, roadstone, and agstone. International Minerals & Chemical Corp. recovered scrap mica from silt deposits in Davy Crockett Lake. Nollichucky Sand Co. mined structural sand and gravel.

Grundy.—Six coal mines were active; the leading producers were the No. 1 Strip mine (Ramsey Coal Co.), the Commando Strip mine (Phipps Coal Co.), and the No. 1 Strip mine (W. P. Church Coal Co.). Viola White Lime Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Hamblen.—White Pine Stone Co. crushed limestone for concrete aggregate and roadstone at the Hamblen quarry.

Hamilton.—Signal Mountain Portland Cement Division of General Portland Cement Co. produced masonry and portland cements at the Signal Mountain mill throughout the year. Chattanooga Rock Products, Division of Vulcan Materials Co., crushed limestone for concrete aggregate, roadstone, railroad ballast, and agstone. Dixie Sand & Gravel Co. mined structural and paving sand and gravel. Nineteen coal mines were active, the leading producers were the No. 2 Strip mine (Walden Ridge Coal Co.), the Lake View No. 1 Strip mine (Russell Mining Co.), and the No. 1 mine (J. M. Kilgore Coal Co.). B. Mifflin-Hood Co. (Daisy mine) mined miscellaneous clay for floor and wall tile.

Hancock.—New Jersey Zinc Co. completed a DMEA project (begun in May 1956) for zinc ore in the Independence area, continued work on the Big War Creek area (begun June 1956) and started a new project on the Little War Creek area for zinc ore. The New Jersey Zinc Co. maintained the Flat Gap mine on a standby basis during the year for full-scale production in 1959.

Hawkins.—Lambert Bros. Division of Vulcan Materials Co. crushed limestone for concrete aggregate and roadstone at the McCloud quarry.

Haywood.—Haywood County Highway Department mined paving gravel.

Henderson.—Ayers Mineral Co. mined molding sand at the Zane mine.

Henry.—H. C. Spinks Co. (Henry mine), Kentucky-Tennessee Clay Co. and Dixie Brick & Tile Co. (Puryear mine) mined ball clay for whiteware; floor and wall tile; firebrick and block; saggers, pins, stilts, and wads; heavy clay products; and for export. Southern Clay Co., Inc. (Porters Creek mine), Tennessee Absorbent Clay Co. (Paris mine) and Mid-South Clay Co. mined fuller's earth for absorbent uses.

Hickman.—M. C. Boyle Phosphate Co. (Bratton mine) mined marketable phosphate rock for agricultural use.

Humphreys.—Lambert Bros. Division of Vulcan Materials Co. crushed limestone for concrete aggregate and roadstone at the Rock Hill quarry. Sangravl Co., Inc., mined structural and paving sand and gravel.

Jefferson.—Jefferson County ranked fourth in total value of mineral production in the State. New Jersey Zinc Co. (Jefferson City mine), American Zinc Co. of Tennessee (Young, North Friends Station, and Coy mines), and Tennessee Coal & Iron Division of United States Steel Corp. (Zinc Mine Works) recovered zinc from zinc ores. New Jersey Zinc Co. continued a DMEA project (begun in 1956) in the Strawberry Plains area. American Zinc Co. of Tennessee, Tennessee Coal & Iron Division, and New Jersey Zinc Co. produced limestone as a byproduct from zinc mines; this material was used for concrete aggregate, roadstone, and agstone.

Johnson.—Six mines produced Metallurgical-grade manganese ore for sale to the Government. Leading producers were Valley Mining Co., Ltd. (Blackburn and Barry Blevins mines), and T. E. Turner. Maymead Lime Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Knox.—Knox County led the State in total value of mineral production. Volunteer Portland Cement Co. produced masonry and portland cements at the Knoxville mill throughout the year. American Zinc Co. of Tennessee (Mascot No. 2 mine) mined zinc ores and recovered limestone as a byproduct. Ten crushing plants produced limestone for concrete aggregate, roadstone, railroad-ballast, agstone, cement, poultry grit, paper, and lime. Leading producers were Volunteer Portland Cement Co., Lambert Bros. Division of Vulcan Materials Co. (Knoxville, Kennedy, Biagotti, and Neuberts quarries), and American Zinc Co. of Tennessee (Mascot No. 2 mine). Gray Knox Marble Co. (Gray Knox quarry), Tennessee Marble Co. (Eagle quarry), and Appalachian Marble Co. (Appalachian and Bond quarries) quarried 18,900 tons of dimension marble for rough and dressed building stone and for cut, dressed monumental stone. Gray Knox Marble Co., Appalachian Marble Co., and Knoxville Crushed Stone Co. crushed 13,000 tons of marble for terrazzo and other uses. Standard Lime & Stone Co. and Williams Lime Mfg. Co. produced lime for building, agricultural, chemical, and industrial uses. Knoxville Sangravl Materials Co. and Oliver King Sand-Lime Co. mined molding, structural, paving, and engine sand, and structural and paving gravel. General Shale Products Corp., Shalite Corp., and Volunteer Portland Cement Co. mined miscellaneous clay for lightweight aggregates, cement, and heavy clay products. American Zinc Co. of Tennessee continued a DMEA project begun July 1956 in the Strawberry Plains area for zinc ores.

Lauderdale.—Lauderdale County Highway Department mined paving gravel.

Lincoln.—Clark & Stephenson crushed limestone for concrete aggregate and roadstone at the Fayetteville quarry.

Loudon.—Brooks Sand & Gravel Co. mined structural sand. Old Hickory Brick Co. (Maryville mine) mined 5,000 tons of miscellaneous clay for heavy clay products.

Macon.—Dixon & Stubblefield crushed limestone for concrete aggregate and roadstone at the Langford quarry. Tennessee Department of Highways & Public Works mined 17,000 tons of paving gravel.

Marion.—Marion County ranked second in the State in total value of mineral production. Ninety-eight coal mines were active; leading producers were the Coal Valley mine (Tennessee Consolidated Coal Co.), the Reel's Cove mine (Tennessee Products & Chemical Corp.), and the Lick Point Strip mine (Serodino, Inc.). Penn-Dixie Cement Corp. produced portland cement at the Richard City mill throughout the year. Signal Mountain Portland Cement Division of General Portland Cement Co. (Bennett's Lake quarry), Penn-Dixie Cement Corp., and Chattanooga Rock Products Division of Vulcan Materials Co. (Ketchall quarry) crushed limestone for cement, concrete aggregate, roadstone, and agstone.

Marshall.—Lewisburg Limestone Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Maury.—Maury County ranked fifth in the State in total value of mineral production. Seven mines produced marketable phosphate rock; leading producers were Monsanto Chemical Co., Victor Chemical Works, and Presnell Phosphate Co., Inc. Columbia Rock Products Corp. crushed limestone for concrete aggregate and roadstone at the Theta Pike quarry.

McMinn.—Floyd D. Webb Stone Co. and McMinn County Highway Department crushed limestone for concrete aggregate and roadstone. McMinn Barium Corp. mined barite at the McMinn mine. Ben T. Traywick produced a small quantity of gem stones (flint).

McNairy.—Worsham Bros. mined structural and paving sand and gravel.

Meigs.—Ten Mile Stone Co. (Carter quarry) and Posey & Caldwell produced limestone for riprap, concrete aggregate, roadstone, and agstone.

Monroe.—National Lead Co. (Jones, Roy, and Stephens & Ballard mines) mined barite for well drilling, glass, rubber, paint, and other uses. Creighead Limestone Co. crushed limestone for concrete aggregate and roadstone. Vonore Sand Co. and Evans Sand Co. mined structural sand. Ben T. Traywick produced a small quantity of gem stones (barite and fossils).

Montgomery.—Simpson Stone Co. and Clarksville Stone Co. produced limestone for riprap, concrete aggregate, roadstone, and agstone.

Morgan.—Forty-one coal mines were active; the leading producers were No. 3 Strip mine (Lueking Bros. Coal Co.), No. 6 Strip mine (Allen Bros. Coal Co.), and Pine Orchard Strip mine (Cofer & Tedder Construction Co.).

Obion.—Obion County Highway Department mined paving gravel.

Overton.—Sixteen coal mines were active; the leading producers were No. 3 mine (Phillips Bros. Coal Co.), No. 1 mine (Brown Coal Co.), and Honey Springs No. 2 mine (Honey Springs Coal Co.).

Perry.—Tennessee Department of Highway & Public Works mined paving gravel.

Polk.—Polk County ranked third in the State in value of mineral production. Tennessee Copper Co. produced mixed sulfide ore at the Boyd, Burra Burra, Calloway, Eureka, and Mary mines. The ore, concentrated in two flotation mills, yielded copper, pyrite, and zinc concentrates; the pyrite concentrate was roasted to produce sulfur dioxide for use mainly in manufacturing sulfuric acid and iron oxide; the iron oxide was sintered for use in iron and steel plants. During the year the Burra Burra mine, one of the oldest copper mines in the State was abandoned because of depleted reserves. The company planned to open a new mine to offset the loss of tonnage from the Burra Burra mine.

Putnam.—The Meadow Creek mine (Clinchfield Coal Co.) was the only active coal mine. Ben T. Traywick produced a small quantity of gem stones (fluorite).

Rhea.—Ten coal mines were active; the leading producers were No. 1 mine (Richard Kirkwood Fuel Co.), Bumbee mine (Norris Coal Co.), and No. 2 mine (E. Campbell Coal Co.). Rhea County Limestone Co. crushed limestone for concrete aggregate, roadstone, and agstone. McCoy Bros quarried dimension limestone for rough architectural uses. Tennessee Rubble Stone Co., Inc., quarried dimension sandstone for dressed building stone and for flagging. W. S. Dickey Clay Mfg. Co. (Graysville Clay mine) mined 17,000 tons of miscellaneous clay for heavy clay products.

Roane.—Lambert Bros. Division of Vulcan Materials Co. (Rockwood quarry) and A. B. Long Construction Co. (Swan Pond quarry) produced limestone for riprap, concrete aggregate, roadstone, railroad ballast, agstone, and stone sand. The Carter mine (Hamby Coal Co.) was the only active coal mine.

Robertson.—Porter Brown Limestone Co. crushed limestone for concrete aggregate and roadstone.

Rutherford.—Bilbrey Rock Co. crushed limestone for concrete aggregate and roadstone.

Scott.—Forty-two coal mines were active; the leading producers were Dean No. 2 Strip mine (Dean Coal Co., Inc.), Lassie No. 1 mine (Laddie Coal & Mining Co.), and No. 2 Strip mine (Overton Coal Co.).

Sequatchie.—Forty-five coal mines were active; the leading producers were Waldon Ridge No. 1 Strip mine (Waldon Ridge Coal Co.), D–203 mine (C. C. Cordell Coal Co.), and the Woodcock mine (Earl Patton Coal Co.). Dunlap Stone Co. crushed limestone for concrete aggregate, roadstone, and agstone.

Sevier.—Lambert Bros. Division of Vulcan Materials Co. (Sevier quarry) crushed limestone for concrete aggregate and roadstone. U.S. Bureau of Public Roads quarried dimension limestone and dimension sandstone for rough construction uses.

Shelby.—Eight companies operated eleven mines for structural, paving, and other sand and gravel. The leading producers were Memphis Stone & Gravel Co. (Harrison, No. 2, Raleigh, and York mines), Bluff

City Sand & Gravel Co., Inc., and Cordova Sand & Gravel Co. Moss Lightweight Aggregate Co. and John A. Denie's Sons Co. mined 119,000 tons of miscellaneous clay for lightweight aggregates and heavy clay products.

Smith.—Oldham Limestone Co. (Rome quarry) crushed limestone for concrete aggregate, roadstone, and agstone.

Sullivan.—Penn-Dixie Cement Corp. produced masonry and portland cements at the Kingsport mill throughout the year. Lambert Bros. Division of Vulcan Materials Co. (New Kingsport quarry) and Sullivan County Highway Department (Fall Creek and Muddy Creek quarries) crushed limestone for concrete aggregate and roadstone. General Shale Products Corp. and Penn-Dixie Cement Corp. mined miscellaneous clay for cement and heavy clay products.

Sumner.—Ralph Rogers & Co., Inc. (Sumner quarry), Pilot Knob Limestone Co., and L & N Stone Co. crushed limestone for concrete aggregate, roadstone, and agstone. Sumner County Highway Department mined paving gravel.

Tipton.—Owens Sand & Gravel Co. (Covington mine) mined structural sand and structural and paving gravel.

Unicoi.—Brooks Sand & Gravel Co. mined structural sand and paving and railroad-ballast gravel. United States Manganese Sulfate Corp. (Bumpass Cove mine) mined Metallurgical-grade manganese ore. The Feldspar Corp. ground feldspar at the Erwin plant.

Union.—Tennessee Marble Co. quarried dimension marble for rough and dressed building stone and dressed monumental stone at the Luttrell quarry. Union County Road Commission crushed limestone for concrete aggregate and roadstone. B. H. Putnam began a DMEA project for zinc ore on the Luttrell property in June in the amount of $86,975, of which the Government's share is 50 percent.

Van Buren.—Eleven coal mines were active; the leading producers were the Buckridge mine (Alton Anderson Coal Co.), the No. 1 mine (I. E. Brown Coal Co.), and the Glade Creek mine (Brown Coal Co.).

Warren.—Warren Limestone Co. (McMinnville quarry) crushed limestone for concrete aggregate, roadstone, and agstone. Ben T. Traywick produced a small quantity of gem stones (sandstone and geodes).

Washington.—Washington County Highway Department crushed limestone for concrete aggregate and roadstone. General Shale Products Corp. mined miscellaneous clay for heavy clay products.

Wayne.—Clifton Towing Co. (Baker mine) mined structural sand and gravel.

Weakley.—United Clay Mines Corp. (No. 6 mine), Bell Clay Co. (Collins mine), H. C. Spinks Clay Co. (Gleason mine), and Cooley Clay Co. (Greenfield mine) mined ball clay for whiteware, art pottery, high-grade tile, kiln furniture, rubber filler, pastes, and enameling.

White.—Sparta Limestone Co., Thompson-Weinman & Co., and White County Highway Department (W. L. Carter quarry) crushed limestone for concrete aggregate, roadstone, agstone, and whiting. Three coal mines were active; leading producer was the T & H strip mine (T & H Coal Co.).

Williamson.—Monsanto Chemical Co. mined marketable phosphate rock for elemental phosphorus. Lambert Bros. Division of Vulcan Materials Co. (Franklin quarry) and Williamson County Highway Department (Globe quarry) crushed limestone for concrete aggregate and roadstone.

Wilson.—Lebanon Limestone Co. and Marquette Cement Mfg. Co. (Martha quarry) crushed limestone for cement, concrete aggregate, roadstone, and agstone.

The Mineral Industry of Texas

This chapter was prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and The University of Texas, Bureau of Economic Geology.

By F. F. Netzeband [1] and John T. Lonsdale [2]

THE TEXAS mineral industry maintained its important position in the industrial activities of the State, the Southwest region, and the Nation in 1958, with a total worth of $4 billion, about one-quarter of the national mineral value. Texas remained the principal domestic producer of petroleum, natural gas, natural gas liquids, helium, sulfur, bromine, shell, and magnesium metal. Other important minerals produced in significant quantities were cement, clay, gypsum, lime, salt, sand and gravel, and stone. A total of 28 minerals and mineral fuels was produced.

TABLE 1.—Mineral production in Texas [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement—thousand 376-pound barrels	22,144	$68,541	25,875	$79,756
Clays [2]—thousand short tons	2,992	4,934	3,719	5,424
Gem stones	(3)	100	(3)	100
Gypsum—thousand short tons	1,043	3,343	1,240	4,120
Helium—thousand cubic feet	204,286	3,353	294,452	4,807
Lime—thousand short tons	796	7,489	691	7,146
Natural gas—million cubic feet	[6] 5,156,215	[6] 500,153	5,178,073	517,807
Natural gas liquids:				
Natural gasoline and cycle products—thousand gallons	2,944,381	201,423	2,871,589	204,501
LP-gases—do	3,831,664	147,618	3,786,575	151,896
Petroleum (crude)—thousand 42-gallon barrels	[6] 1,073,867	[6] 3,338,119	[4] 940,706	[4] 2,873,988
Salt (common)—thousand short tons	4,612	17,104	3,843	15,115
Sand and gravel—do	23,685	23,427	32,871	30,808
Stone—do	[6] 31,248	[6] 36,153	36,076	40,912
Sulfur (Frasch-process)—thousand long tons	2,879	70,226	2,616	61,621
Talc and soapstone	47,780	199	60,827	168
Value of items that cannot be disclosed: Abrasive stones (1957), native asphalt, bromine, clay (fuller's earth), coal (lignite), feldspar, graphite, iron ore (usable), magnesium chloride (for metal), magnesium compounds (except for metal), mercury, pumice, sodium sulfate, and uranium ore	----------	71,510	----------	50,635
Total Texas [5]	----------	[6] 4,484,538	----------	4,038,656

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes certain clays, value for which is included with "Items that cannot be disclosed."
[3] Weight not recorded.
[4] Preliminary figure.
[5] Total has been adjusted to eliminate duplicating the value of clays and stone.
[6] Revised figure.

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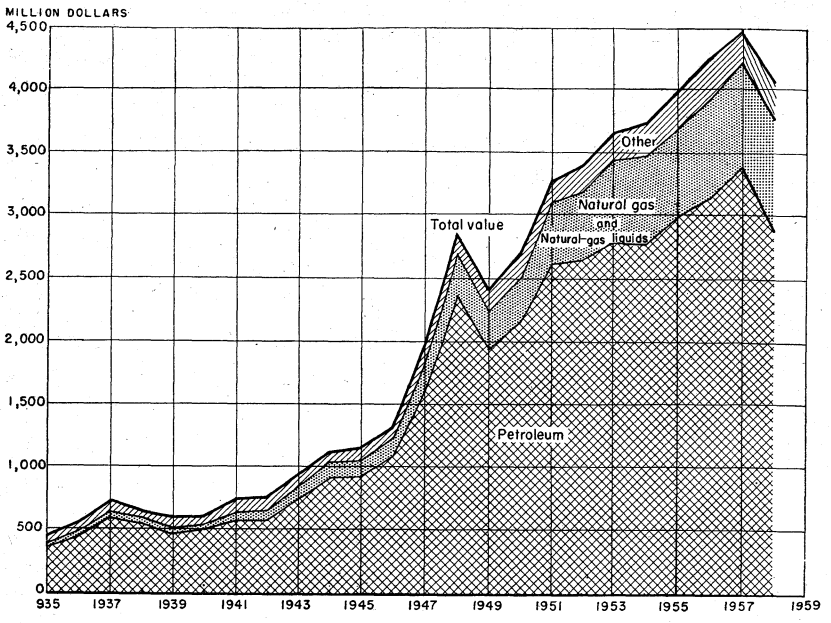

FIGURE 1.—Value of petroleum, natural gas, and natural-gas liquids and total value of mineral production in Texas, 1935–58.

The mineral resources of Texas are widely distributed over the State, as 232 of the 254 counties reported mineral output. Mineral fuels—petroleum, natural gas, natural gas liquids, lignite, and helium—were reported from 214 counties, nonmetals from 153 counties, and metals from 6 counties. Eight counties reported mineral value greater than $100 million.

Another substantial part of the State's mineral industry recovered secondary products from locally produced minerals, recovered sulfur and carbon black from sour natural gas and refinery residues, or processed minerals and mineral fuels from other States and from foreign countries.

Most of the mineral fuels, both crude and refined, were destined for markets outside the State. Pipelines and barges carried many of these products to northern and eastern markets, and ocean tankers transported significant quantities to eastern seaboard markets and foreign ports. Out-of-State markets also were principal consumers of ferrous, base-, and light-metal smelter products. Nonmetal commodities depended largely on local and intrastate markets.

The 10-percent decline in the 1958 value of Texas mineral production, as compared with 1957, was the result of declining State and national markets which began in late 1957 and continued into the first half of 1958, to mounting stocks held by producers, to keener competition from out-of-State mineral producers and from foreign imports, and to the liquidation of consumer inventories. Most of the decline was attributable to severe cutbacks in crude-oil production and refining. Construction activity improved steadily in 1958. Residential construction composed nearly 70 percent of all construc-

tion and was the only factor to show a major gain over 1957 experience; industrial and commercial construction declined less than 1 percent. Activity in metal mining, smelting, and refining, drastically curtailed during the first half of the year, progressively improved until much of the idle capacity was returned to production.

TABLE 2.—Average employment, weekly hours worked, and weekly earnings in selected industries [1]

Industry	Employment		Weekly hours worked		Weekly earnings	
	1957	1958	1957	1958	1957	1958
Manufacturing	483,800	460,400	41.2	40.8	$84.46	$85.07
Primary metals	26,700	22,000	40.1	39.2	96.24	98.14
Chemicals	48,500	48,000	42.2	42.4	102.12	104.57
Petroleum and coal products	48,700	48,200	40.7	40.2	111.93	113.07
Machinery (oil field)	46,800	42,400	41.8	39.8	93.21	92.49
Transportation equipment	73,000	60,300	40.8	39.7	96.70	101.86
Nonmanufacturing	1,988,400	1,997,000				
Mining	132,900	125,000	43.4	42.9	105.46	107.42
Crude petroleum	125,000	117,300	43.4	42.8	107.20	109.22
Sulfur	7,900	7,700	39.8	40.2	94.33	101.10
Construction	165,300	159,967				

[1] Texas Employment Commission, in cooperation with U.S. Bureau of Labor Statistics.

Legislation and Government Programs.—Multimillion-dollar demonstration plants for converting salt water into municipal and industrial water at Gulf coast and inland sites of Texas were possible under legislation approved by the 85th Congress. Sites were to be selected by the Secretary of the Interior early in 1959, with construction to begin before the end of 1959. Criteria to determine plant location were availability of saline waters, the need for increasing the water supply, and the extent of public and private cooperation. Under the legislation, one plant each would be built on the Gulf, Atlantic, and Pacific coasts; in the Southwest; and in the northern Great Plains. Gulf coast cities bidding for the site were Beaumont, Corpus Christi, Galveston, Houston, and Orange. Bidding for inland sites were Childress, Midland, and Wichita Falls. About six processes were being considered for demonstration plants. The capacity of the largest plant would be 1 million gallons of converted water daily.

All programs of the Defense Minerals Exploration Administration were inactive. The copper project of Trans-Pecos Minerals, Inc., in Culberson County and the mercury project of Southern Geophysical Co. in Brewster County were idle during the calendar year while the uranium project of Briscoe County Uranium Co. in Briscoe County was terminated at mid-year.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The imbalance of supply and demand of crude oil and many of its products began early in 1957 and was accentuated during the first half of 1958 as output plus imports continued to exceed demand, despite a substantial increase in consumption and drastically

curtailed domestic production schedule for both wells and refineries. Shut-in capacity of wells mounted, as the Texas Railroad Commission strove to balance crude output with demand by reducing the number of producing days to a minimum of eight, the lowest on record. The commission gradually increased proration the remainder of the year.

Texas oil-refining and chemical industries prepared for significant technologic advances in 1958, with fully automatic control of processing units. Three computer-controllers to provide automatic control of select units in oil refining and chemical processing were being installed. The Texas Company planned a digital computer for automatic control of a catalytic polymerization unit at its Port Arthur refinery. An oil company scheduled installation of an Opcon control system containing an analog computer for one of its refining operations, yet to be designated. Monsanto Chemical Co. planned to install a computer in one of its technical plants, still to be chosen. The computer would constantly monitor process conditions and automatically adjust controls for optimum performance. Such a computer has control units particularly valuable in research and development projects for determining the best operating conditions for new processes before pilot-plant testing.

West Texas refiners were provided outlets to markets in the Midwest and Ohio Valley through completion of a 47-mile pipeline connecting Wichita Falls with the Oklahoma-Mississippi River Co. pipeline near Duncan, Okla. The new line will serve the Big Spring, Col-Tex, and Hawley refineries of Cosden Petroleum Co. and the Wichita Falls refineries of American Petrofina Co. and Continental Oil Co. Upper Midwest markets in Missouri, Iowa, Nebraska, Minnesota, Wisconsin, and North and South Dakota will be available via Oklahoma-Mississippi pipeline and Texas Eastern pipeline.

Carbon Black.—There were 23 active carbon-black plants compared with 24 in 1957. Of these, 13 were furnace-type, 8 were channel-type, and 2 were roller-type. The volume of natural gas used as raw material in producing carbon black continued to decrease, composing 30 percent of the total carbon black produced compared with 39 percent in 1957. Production from petroleum liquids amounted to 505 million pounds; from natural gas, 339 million pounds. Average carbon-black yield from liquids was 3.90 pounds a gallon, with 2.61 pounds recovered a thousand cubic feet of natural gas.

At Port Neches Goodrich-Gulf Chemicals, Inc., completed additional facilities to produce a new type of dry synthetic rubber containing carbon black. Ordinarily, the carbon blacks are mixed with rubber and other chemicals at the manufacturing plants.

Helium.—Demands for helium continued to increase because of the growing requirements of atomic energy, missile development, space-exploration programs, and expanding industrial uses such as shielded arc welding. Seventy-seven percent of the 1958 helium output was used in defense, atomic energy, and other vital Federal programs.

New legislation that would enable the U.S. Department of the Interior to carry out an effective long-range helium conservation program and permit the Secretary of the Interior to enter into long-term contracts with private industry for helium production

was proposed to the Vice President and the Speaker of the House by the Secretary of the Interior, Fred A. Seaton. The proposed program would entail construction of some 12 new recovery plants in helium-bearing gas areas, thus permitting the recovery and conservation of some 3 billion cubic feet a year of helium now being wasted when the natural gas is marketed as fuel. The helium would then be stored underground in the Government-owned Cliffside gasfield near Amarillo. In 1958 helium was produced in four Government owned and operated plants at Exell and Amarillo, Tex.; Otis, Kans.; and Shiprock, N. Mex.

Lignite.—Lignite used as a fuel to generate electric power and as a raw material for manufacturing activated carbon was mined by open-pit methods in Milam and Harrison Counties.

A joint study was made by the Federal Bureau of Mines and the Texas Power & Light Co. of pipeline-transportation costs on Texas lignite for distances up to 100 miles. The study revealed that rail- or truck-haulage costs were less than by pipeline because of the degradation of lignite in the line and the high cost of dewatering it for use.[3]

Natural Gas.—Gross natural gas production was 6,083,006 million cubic feet, 5,178,073 million cubic feet of which was marketed. Of the marketed gas, 2,555,541 million cubic feet was consumed in Texas and the rest in other States. About 70 percent of the gas came from gas wells and 30 percent from oil wells (casinghead gas). Over 70 percent of the gas was processed to extract liquid fuels.

TABLE 3.—Marketed production of natural gas [1]

Year	Million cubic feet	Value (thousand)	Year	Million cubic feet	Value (thousand)
1949–53 (average)	3,605,484	$212,048	1956	4,999,889	$434,990
1954	4,551,232	386,855	1957	5,156,215	500,153
1955	4,730,798	378,464	1958	5,178,073	517,807

[1] Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.

Of 20,537 wells drilled, 2,097 were completed as gas wells. Development drilling added 4,598,030 million cubic feet of natural gas reserves through extensions and revisions; exploratory drilling added 2,799,626 million cubic feet to reserves through new discoveries, resulting in a total recoverable reserve of 115,045,743 million cubic feet of natural gas as of December 31, 1958. This amounted to 19 cubic feet of gas reserve for each cubic foot produced. About 30 percent of the new gas reserve resulted from exploratory wells as compared with 44 percent in 1957.

The No. 8 Santa Cruz Farms well of Magnolia Petroleum Co. in the San Carlos gasfield of Hidalgo County was the first gas well known to produce from four separate reservoirs. Such multiple completions would permit production from gas reservoirs too small to justify drilling separate wells. The Texas Railroad Commission approved the completion when necessary equipment (to prevent gas

[3] Lammers, G. C., Donaven, D. J., Wagner, E. O., Allen, R., and Tarry, D. F., A Study of the Feasibility of Hydraulic Transport of a Texas Lignite: Bureau of Mines Rept. of Investigations 5404, 1958, 39 pp.

and gas liquid movement from one reservoir to another) was available.

The first dual completion in the large Puckett gasfield of Pecos County was made by Phillips Petroleum Co. with completion of its No. 1 Rosa Mitchell well. The well had a potential of 172.3 million cubic feet of gas daily—150 million cubic feet from the Ellenberger formation and 22.3 million cubic feet from the Devonian.

The ratio of the proved gas reserve to consumption was 22:1, the same as 1957.

Natural-Gas Liquids.—Recovery of natural-gas liquids declined compared with 1957 owing largely to huge stocks held by the industry and to keener competition from imports for the relatively static market. LP-gases supplied 57 percent of the output; natural gasoline and cycle products the remainder. Most of the natural gasoline was utilized by the refining industry within Texas, but most of the LP-gases was shipped to markets outside the State. Production was reported from 221 gasoline plants and 30 cycling plants in 90 counties.

The underground storage capacity for LP-gases exceeded 29.6 million barrels—almost 70 percent of the United States storage capacity for gas liquids. Most of the capacity was in the Gulf Coast region, where massive salt deposits offered accessible, clean storage facilities. Underground storage chambers in excess of 1 million barrel capacity were: Dade Petroleum Corp., Texas Butadiene & Chemical Corp., and Warren Petroleum Corp. facilities in salt formations in Chambers County; Phillips Petroleum Co. salt-dome caverns in Brazoria County and salt-layer caverns in Hutchinson County; Magnolia Petroleum Co.'s salt-dome caverns in Liberty County; Humble Oil & Refining Co.'s Waller County storage in gas sand; and Shamrock Oil & Gas Corp.'s oil-sand storage in Moore County. There were 73 such underground storage facilities in 32 counties.

Exploratory and development drilling increased the natural-gas liquid reserve 120,350,000 barrels—to 3,391,967,000 barrels, according to the Committee on Natural-Gas Liquid Reserves of the American Gas Association. Development drilling added 259,799,000 barrels through extensions and revisions, and exploratory drilling added 50,035,000 barrels through new discoveries.

A 4-million-cubic-feet-a-day gas-processing plant was being built north of Monahans by Pan American Petroleum Corp. The plant will recover natural gas liquids from casinghead gas of the North Monahans field. Plant design will permit expansion to a 12-million-cubic-feet-a-day capacity. About midyear, Lone Star Gas Co. completed a $2-million natural gasoline plant in the Fashing field of Atascosa County. The plant will process 65 million cubic feet of gas daily. Other major projects included a completely automatic gasoline plant of Sunray Mid-Continent Oil Co. near Port Lavaca in Jackson County; a 100-million-cubic-feet-a-day gasoline and dehydration plant of Northern Natural Gas Co. near Stillman; a cycling and sulfur-extraction plant at Scroggins of Tidewater Associated Oil Co.; a $1-million gas-cleaning plant of Pioneer Gathering System, Inc., near Somora; a $3.5-million gasoline and LP-gas plant of Cities Service Oil Co. near Midland; a $2.5-million gas-processing plant of Transcontinental Gas & Pipeline Corp. near Tilden; a

$3.75-million gas-processing plant of Lone Star Gas Co. near Pleasanton; and the $4-million dehydration plant of El Paso Natural Gas Co. near Fort Stockton.

Capital construction and expansion of the petrochemical industry of Texas were at a much lower, but still impressive rate, due primarily to the business recession and the first showings of excess capacity in several of its products. New construction and expansion projects of the petrochemical industry are discussed in the Review by Counties because of the large number of projects. Eleven butadiene plants, with an annual capacity of 725,000 tons were operating, mostly along the Gulf coast. Idle capacity developed early in 1958 as output exceeded demand.

Petroleum.—Production of crude oil declined for the second year and dropped below 1 billion barrels for the first time since 1954. Production was reported from 194 counties, 1 less than in 1957. There were 141 counties reporting production in excess of 1 million barrels each. The five leading counties, in order of production, were: Ector, Andrews, Gregg, Winkler, and Scurry.

TABLE 4.—Production of natural-gas liquids

Year	Natural gasoline and cycle products		LP-gases		Total	
	Million gallons	Value (thousands)	Million gallons	Value (thousands)	Million gallons	Value (thousands)
1949–53 (average)	2,422	$174,932	2,038	$73,017	4,460	$247,949
1954	2,732	200,559	2,984	95,913	5,716	296,472
1955	2,988	206,506	3,450	110,414	6,438	316,920
1956	2,965	216,378	3,731	144,745	6,696	361,123
1957	2,944	201,423	3,832	147,618	6,776	349,041
1958	2,872	204,501	3,786	151,896	6,658	356,397

TABLE 5.—Production of crude petroleum

Year	Thousand 42-gallon barrels	Value at wells (thousands)	Year	Thousand 42-gallon barrels	Value at wells (thousands)
1949–53 (average)	925,256	$2,421,952	1956	1,107,808	$3,131,225
1954	974,275	2,768,490	1957	1,073,867	3,338,119
1955	1,053,297	2,989,330	1958 [1]	940,706	2,873,988

[1] Preliminary figures.

TABLE 6.—Production and indicated demand of crude petroleum in 1958 by months

(Thousand barrels)

Month	Production	Indicated demand	Month	Production	Indicated demand
January	84,573	84,352	September	86,655	79,935
February	76,963	73,810	October	83,742	81,264
March	72,454	77,549	November	82,327	79,679
April	68,308	74,998	December	88,410	84,534
May	68,821	76,159			
June	68,801	73,242	Total: 1958	940,706	949,166
July	74,983	78,970	1957	1,073,867	1,064,367
August	84,669	84,674			

TABLE 7.—Production of crude petroleum, by districts and fields

(Thousand barrels)

District and field [1]	1957	1958 [2]
Gulf Coast:		
Amelia	(3)	(3)
Anahuac	5,279	4,028
Barbers Hill	1,662	1,585
Beaumont-West	(3)	(3)
Bloomington	1,130	866
Boling	1,433	1,395
Chocolate Bayou	4,361	4,200
Conroe	9,492	6,979
Damon Mound	(3)	(3)
Dickenson-Gillock	3,571	3,222
Dyersdale	(3)	(3)
Esperson	1,005	1,037
Fairbanks	1,054	894
Falls City	(3)	(3)
Fannette	1,511	1,760
Francieas	1,272	846
Friendwood	9,511	6,760
Goblke, Helen	1,715	1,244
Goose Creek	2,736	2,617
Greta	2,221	1,668
Hankamer	1,023	1,034
Hastings	10,304	7,919
Heyser	(3)	(3)
High Island	3,554	3,864
Houston-North-South	1,227	1,045
Hull	3,668	3,653
Humble	1,074	1,065
Liberty, South	4,100	5,657
Livingston	(3)	(3)
Lolita	1,378	1,407
Lovells Lake	(4)	----
McFaddin	1,138	796
Manvel	1,469	1,069
Markham	1,819	1,957
Old Ocean	5,674	4,707
Oyster Bayou	2,612	2,044
Pierce Junction	6,720	5,007
Placedo	1,371	1,057
Port Neches	1,002	921
Raccoon Bend	1,694	1,321
Refugio-Fox	2,055	1,923
Saratoga	1,618	1,431
Silsbee	937	1,221
Sour Lake	1,319	1,194
Stowell	1,198	603
Sugarland	853	608
Sugar Valley	921	715
Thompson	8,193	6,000
Tomball	2,035	1,498
Village Mills	2,730	2,063
West Columbia	2,475	2,687
West Ranch	6,190	4,641
Withers-Magnet	3,162	2,458
Other Gulf Coast	77,995	68,720
Total	209,461	179,386
East Texas:		
East Texas Proper	70,109	52,593
Cuyuga	999	925
Ham Gossett	659	486
Hawkins	14,786	10,687
Long Lake	1,779	645
New Hope	2,162	1,993
Pewitt Ranch	927	700
Pickton	1,189	983
Quitman	2,192	2,117
Taleo	4,523	3,977
Vac	7,823	5,683
Waskom	872	889
Woodlawn	419	380
Other East Texas	21,919	24,242
Total	130,358	106,300
Central Texas:		
Big Foot	1,610	2,021
Charlotte	2,071	1,541
Darst Creek	3,450	3,465
Luling	2,598	2,444
Other Central Texas	8,727	6,916
Total	18,456	16,387
South Texas:		
Aqua Dulce	1,479	1,171
Flour Bluff	872	750
Fulton Beach	4,340	2,415
Garcia	834	645
Hoffman	1,440	1,210
Kelsey	3,359	2,457
London Gin	1,083	728
Midway	940	644
Mustang Island	2,246	1,755
Plymouth	4,757	3,992
Portilla	2,936	2,228
Saxet-Saxet Frio	1,312	847
Stratton	1,999	1,500
Sun	1,673	1,439
Taft	929	744
White Point	3,426	2,417
Willamer, West	2,072	1,491
Other South Texas	47,002	43,057
Total	82,699	69,490
North Texas	132,457	120,716
Panhandle	38,481	38,587
West Texas by fields:		
Abell	1,590	1,465
Adair	2,107	1,552
Andector	4,500	2,719
Anton Irish-Anton	2,600	2,000
Benedum	1,982	1,657
Big Lake	(3)	(3)
Block 31	5,690	5,695
Bronte	1,865	1,261
Cedar Lake	1,385	1,061
Cogdell	6,908	4,972
Cowden	9,764	9,178
Cree-Sykes	1,241	761
Diamond M	8,465	5,779
Dollarhide	4,139	3,227
Elkhorn	(3)	(3)
Embar	1,862	1,522
Emma	3,452	2,621
Fort Chadborne	3,788	3,806
Fort Stockton	1,272	976
Foster	4,282	3,388
Fuhrman	4,471	3,878
Fullerton	5,977	5,700
Garza	2,625	2,104
Goldsmith	20,434	20,827
Good	1,248	1,022
Harper	2,424	1,999
Hendrick	1,351	1,522
Howard-Glasscock	6,683	6,865
Hulldale-Hulldale Penn	1,763	1,278
Jameson	4,822	3,360
Jordan	3,378	3,007
Kelly Snyder	26,827	19,568
Kermit	4,841	4,510
Keystone	7,005	6,214
Lea	1,359	1,047
Levelland	7,892	6,584
Luther	1,073	900
McCamey	1,881	1,947
McElroy	10,751	9,220
McFarland	3,708	5,954
Mabee	1,093	1,112

See footnotes at end of table.

TABLE 7.—Production of crude petroleum, by districts and fields—Continued

(Thousand barrels)

District and field [1]	1957	1958 [2]	District and field [1]	1957	1958 [2]
West Texas by fields—Con.			West Texas by fields—Con.		
Magutex	2,132	1,604	Triple N	1,342	1,406
Martin	2,067	1,515	TXL	5,502	4,449
Means	6,495	5,058	University	4,122	3,419
Midland Farms	7,143	5,993	Vealmoor-East	2,903	2,088
Pegasus	4,490	3,342	Waddell	2,635	2,903
Penwell	2,049	2,245	Ward-Estes	14,245	17,561
Prentice	5,164	4,322	Wasson	14,377	11,566
Reinecke	1,401	1,008	Welch	1,858	1,616
Robertson	1,652	2,143	Wellman	(3)	(3)
Russell	6,874	5,137	Westbrook	1,869	1,577
Salt Creek	3,679	2,840	Wilshire	1,949	1,405
Sand Hills	6,729	5,334	World	1,814	1,734
Seminole	5,246	3,836	Yarbrough	1,900	1,372
Shafer Lake	3,019	2,375	Yates	8,818	6,396
Sharon Ridge	1,966	2,500	Other West Texas	117,027	115,524
Slaughter	10,180	8,237			
Spraberry Trend	19,835	15,021	Total	461,955	409,840
Three Bar	1,036	758			
Todd	1,939	1,298	Grand total	1,073,867	940,706

[1] Texas Railroad Commission districts.
[2] Preliminary figures.
[3] Included in "Other" fields.
[4] Data not available.

There were 189,960 producing oil wells at the end of 1958. Average daily production amounted to 14.1 barrels a well compared with 16.1 barrels in 1957.

Indicated daily demand for crude was 2,600,455 barrels compared with 2,949,127 barrels in 1957. Peak daily demand occurred in August; minimum daily demand in June.

In 1958, 20,537 wells were drilled in search of crude oil and natural gas—a decrease of 3,597 wells or nearly 15 percent under those completed in 1957. Of the 20,537 completions, 4,106 were wildcat starts, of which 373 were completed as oil wells and 64 as gas wells and 3,669 were dry holes. Of the 16,431 development wells completed, 11,895 were oil wells, 2,033 gas wells, and 2,503 dry. Only 20 percent of the wells completed were wildcat wells that sought to discover new fields. The success ratio of wildcat drilling amounted to 1 discovery for every 10 wells completed. The estimated proved recoverable reserve of crude oil declined to 14,322,216,000 barrels, as of December 31, 1958, according to the Committee on Crude Oil Reserves of the American Petroleum Institute. Extensions and revisions added 566,771,000 barrels to the proved reserve, and new discoveries added 109,659,000. The proved crude-oil reserve declined in relation to the United States reserve from 49.4 percent in 1957 to 46.9 percent in 1958.

At the end of 1958, Texas had 58 refineries, 43 of which operated, processing 736 million barrels of crude oil an amount equal to 78 percent of the State crude output. Yearly refinery capacity at the end of 1958 was 2,650,442 barrels of crude oil—27 percent of the United States capacity. About 85 percent of this capacity was on the Gulf coast, centering around the Beaumont-Port Arthur-Houston areas; Jefferson County had nearly 60 percent of the Gulf coast capacity. The concentration of refinery capacity was due to excellent facilities for import or export to foreign or domestic markets.

Capital expenditures by the refining industry declined nearly 50 percent compared with 1957, owing to sagging products markets, unwieldly stock accumulations of both crude and products, and the business and industrial recession. A few of the major refinery-construction projects in 1958 were the $7-million modernization program at the Beaumont refinery of Magnolia Petroleum Co., the $3-million expansion and modernization program of Champlin Oil & Refining Co. at Bishop, the $1.5-million modernization program at the La-Gloria Oil & Gas Co. Tyler refinery, and expansion and modernization projects at the Baytown refinery of Humble Oil & Refining Co.

TABLE 8.—Prospecting and drilling in 1958 by counties [1]

County	Prospecting				Drilling						
					Development			Exploratory			Total
	Seismic	Gravity	Magnetic	Core drill	Oil	Gas	Dry	Oil	Gas	Dry	
Anderson	72	9		3	19	10	18	4	1	50	102
Andrews	50				124	2	22	11	0	18	177
Angelina											4
Aransas	16					1	2		1	5	9
Archer	44				306		135	35		73	549
Armstrong	35	7								1	1
Atascosa	27	3			35	21	13	2	1	19	91
Austin	27	2			1	3	3		1	4	12
Bailey										1	1
Bandera										2	2
Bastrop	6	12	7		5		4	1		15	25
Baylor	21				259	2	176	7		55	499
Bee	13				8	24	18	6	13	21	89
Bell										2	2
Bexar	15	7			60		16	2		12	90
Blanco											
Borden	89				54		10	12		18	94
Bosque										4	4
Bowie	12									2	2
Brazoria	146	7			42	6	36	1	2	29	116
Brazos	10	10				3	3			3	9
Brewster	4	18								1	1
Briscoe	12									3	3
Brooks	18				6	5	4	3	5	13	36
Brown					15	6	13	1	4	21	60
Burleson	11	2								1	1
Burnet										1	1
Caldwell					91		9	1		5	106
Calhoun	190				9	11	13	6	5	21	65
Callahan	2	18		4	79	2	99	10	1	94	285
Cameron	55			8						4	4
Camp	42				8			1			9
Carson	11	3			115	8	19			2	144
Cass	90				44	4	9		1	6	64
Castro	20									2	2
Chambers	92	11			47	14	14	3	7	19	104
Cherokee	13	2			1	7	10		3	37	58
Childress	3										
Clay	28	1			100		23	6		78	207
Cochran	28				64	6	1			8	79
Coke	18				47		2	5		11	65
Coleman					89	6	62	10	4	33	204
Collin										2	2
Collingsworth						91	2				93
Colorado	18				2	6	4		9	18	39
Comal		7									
Comanche	5					1	5	1		3	10
Concho	1	4			3	1	2			4	10
Cooke	25	5			192		70	10	1	36	309
Coryell	10										
Cottle	4										
Crane	14				390	4	34	12		16	456
Crockett	38	12	1		65	3	15	6		22	111
Crosby	14				3			1		2	6
Culberson	99	65			89		18	5		57	169
Dallam	17					6	1			6	13
Dallas										3	3
Dawson	39				42		5	3		8	58

See footnote at end of table.

TABLE 8.—Prospecting and drilling in 1958 by counties [1]—Continued

County	Prospecting				Drilling						
					Development			Exploratory			Total
	Seismic	Gravity	Magnetic	Core drill	Oil	Gas	Dry	Oil	Gas	Dry	
Deaf Smith	24	21								4	4
Delta	2									2	2
Denton	4				6		5			11	22
De Witt	86				2	6	9	2	4	14	37
Dickens					4		2	1		12	19
Dimmit	21	5			12	1	11	7	2	21	54
Donley	3	2				2			1	6	9
Duval	44				92	18	58	9	14	67	258
Eastland					16	6	11	2		8	43
Ector	13				650	1	18	3		17	689
Edwards		46	1							5	5
Ellis	2				16		4			4	24
El Paso											
Erath							2			1	3
Falls	9			4			1			1	2
Fannin										3	3
Fayette	47				1		3			3	7
Fisher	17	6			63		18	6	1	15	103
Floyd										1	1
Foard	47				10		4			5	19
Fort Bend	33				14	3	16			20	53
Franklin	15				2	1		2		2	7
Freestone	41				5	2	4	1	2	25	39
Frio	35				22	31	9	1	1	10	74
Gaines	109				175	11	13	4	1	17	221
Galveston	34				21	6	18	2	3	8	58
Garza	70				136		15	17		20	188
Gillespie											
Glasscock	10				11		3	1		6	21
Goliad	70				9	12	20	2	3	19	65
Gonzales	85				3		6			16	25
Gray	1	12			60	72	8			1	141
Grayson	54	10			5		6	5		10	26
Gregg					29	4	3				36
Grimes	33	14					1			1	2
Guadaloupe	52				37		7	1		14	59
Hale										1	1
Hall	6										
Hamilton	6							1	1	1	3
Hansford	9				31	71	20	5	5	11	143
Hardeman	29	9		26						1	1
Hardin	65	2			75	3	31	4	3	22	138
Harris	11	12			79	11	57	2	2	25	176
Harrison	5				112	13	15	3	2	7	152
Hartley	21	11								3	3
Haskell	12			3	39		43	9		31	122
Hays		4									
Hemphill	10	8			1	5	1	3	1		11
Henderson	43	1			1	1	1			5	8
Hidalgo	137				6	37	26	3	14	30	116
Hill	7				1					5	6
Hockley	53				30		4	2		10	46
Hood									1		1
Hopkins	25				1				1	6	8
Houston	41					7	3	1		16	27
Howard	9				29		17	1		14	61
Hudspeth											
Hunt	8						1			6	7
Hutchinson	7	4			304	7	8		1	1	321
Irion	8				16	1	7	5		15	44
Jack	2				61	12	38	8	3	23	145
Jackson	38	5			34	24	17	6	5	32	118
Jasper	89				3	1	4		1	7	16
Jeff Davis	2	36								1	1
Jefferson	104	4			38	22	20	3	4	25	112
Jim Hogg	23				24	10	19	5	2	22	82
Jim Wells	2				23	15	30	6	9	27	110
Johnson	18									1	1
Jones	1	8			86		46	10		64	206
Karnes	57				7	4	3			11	25
Kaufman	7									11	11
Kendall											
Kenedy	7	3					2		2	7	11
Kent	17				13		3	5		11	32
Kerr										2	2
Kimble									1	2	3
King					5		3		1	9	18

See footnote at end of table.

TABLE 8.—Prospecting and drilling in 1958 by counties [1]—Continued

County	Prospecting				Drilling						
					Development			Exploratory			Total
	Seismic	Gravity	Magnetic	Core drill	Oil	Gas	Dry	Oil	Gas	Dry	
Kinney		2								3	3
Kleberg	86	14			6		8	7	5	10	36
Knox					116		107	1		33	257
Lamar										5	5
Lamb	15				14		3			6	23
Lampasas											
La Salle	69				6	2	4	3	2	27	44
Lavaca	70					13	5		4	6	28
Lee	18	3	5							2	2
Leon	24				3	5	1		1	4	14
Liberty	57				74	7	28	1	1	28	139
Limestone	3			9	2		4	1		6	13
Lipscomb	32				1	7	4	6	7	10	35
Live Oak	86		21		64	13	40	6	17	35	175
Llano											
Loving	34	15			58	1	5	1		41	106
Lubbock	4				9		1	1		3	14
Lynn	77				12		6	1		12	31
McCulloch					2		1			5	8
McLennan							1			1	2
McMullen	53	2			16	17	20	4	2	30	89
Madison	25	9			1	2	2				5
Marion	10				24	7	3	2		4	40
Martin	38	4			18		2	1		5	26
Mason											
Matagorda	122				14	12	23	4	4	24	81
Maverick			9		2		12			58	72
Medina		3		13	25		9	1		12	47
Menard		5			3		3			7	13
Midland					88	10	1	5		1	105
Milam	9		5		7		4			5	16
Mills	5									3	3
Mitchell	4				84		5	1		9	99
Montague	12				74		24	3		35	136
Montgomery	29	12			3	4	1		3	13	24
Moore					14	11	5			1	31
Morris	22	3								1	1
Motley	10						4	1	1	5	11
Macogdoches	1				1	1	2			3	7
Navarro					55		20		1	11	87
Newton	66				13	1	6	4	1	6	31
Nolan	5			1	48	1	21	7		25	102
Nueces	43	2			30	8	35	11	5	29	118
Ochiltree		2			55	26	13	13	16	9	132
Oldham	68	41					1			7	8
Orange	89				10	4	6		1	11	32
Palo Pinto					10	6	15	7	5	13	56
Panola	8				43	6	2			3	54
Parker						21	8	1	1	6	37
Parmer	6										
Pecos	270	9	1		129	20	33	3	7	44	236
Polk	16				4	3	3	1		6	17
Potter	47	2				10	4			1	15
Presidio		7									
Rains	28									1	1
Randall	72	6									
Reagan	28				53		3	2		5	63
Real											
Red River				2			4	1		15	20
Reeves	137	48			107	3	5	4		47	166
Refugio	35				20	22	16	4	6	21	89
Roberts		7			8	12	10	3	4	10	47
Robertson							1			1	2
Rockwell										1	1
Runnels	15			34	66	4	37	11	3	53	174
Rusk	17				39	14	17	3	1	12	86
Sabine	4									1	1
San Augustine											
San Jacinto	18									4	4
San Patricio	21				14	23	32	11	7	33	120
San Saba											
Schleicher	16				28	8	3	3	1	19	62
Scurry	13	5			178	1	17	2		16	214
Shackelford	22			42	194	3	130	13	2	53	395
Shelby	4					1	1			6	8
Sherman					1	39	6	1	1	4	52
Smith	59	7		1	44	1	6		1	27	79

See footnote at end of table

TABLE 8.—Prospecting and drilling in 1958 by counties [1]—Continued

County	Prospecting				Drilling						
	Seismic	Gravity	Magnetic	Core drill	Development			Exploratory			Total
					Oil	Gas	Dry	Oil	Gas	Dry	
Somervell											
Starr	51				21	12	26	10	11	41	121
Stephens	38				35	3	37	13	4	21	113
Sterling	17				12		12	1		14	39
Stonewall	12			7	31		28	15		38	112
Sutton	15				2	13	3		1	8	27
Swisher	8									3	3
Tarrant											
Taylor				3	140	1	82	21		90	334
Terrell	265	39	1			1			1	2	4
Terry	44				28		1	1		3	33
Throckmorton	42	7			57	1	43	19		45	165
Titus	20	8					1	1		1	3
Tom Green	9	3			21		7	3		18	49
Travis			7		1		3			11	15
Trinity	17										
Tyler	75				17		2	4		4	27
Upshur	5				21					9	30
Upton	44				154	1	11	3	1	16	186
Uvalde											
Val Verde	91	13	5		2		7			5	14
Van Zandt	41	10			1		4		2	11	18
Victoria	41				14	20	18	4	16	7	79
Walker	20	16									
Waller	2				4	1	1			2	8
Ward	32	16			249	8	12	3	1	7	280
Washington	1	10					3				3
Webb	150			14	13	4	21	4	11	41	94
Wharton	18	7			36	12	44		4	22	118
Wheeler	41	16			46	37	10			1	94
Wichita					406		98	1		16	521
Wilbarger	29				175		81	13		49	318
Willacy	35			2			1			3	4
Williamson							2			9	11
Wilson	14				33		15	3		28	79
Winkler	59	7			525	49	16	4	1	8	603
Wise	2				102	115	27	30	7	8	289
Wood	70	3			43	4	6	3	2	9	67
Yoakum	56				87		4	4		12	107
Young	35				223	5	163	13		41	445
Zapata	38				15	6	22	1	4	18	66
Zavala	35	1	17		4	7	4	3	3	13	34
Offshore	30	28			1	2	8	1	1	4	17
Total	6,868	820	80	176	9,243	1,324	3,200	646	330	3,300	18,043

[1] National Oil Scouts and Landmen's Association, vol. 29.

TABLE 9.—Daily average production and runs to stills of petroleum

(Thousand barrels)

Month	1957		1958	
	Crude production	Runs to stills	Crude production	Runs to stills
January	3,120	2,312	2,728	2,034
February	3,226	2,215	2,749	1,942
March	3,342	2,222	2,337	1,963
April	3,220	2,205	2,277	1,935
May	3,156	2,146	2,220	1,887
June	3,083	2,144	2,293	1,905
July	2,781	2,131	2,419	1,996
August	2,771	2,203	2,731	2,084
September	2,836	2,175	2,889	2,068
October	2,711	2,048	2,701	2,126
November	2,728	1,997	2,744	2,092
December	2,749	2,073	2,852	2,150

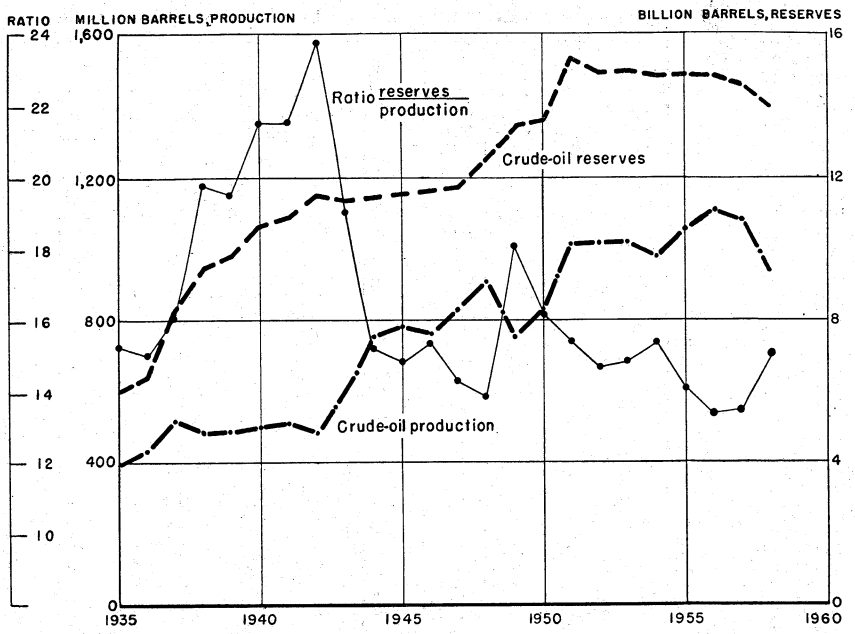

FIGURE 2.—Ratio of proved crude reserves to production, 1935–58.

TABLE 10.—Runs to stills and output of refineries, in 1958, by month

(Thousand barrels)

Month	Runs			Output					
	Crude	Products	Rerun	Gasoline	Kerosine	Fuel oil		Jet fuel	Miscellaneous
						Distillate	Residual		
January	63,045	5,025	465	32,953	4,339	16,229	7,041	1,160	6,813
February	54,364	5,065	1,224	29,655	4,169	13,345	6,081	1,256	6,147
March	60,864	5,284	−2,380	30,861	3,647	15,002	6,378	1,282	6,598
April	58,047	5,064	−667	30,466	2,796	13,687	6,353	2,254	6,888
May	58,498	4,884	−291	31,247	2,447	13,893	6,024	2,183	7,297
June	57,150	5,300	−653	30,968	2,209	12,835	5,905	2,252	7,628
July	61,885	5,871	827	35,018	2,508	14,258	6,759	2,063	7,977
August	64,612	6,651	−700	35,939	3,020	15,329	6,298	2,098	7,879
September	62,026	6,324	−143	33,363	3,049	15,508	6,600	2,520	7,167
October	65,922	6,373	1,166	35,825	3,959	17,205	6,931	2,292	7,249
November	62,767	6,651	−76	35,176	4,054	14,872	6,328	1,954	6,958
December	66,659	6,386	1,054	36,464	4,215	17,138	6,493	2,274	7,515
Total: 1958	735,839	68,878	−174	397,935	40,412	179,301	77,191	23,588	86,116
1957	786,851	67,509	−6,954	407,093	40,076	198,803	91,592	18,543	91,299

TABLE 11.—Stocks of crude petroleum at refineries, tank farms, and gathering systems in 1958, by months

(Thousand barrels)

Month	Refineries	Tank farms and pipelines	Lease tanks	Total
January	16,013	80,537	7,360	103,910
February	17,288	82,183	7,295	106,766
March	16,130	78,429	7,164	101,723
April	16,239	72,252	6,884	95,375
May	14,341	67,009	6,959	88,309
June	14,878	62,591	6,879	84,348
July	14,318	61,253	6,729	82,300
August	13,381	60,757	7,434	81,572
September	14,336	65,962	7,429	87,727
October	14,920	67,430	7,344	89,694
November	14,178	69,664	7,684	91,526
December	15,275	73,403	7,389	96,067

TABLE 12.—Stocks of refined products by refineries in 1958, with plants, and pipelines by months

(Thousand barrels)

Month	Gasoline [1]	Kerosine	Fuel oil		Jet fuel	Natural gas liquids	Miscellaneous products
			Distillate	Residual			
January	39,003	2,322	14,749	8,075	1,291	649	22,755
February	41,510	2,008	10,265	7,531	1,391	569	21,468
March	37,721	2,109	8,959	6,257	1,247	622	23,066
April	34,946	2,503	8,434	5,803	1,326	573	23,734
May	32,114	2,849	10,062	6,794	1,463	477	24,009
June	29,206	2,956	11,465	8,407	1,619	565	24,378
July	28,964	2,951	14,028	10,417	1,695	549	23,735
August	29,367	2,996	16,541	10,707	1,836	532	24,555
September	28,422	3,170	18,147	10,854	1,574	603	24,709
October	29,424	3,370	20,119	10,063	1,589	490	23,994
November	30,310	3,225	17,675	8,908	1,379	520	23,536
December	32,742	2,763	13,573	8,281	1,553	473	21,772

[1] Includes naphtha.

NONMETALS

Activity in the nonmetallic industry improved, owing largely to gains established by producers of construction materials, cement, clay, gypsum, sand and gravel, and stone. Acceleration of the highway program and increased residential construction resulted in establishment of a large number of new plants and expansions of existing plants.

Construction awards totaled $1,142 million, a decline of some $22 million from the preceding year. Gains of $39 million in engineering awards and more than $61 million in residential construction failed to offset sharp declines in nonresidential contracts. Private spending reached new highs for office buildings, warehouses, schools, and hospitals. Industrial and store buildings declined, while construction of churches and related buildings and privately owned public utilities held near the record 1957 figure. Expenditures for additions and alterations to existing residences were slightly below 1957. The 8-percent advance in highway construction was due largely to the new interstate highway program.

Major new plants and expansions in the construction-material industry included a new cement plant of Southwestern Portland Cement Co. at Odessa, the $250,000 expansion and improvement project at the Houston facilities of Texcrete Co., the $800,000 expansion project of Henderson Clay Products Co., the new $250,000 concrete-pipe plant of Gifford Hill Pipe Co. at Sweetwater, and the $750,000 expansion program of lime facilities of the Texas Lime Co. at Cleburne.

According to the Texas Highway Department, quantities of materials used on the State highway system in fiscal year 1958 ending August 31, included:

Steel:		
Reinforcing steel	tons	43,358
Structural steel	do	14,024
Cement	barrels	2,830,475
Stone:		
Rock and gravel	tons	6,637,378
Shell	do	397,535
Asphalt or bituminous surfacing	do	3,422,407
Concrete covered pipe	linear feet	19,167
Petroleum:		
Gasoline	gallons	10,285,234
Diesel fuel	do	2,521,843
Lubricating oil	do	256,733
Grease	pounds	249,161
Glass beads	million pounds	2.5
Paint	gallons	543,917

In all, 85.2 miles of urban freeways was completed and 58 miles under construction, at an estimated completion cost of $174 million; also, 475.6 miles of rural freeways and expressways was completed and 380.6 miles under construction. Multilane divided highways, both rural and urban, completed and under construction, amounted to 864.8 miles. Average costs a mile were: for six-lane divided urban highway, $2 million; for four-lane divided rural highways, $0.5 million; for two-lane highways, $60,000; and for farm-to-market roads, $23,000.

Abrasives (Grinding Pebbles).—Gravel of abrasive quality was recovered from open pits in Travis County and prepared by Dezendorf Marble Co.

Barite.—Barite from other States and from foreign countries was ground and prepared at Brownsville, Carthage, Corpus Christi, and Houston. Most of the processed material was used in preparing drilling mud for the oil and gas industry.

Bromine.—Texas remained the foremost producing State and Ethyl-Dow Chemical Co. the leading domestic producer of bromine. Most of the bromine was produced as ethylene dibromide and used as an additive in antiknock compounds for motor fuels. The State's oil-refining industry consumed most of this material; a substantial portion was also shipped to out-of-State markets.

Cement.—1958 was an active year for the cement industry; 14 plants operated at 71 percent of rated capacity (36 million barrels) compared with 68 percent of capacity (32 million barrels) in 1957. Cement productive capacity was increased 3.7 million barrels with completion of one new plant, and expansion projects at two others. Twelve of the 14 plants produced masonry as well as portland cement. The industry quarried 5,060,000 tons of limestone and re-

covered or purchased 1,843,000 tons of shell for producing 26 million barrels of portland and masonry cement. Cement plants in Harris, Nueces, and Orange Counties used shell as raw material, while plants in Bexar, Dallas, El Paso, McLennan, Nolan, and Tarrant Counties used limestone.

TABLE 13.—Portland cement produced and shipped, by months, in thousands

Year	Production (barrels)	Shipments	
		Barrels	Value
1949–53 (average)	17,897	17,731	$42,455
1954	21,541	21,928	56,674
1955	24,241	24,038	64,820
1956	25,655	25,234	73,070
1957	21,845	21,547	66,201
1958:			
January	1,577	1,572	4,835
February	1,553	1,470	4,521
March	1,785	1,892	5,819
April	2,043	1,962	6,004
May	2,325	2,242	6,861
June	2,288	2,311	7,072
July	2,333	2,495	7,594
August	2,437	2,403	7,314
September	2,241	2,165	6,589
October	2,486	2,565	7,883
November	2,344	2,093	6,430
December	2,053	2,039	6,264
Total: 1958	25,465	25,209	77,186

Demand for cement continued strong through most of the year owing to accelerated construction of the interstate and State highway system and additional Federal, State, county, and municipal construction projects.

A $12-million, 1,250,000-barrel, dry-process cement plant was being built by Southwestern Portland Cement Co. near Odessa, Ector County. Facilities include a 400-foot kiln, two grinding mills, and two 150,000-barrel cement silos. Initial production was scheduled for early 1959. Ideal Cement Co. completed a $16-million, 2.8-million-barrel wet-process plant at Houston. Facilities include two 450-foot kilns and four 11- by 32-foot mills.

Clays.—Extensive and widely distributed clay deposits were mined for use in manufacturing building and face brick, heavy clay products, lightweight aggregate, cement, drilling mud, and filtering aids. Production was reported from 44 counties by 73 producers and 10 portland-cement companies. Miscellaneous clay (or shale) composed 83 percent of the total clay production but only 63 percent of total clay value; this clay was used in manufacturing cement, brick, and heavy clay products. Thirteen percent of the total clay production was fire clay, accounting for 21 percent of the total clay value, bentonite being responsible for the remaining 4 percent of output and 16 percent of value. Fuller's earth was produced in Fayette County and composed less than 1 percent of the total clay output. Use of clay in manufacturing lightweight aggregate has increased progressively for the past 5 years, increasing from 273,000 tons in 1954 to over 1 million tons in 1958.

TABLE 14.—Clays sold and used by producers, in thousands

Year	Bentonite		Fire clay		Fuller's earth		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	34	$418	317	$791	113	$1,379	1,621	$1,689	2,085	$4,277
1954	106	1,299	347	2,188	63	590	1,885	2,925	2,401	7,002
1955	155	1,462	437	1,068	(1)	(1)	2,504	2,569	[2] 3,096	[2] 5,099
1956	161	1,183	483	1,007	(1)	(1)	2,502	2,575	[2] 3,146	[2] 4,765
1957	127	963	454	1,057	(1)	(1)	2,411	2,913	[2] 2,992	[2] 4,933
1958	121	889	501	1,135	(1)	(1)	3,097	3,400	[2] 3,719	[2] 5,424

[1] Figures withheld to avoid disclosing individual company confidential data.
[2] Incomplete total; excludes fuller's earth.

Feldspar.—Crude feldspar was mined from open pits and ground in Llano County for use principally as roofing material.

Gem Stones.—Growing interest in the collection and preparation of gem stones by lapidarists, hobbyists, and dealers was evident. Collections were reported from 16 counties, with the origin of a significant quantity of gem stones unavailable. The variety of stones of gem quality likewise increased.

Graphite.—Southwestern Graphite Co. was one of the Nation's two domestic producers in 1958. Graphite was mined by open-pit methods and processed at an adjoining mill in Burnet County.

Gypsum.—Mining and milling of gypsum were centered in four counties—Fisher, Hardeman, Hudspeth, and Nolan. Nearly 99 percent of the output was calcined at five plants. Building products, consisting of wallboard, lath, exterior sheathing, and plaster, consumed most of the output; minor amounts of the crude material were used as a retarder in cement.

TABLE 15.—Gypsum mined

Year	Crude gypsum mined		Year	Crude gypsum mined	
	Short tons	Value		Short tons	Value
1949–53 (average)	1,029,076	$2,696,185	1956	1,156,956	$3,623,005
1954	1,218,048	3,773,230	1957	1,043,236	3,343,217
1955	1,349,434	4,219,652	1958	1,240,050	4,120,311

Lime.—The Texas lime industry was the fourth largest in the Nation. Lime was produced from high-calcium limestone by five producers in four counties and required 871,000 tons of stone; 41 percent of the State's lime output was produced from shell by four producers in three counties and required 612,000 tons of shell. Most production was captive, being used in the chemical, steel, and pulp and paper industries. Although the output was less than in 1957 (due to curtailment of heavy chemicals and magnesium-recovery industries), some added consumption resulted from the growth of new uses, such as road stabilization.

Lithium.—Lithium hydroxide and lithium compounds were processed from imported lepidolite ore at the San Antonio plant of American

Lithium Chemicals, Inc. This firm was one of the suppliers of lithium hydroxide to the Atomic Energy Commission.

Magnesium Compounds.—Compounds of magnesium were produced at the large Freeport plant of Dow Chemical Co. in Brazoria County.

Natural Salines.—Natural sodium sulfate was recovered from artificial brines in Terry and Ward Counties by Ozark-Mahoning Co. Most of the output was used in preparing salt cake.

TABLE 16.—Lime (quick and hydrated) sold by producers

Year	Quick lime (short tons)	Hydrated lime (short tons)	Total	
			Short tons	Value (thousands)
1949–53 (average)	192,645	92,814	285,459	$2,670
1954	306,433	241,003	547,436	5,422
1955	307,322	277,533	584,855	5,549
1956	349,693	242,443	592,136	6,938
1957	559,426	236,968	796,394	7,489
1958	414,302	276,359	690,661	7,146

Perlite (Expanded).—Crude perlite from adjoining States was expanded at five plants in three counties. Most of the expanded material was used as substitute for sand in gypsum plaster and as a lightweight aggregate in concrete. Perlite concrete has also been used in grouting oil wells, and loose perlite has been pumped into oil wells to seal off undesirable porous formations.

Pumice (Volcanic Ash).—Pumicite was mined by open-pit methods in Dickens and Starr Counties for use as a lightweight aggregate in concrete and plaster, as a loose-fill insulation in buildings and residences, and as an abrasive.

Salt.—Numerous salt domes along the Gulf coast and the salt beds of West Texas were mined. Texas was the third-ranking salt-producing State. Most of the salt was produced from natural and artificial well brines in Brazoria, Chambers, Duval, Fort Bend, Harris, Ward, and Yoakum Counties; significant quantities were mined by underground methods in two counties. Most of the output was used as a basic raw material by the State's heavy-chemical industry; evaporated salt was sold primarily for chemical uses and meat packing.

Sand and Gravel.—The expanding construction industry found the extensive and widespread deposits of sand and gravel a boon to their construction-material requirements. Sand and gravel was responsible for 49 percent of the aggregate output; stone—including shell—for the remainder. More rigid specifications for aggregates in concrete used in highway construction created problems for the industry, necessitating more accurate sizing and cleaner material.

TABLE 17.—Salt sold or used by producers, in thousands

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	2,276	$3,736	1956	3,963	$14,370
1954	2,864	9,310	1957	4,612	17,104
1955	3,583	12,867	1958	3,843	15,114

TABLE 18.—Sand and gravel sold or used by producers, in thousands

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	14,328	$14,415	2,716	$574	17,044	$14,989
1954	23,136	23,893	3,179	948	26,315	24,841
1955	24,973	26,303	6,545	2,177	31,518	28,480
1956	23,311	25,512	6,025	1,701	29,336	27,213
1957	19,155	21,979	4,530	1,448	23,685	23,427
1958	27,015	28,703	5,856	2,105	32,871	30,808

TABLE 19.—Commercial sand and gravel produced in 1958, by uses

Use	Short tons	Value	Use	Short tons	Value
Sand:			Gravel:		
Blast	88,732	$544,061	Paving	8,072,432	$9,517,271
Engine	7,647	5,793	Railroad ballast	187,407	135,255
Molding	17,280	36,445	Structural	5,863,839	7,364,185
Paving	4,830,464	3,944,014	Other	893,580	706,851
Structural	5,338,316	4,742,770			
Other	1,436,515	1,070,884	Total	15,017,258	17,723,562
Undistributed [1]	278,733	635,157			
Total	11,997,687	10,979,124			

[1] Includes filter furnace, railroad ballast, and glass sands.

The output of sand and gravel was 39 percent greater than in 1957. Over 75 percent was washed. Washed material brought $1.13 a ton, while unwashed brought 35 cents a ton; the latter included a considerable quantity of bank-run material used for fill. Commercial production was responsible for 82 percent of the output; Government-and-contractor operations for the remainder. The sand and gravel industry operated in 103 counties, the same number as in 1957. Building and paving uses accounted for most of the demand (73 percent); other important uses included blast and molding sands and railroad ballast.

Stone.—Texas, the second ranking stone producer in the Nation in 1958, quarried and prepared six kinds of stone: basalt, granite, marble, miscellaneous stone, limestone, and sandstone. Shell was not included in this count, although the commodity is covered in the Stone chapter. The total output, including shell, amounted to 36.1 million tons, up 15 percent from 1957 output. Crushed-limestone production amounted to 70 percent of the total; dimension limestone accounted for less than 1 percent. Shell output composed 25 percent of the total; and sandstone, 3 percent; the remaining 2 percent was divided among basalt, granite, marble, and miscellaneous stone. Production was reported from 71 counties; the 5 leading counties, in order of their output were Wise, Bexar, Travis, Dallas, and Bell. Shell production was reported from seven Gulf coast counties: Chambers, Galveston, Matagorda, Nueces, Calhoun, Aransas, and Harris.

Asphaltic Limestone.—Native asphalt was quarried and processed for highway surfacing and maintenance projects. Production was reported from Uvalde County.

Granite.—Granite was quarried and prepared in four counties. Dimension granite was used for paving blocks, building, and monumental stone; crushed granite for concrete and roadstone. All crushed granite came from Burnet County.

Limestone.—Limestone was quarried in 59 counties. 1958 output was 31 percent greater than 1957. Nearly all of the limestone was crushed for the construction industry, less than 1 percent being dimension stone. Government-and-contractor operations accounted for 35 percent of all crushed limestone, and commercial operations the remainder. Principal uses for crushed limestone were: 17 million tons (67 percent) for roadstone or as aggregate in concrete; 5 million tons (20 percent), cement manufacture; 871,000 tons in lime manufacture; 614,000 tons as railroad ballast; 496,000 tons as metallurgical flux; and 458,000 tons as asphaltic filler. Truck transportation was utilized for 67 percent of the commercial crushed limestone, rail for 32 percent, and unspecified 1 percent. Commercial crushed limestone was priced at $1.12 a ton, noncommercial at 67 cents a ton. Dimension limestone was quarried and prepared in six counties by seven producers. Uses included rough construction, rough architectural building stone, dressed building stone, and rubble.

TABLE 20.—Stone sold or used by producers, in thousands

Year	Limestone		Sandstone		Shell		Miscellaneous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1954	13,483	$14,385	(1)	(1)	10,314	$12,193	1,298	$1,112	[2] 25,840	[2] $29,344
1955	14,103	16,081	(1)	(1)	11,085	14,763	724	700	[3] 27,321	[3] 33,544
1956	18,706	18,357	1,286	$1,244	12,018	15,483	700	636	[3] 32,773	[3] 36,350
1957	19,423	20,509	1,810	1,587	[4] 9,650	[4] 12,640	(1)	(1)	[3 4] 31,248	[3 4] 36,153
1958	25,470	24,794	997	851	9,035	12,684	404	803	[3] 36,076	[3] 40,912

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Total."
[2] Excludes certain stone; Bureau of Mines not at liberty to publish separately.
[3] Includes certain stone; Bureau of Mines not at liberty to publish separately.
[4] Revised figures.

Marble.—Marble was quarried and prepared in Llano County by one producer.

Miscellaneous Stone.—Miscellaneous stone consisted of andesite, basalt, graphitic schist, magnetite, and rhyolite. A significant quantity of blast-furnace slag was also prepared. About 69 percent of miscellaneous stone was transported by rail, 30 percent by truck, and 1 percent by water or unspecified. Price averaged $1.98 a ton.

Sandstone.—Sandstone was quarried and crushed for use as aggregate in concrete, for roadstone, and for riprap. Commercial production accounted for 37 percent of the output, noncommercial production for 63 percent. The crushed material was priced at 85 cents a ton. Production was reported from 11 counties.

Shell.—Shell was recovered from shallow bays of seven Gulf coast counties and composed 25 percent of the total stone output. Cement and lime manufacture consumed 27 percent of the shell produced. Other uses included road surfacing and aggregate for concrete. Most of the shell was moved by water (78 percent), followed by truck haulage (21 percent) and rail (1 percent).

Sulfur.—Texas remained the leading sulfur-producing State, with an output of 2.6 million tons. Production by the Frasch method supplied 93 percent of the total; the remainder was recovered from refinery gases and sour natural gases. Consumption declined owing to the business recession and resultant curtailment in such major industries as steel, rubber, and textiles. The fertilizer industry and certain branches of the chemical industry, however, reported continued good demand.

Four major sulfur producers—Texas Gulf Sulphur Co., Freeport Sulphur Co., Jefferson Lake Sulphur Co., and Duval Sulphur & Potash Co.—formed the Sulphur Export Corp. to market sulfur abroad.

The multimillion-dollar Fannett dome Frasch plant of Texas Gulf Sulphur Co., designed to produce 500,000 tons of sulfur annually, began production in May. Eight wells served the new plant. Most of the sulfur will be shipped in the molten state from the company's spindletop facilities. The company began shipping molten sulfur to its St. Louis market in specially built barges.

TABLE 21.—Sulfur produced and shipped from Frasch mines, in thousands

Year	Production (long tons)	Shipments		Year	Production (long tons)	Shipments	
		Long tons	Value			Long tons	Value
1949–53 (average)	3,765	3,814	$80,984	1956	3,994	3,437	$91,026
1954	3,505	3,474	92,792	1957	3,366	2,880	70,225
1955	3,658	3,767	105,128	1958	2,588	2,616	61,621

U.S. Sulphur Corp. of Houston purchased the million-dollar Frasch sulfur plant of Admiral Sulphur Corp., on the Long Point dome in Fort Bend County.

American Sulphur Co. of Houston planned a 110,000-ton Frasch sulfur plant on the Humble dome in Harris County. Further development of the deposit was in progress.

Olin Mathieson Chemical Corp. began assembling a sulfur-recovery plant at Beaumont, with production anticipated about June 1959. The plant was moved from Columbia County, Ark.

Talc and Soapstone.—60,827 tons of talc and soapstone were mined from open pits in two counties by seven producers in 1958; 29,765 tons was ground and processed for use in ceramics, as a carrier for insecticides, and as roofing granules; and 14,404 tons was exported.

Vermiculite (Exfoliated).—Crude vermiculite from other States was expanded at four plants; two in Harris County, one in Dallas County, and one in Burnet County. Principal uses were lightweight aggregate in plaster, loose-fill insulation and soil conditioner.

Water.—Water supply continued to be one of the State's major mineral problems, notwithstanding a 2-year improvement in surface reservoir capacity in the eastern and central parts of the State. Although the rate of industrial expansion was much lower than that in 1950–55, continued economic development depends largely upon current and future water-development programs, particularly in the western part of Texas, where rainfall is scant and dependency

is placed upon underground water supplies. Local, State, and Federal agencies are making numerous studies of this crucial problem. The Bureau of Reclamation, U.S. Department of the Interior, released a report, "Elements of the Texas Water Problem," in January 1957 to prompt public and industry awareness of the State's water situation.

METALS

Production and consumption cutbacks in the first half of the year in the primary metals industry were important influencing factors in the decline of 1958 industrial activities. Much of the earlier loss was recovered in the latter half of the year, as consumer demand for durable goods continued strong, and inventory liquidation by consuming industries reversed to one of mild accumulation. The mineral-production index, as determined by the Federal Reserve Board, dropped over 25 percent (including crude oil) but regained over 70 percent of the loss in the second half of the year as business confidence returned. Extensive Federal spending for defense activity, public services, educational institutions, and interstate highway construction contributed in large measure to improved industrial activities in the latter part of the year.

Although iron ore, magnesium, mercury, and uranium were the only metals mined, a large number of metallurgical plants processed ores and other materials mined in other States and in foreign countries. Metals produced in these plants included aluminum, antimony, cadmium, copper, lead, magnesium, manganese, silver, tin, and zinc. Most of the metals produced, except iron, were shipped to out-of-State markets, despite rapid growth of the Texas metal-fabricating industry.

Aluminum and Bauxite.—Aluminum plants in Texas curtailed production to less than 70 percent of capacity by June 1958 but reactivated part of the idle capacity during the latter half of the year to an operating rate of about 85 percent. Aluminum Company of America planned to begin operations at the first of four units of its new Point Comfort alumina works by February of 1959. The 187,500 ton unit was to process bauxite from the Dominican Republic. Reynolds Metals Co., after completing a $30 million expansion program at its Sherwin alumina plant in 1957 outside Corpus Christi, during 1958 was expanding the plants capacity by an additional 182,500 to a total of 730,000 tons annually.

Antimony.—Antimony was recovered from ores and concentrates from Mexico and Bolivia at the Laredo smelter of National Lead Co.

Cadmium.—Cadmium was recovered as a byproduct of zinc smelting at the Corpus Christi electrolytic zinc plant of American Smelting & Refining Co.

Copper.—Blister copper was produced at the El Paso copper smelter of the American Smelting & Refining Co. from ores and concentrates of Western States and some foreign countries. Fire-refined copper and electrolytic-grade copper were produced at the Nichols refinery of the Phelps-Dodge Refining Corp. at El Paso.

Iron and Steel.—The iron and steel industry comprising two integrated mills with a combined capacity of 2.4 million tons, supplied less than 40 percent of the State's steel requirements. Wholesale

liquidation of the large inventories of oil-country tubular goods by consumers, beginning in mid-1957 and continuing through most of 1958, was the major factor in market decline in pig iron and steel production in Texas. Other contributing factors were the drop in oil-industry exploration, in capital expenditures for gas transmission and distribution lines, and the growing competition of foreign imports. The oil and gas industry delayed many projected expansions of its transmission systems pending settlement of the "Memphis case." Industry expansions included a rod mill at the Daingerfield plant of Lone Star Steel Co., which would further diversify the company mill products. Sheffield Division of Armco Steel Corp. installed a new alloy-steel-producing unit at its Houston works. A study of the feasibility of smelting low-grade iron ores in east Texas was conducted at the Mississippi Valley Experiment Station of the Federal Bureau of Mines.[4]

Iron and Steel Scrap.—The business recession and lower demand for iron and steel scrap and pig iron by steel mills and gray iron foundries resulted in 29 and 15-percent decreases, respectively, in the consumption of these materials compared with 1957.

A new $1-million plant of Proler Steel Co., designed to process junked autos, refrigerators, washing machines, and other bulk scrap material into small pieces of high density (eliminating paint, enamel, porcelain and non-ferrous foreign materials), began operations in the Houston area in May. All output was contracted to Sheffield Division of Armco Steel Corp., with steel mills in Houston; Kansas City, Mo.; and Sand Springs, Okla.

Lead.—Base bullion was produced at the El Paso smelter of American Smelting & Refining Co. from domestic and foreign ores and concentrates. Most of the markets were out-of-State, although chemical uses (including tetraethyl lead) had a significant intrastate market. Lead scrap was processed and refined at three secondary lead smelters in Houston, three in Dallas, and one in Fort Worth.

Magnesium.—The imbalance of magnesium-ingot production with demand was greatly reduced in the second quarter of 1958, when shipments exceeded production by 18 percent. Magnesium metal was recovered from sea water at the Freeport plant of Dow Chemical Co. Import duty was changed from 14.3 cents a pound to 50 percent ad valorem on July 1.

Manganese.—Tenn-Tex Alloy & Chemical Corp. concentrated and processed foreign manganese ore at its Houston plant. The material was used principally as an alloying ingredient in steel.

Electro Metallurgical Co. (Division of Union Carbide Corp.) purchased the 297,000-ton Government stockpile of low-grade manganese ore at El Paso from General Services Administration in December. A base price of 17 cents a long-ton unit of contained manganese for ore of 30-percent manganese content was established.

Mercury.—A limited amount of mercury was recovered from mine-development projects in Brewster County.

Rare Metals.—American Potash & Chemical Corp. continued as the world's leading producer of cesium and rubidium compounds. Pure

[4] Kenworthy, H., and Starliper, A. G., Electric-Furnace Smelting of East Texas Iron Ores—a Progress Report: Bureau of Mines Rept. of Investigations 5427, 1958, 12 pp.

compounds were recovered from a mixed potassium-rubidium-cesium carbonate of an alkali-rich end liquor at the company San Antonio lithium hydroxide plant.

Silver.—Silver was recovered from smelting lead and copper ores and concentrates from other States and foreign countries and from residues of zinc smelters.

Tin.—Wah Chang Corp., which had purchased the Longhorn tin smelter at Texas City from the Federal Government in 1957, intermittently processed tin concentrate of Indonesian origin. There was a possibility that Billiton concentrate might likewise be directed to the United States smelting facilities, in addition to the Banka ores.

Uranium.—Several trial shipments of uranium ore were made from Garza and Karnes Counties to New Mexico leaching mills. The Nuclear Division of Union Carbide Co. was negotiating with AEC for authorization to build a 600-ton-a-day mill which would process uranium ores from the company 3,100-acre lease in Duval County, as well as uranium ores from adjoining counties. The uranium mineralization occurs in strata 800 feet below the surface in a craterlike depression on the Palangana salt dome.

Zinc.—Zinc ores and concentrates from Western States and foreign countries were processed at horizontal-retort smelters at Amarillo and Dumas and at an electrolytic smelter at Corpus Christi. Operations were curtailed approximately 25 percent during the year owing to growing metal stocks at smelters, increased competition from foreign imports, and sagging metal prices. American Smelting & Refining Co. installed new facilities to produce a special high-grade zinc for use in die casting at its electrolytic smelter at Corpus Christi.

REVIEW BY COUNTIES

TABLE 22.—Value of mineral production in Texas, by counties [1]

County	1957 [2]	1958	Minerals produced in 1958 in order of value
Anderson	$24,777,955	$19,623,772	Petroleum, natural gas, natural-gas liquids.
Andrews	207,564,862	199,004,190	Petroleum, natural-gas liquids, natural gas.
Angelina	906,013	712,274	Clays, petroleum, natural gas, stone, natural-gas liquids.
Aransas	12,641,749	9,983,813	Petroleum, natural gas, natural-gas liquids, shell.
Archer	28,614,132	30,126,321	Petroleum, natural-gas liquids, sand and gravel.
Armstrong	20,321	----------	
Atascosa	16,758,324	13,914,170	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Austin	7,170,601	5,413,384	Do.
Bastrop	993,246	893,080	Petroleum, clays.
Baylor	8,043,200	9,078,500	Petroleum.
Bee	22,728,045	11,932,620	Natural gas, petroleum, natural-gas liquids, stone.
Bell	610,749	1,471,888	Stone, sand and gravel.
Bexar	13,779,097	16,484,963	Cement, stone, petroleum, sand and gravel, clays, gem stones.
Blanco	1,758	6,561	Sand and gravel.
Borden	34,218,095	30,212,800	Petroleum.
Bosque	151,030	23,333	Sand and gravel.
Bowie	369,399	336,343	Sand and gravel, petroleum, natural gas, natural-gas liquids.
Brazoria	184,244,267	151,182,858	Petroleum, natural gas, natural-gas liquids, bromine, magnesium chloride, salt, Frasch sulfur, magnesium compounds, lime.
Brazos	29,700	20,000	Natural gas.
Brewster	88,623	43,538	Clays, sand and gravel, mercury, gem stones.
Briscoe	(3)	33,089	Clays.
Brooks	13,734,028	14,649,772	Petroleum, natural gas, natural-gas liquids.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Texas, by counties [1]—Continued

County	1957 [2]	1958	Minerals produced in 1958 in order of value
Brown	$2,400,585	$1,996,260	Petroleum, stone, natural gas, clays, natural-gas liquids, gem stones.
Burleson	234,174	12,518	Sand and gravel, petroleum.
Burnet	(3)	1,744,097	Stone, graphite, sand and gravel.
Caldwell	11,596,800	11,167,800	Petroleum.
Calhoun	18,030,797	12,242,039	Petroleum, natural gas, shell, natural-gas liquids, sand and gravel, stone.
Callahan	10,393,979	8,323,100	Petroleum, natural gas.
Cameron	45,300	29,200	Do.
Camp	631,700	784,500	Do.
Carson	34,456,567	27,057,383	Petroleum, natural gas, natural-gas liquids.
Cass	7,228,798	9,096,177	Petroleum, iron ore, natural-gas liquids, natural gas.
Chambers	69,504,958	61,695,821	Petroleum, natural gas, shell, salt, natural-gas liquids.
Cherokee	49,422,353	16,695,570	Petroleum, iron ore, natural-gas liquids, natural gas, clays.
Childress	65,178	15,884	Sand and gravel.
Clay	17,594,390	16,871,890	Petroleum, natural-gas liquids, stone, natural gas.
Cochran	21,609,653	29,594,009	Petroleum, natural-gas liquids, natural gas.
Coke	23,573,244	25,433,896	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Coleman	12,059,718	11,188,069	Petroleum, sand and gravel, natural gas, natural-gas liquids, clays, stone.
Collin	107,567		
Collingsworth	790,488	1,349,300	Natural gas, petroleum.
Colorado	24,886,575	19,447,265	Natural gas, natural-gas liquids, sand and gravel, petroleum, stone.
Comal	(3)	(3)	Lime, stone, sand and gravel.
Comanche	406,923	369,119	Petroleum, stone, natural gas.
Concho	67,896	89,192	Petroleum, natural gas, natural-gas liquids.
Cooke	26,228,035	27,631,939	Petroleum, natural-gas liquids, stone, sand and gravel, natural gas.
Coryell	99,646	45,797	Stone.
Cottle	(3)	74,800	Sand and gravel, petroleum.
Crane	101,978,421	121,500,255	Petroleum, natural gas, natural-gas liquids.
Crockett	29,834,145	23,544,236	Petroleum, natural gas, natural-gas liquids, stone.
Crosby	(3)	(3)	Sand and gravel, petroleum.
Culberson	111,750	1,695,850	Petroleum, sand and gravel, gem stones.
Dallam	94,060	283,000	Natural gas.
Dallas	17,818,945	23,234,291	Cement, sand and gravel, stone, clays, gem stones.
Dawson	14,392,468	13,279,709	Petroleum, stone.
Deaf Smith	12,340		
Denton	645,085	547,441	Petroleum, clays, sand and gravel.
De Witt	12,470,497	9,725,183	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone.
Dickens	104,712	281,221	Petroleum, pumicite, sand and gravel.
Dimmit	1,563,227	1,497,950	Petroleum, natural gas, natural-gas liquids.
Donley	79,800		
Duval	44,006,424	38,516,461	Petroleum, natural gas, salt, natural-gas liquids.
Eastland	4,482,223	4,042,739	Petroleum, natural-gas liquids, clays, natural gas, stone.
Ector	205,254,351	209,165,816	Petroleum, natural-gas liquids, natural gas, stone.
Edwards	4,300	3,600	Petroleum.
Ellis	274,202	310,912	Sand and gravel, clays, stone.
El Paso	6,227,864	5,863,788	Cement, sand and gravel, stone.
Erath	157,733	123,383	Natural gas, petroleum, stone.
Falls	185,699	154,938	Stone, sand and gravel, petroleum.
Fayette	1,515,120	1,253,307	Petroleum, sand and gravel, clays, stone, natural gas, gem stones.
Fisher	21,979,640	17,551,454	Petroleum, gypsum, natural-gas liquids, sand and gravel.
Floyd	67,729	30,000	Sand and gravel, petroleum.
Foard	1,640,500	1,966,000	Petroleum, natural gas.
Fort Bend	47,762,299	38,035,218	Petroleum, Frasch sulfur, natural gas, salt, natural-gas liquids, clays.
Franklin	11,381,646	11,781,322	Petroleum, natural-gas liquids, natural gas.
Freestone	2,322,113	2,097,037	Petroleum, natural gas. natural-gas liquids, stone, clays.
Frio	7,568,279	6,573,876	Petroleum, natural gas, natural-gas liquids.
Gaines	85,666,106	75,666,502	Petroleum, natural-gas liquids, natural gas, stone.
Galveston	29,478,388	28,922,754	Petroleum, shell, natural gas, natural-gas liquids, sand and gravel.
Garza	18,800,428	18,321,471	Petroleum, sand and gravel, uranium.
Gillespie	112,178	82,905	Sand and gravel, talc, stone, gem stones.
Glasscock	18,271,534	21,846,920	Petroleum, natural gas, natural-gas liquids.
Goliad	16,945,197	12,774,115	Do.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Texas, by counties [1]—Continued

County	1957 [2]	1958	Minerals produced in 1958 in order of value
Gonzales	$340,716	$351,993	Petroleum, clays, sand and gravel.
Gray	67,529,920	60,919,072	Petroleum, natural-gas liquids, natural gas.
Grayson	29,835,427	23,848,277	Petroleum, natural-gas liquids, stone, sand and gravel, natural gas.
Gregg	127,500,052	134,560,012	Petroleum, natural-gas liquids, natural gas.
Grimes	224,220	483,450	Natural gas, natural-gas liquids, petroleum.
Guadalupe	12,135,400	11,944,548	Petroleum, clays, sand and gravel, natural gas.
Hale	6,117,800	4,405,800	Petroleum.
Hall	[3]	1,020	Sand and gravel.
Hamilton	169,951	111,775	Sand and gravel, stone.
Hansford	16,016,925	20,008,228	Natural gas, natural-gas liquids, petroleum.
Hardeman	[3]	[3]	Gypsum, petroleum, sand and gravel.
Hardin	33,524,063	28,201,454	Petroleum, natural-gas liquids, natural gas.
Harris	123,274,341	113,645,968	Petroleum, cement, natural gas, natural-gas liquids, salt, lime, clays, shell, sand and gravel, stone, gem stones.
Harrison	23,471,347	19,846,821	Petroleum, natural-gas liquids, natural gas, lignite, clays.
Hartley	836,744	7,393,100	Natural gas, petroleum.
Haskell	9,658,600	8,749,600	Petroleum.
Hays	571,650	747,171	Stone, sand and gravel.
Hemphill	25,746	175,777	Petroleum, natural gas, natural-gas liquids.
Henderson	5,503,423	5,754,370	Natural gas, petroleum, natural-gas liquids, sand and gravel, clays.
Hidalgo	27,382,752	19,220,079	Do.
Hill	525,829	15,420	Sand and gravel.
Hockley	41,492,992	24,498,791	Petroleum, natural-gas liquids, natural gas.
Hopkins	5,759,078	6,337,588	Petroleum, natural-gas liquids, clays, natural gas.
Houston	3,675,179	1,742,641	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Howard	43,172,877	30,376,825	Petroleum, natural-gas liquids.
Hudspeth	540,846	358,819	Talc and soapstone, stone, gypsum, sand and gravel, gem stones.
Hunt	49,100	[3]	Sand and gravel, petroleum.
Hutchinson	63,976,837	65,187,952	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.
Irion	2,431,700	1,986,900	Petroleum.
Jack	17,738,131	13,952,632	Petroleum, natural gas, stone, natural-gas, liquids.
Jackson	49,790,002	45,485,365	Petroleum, natural gas, natural-gas liquids.
Jasper	1,926,905	1,967,850	Petroleum, natural gas, clays.
Jeff Davis	20,000	16,352	Sand and gravel.
Jefferson	43,057,012	52,867,065	Petroleum, natural gas, Frasch sulfur, natural-gas liquids, sand and gravel, clays.
Jim Hogg	14,359,586	10,089,800	Petroleum, natural gas.
Jim Wells	50,832,674	51,133,014	Petroleum, natural gas, natural-gas liquids.
Johnson	829,951	1,151,996	Lime, stone.
Jones	21,094,432	17,299,690	Petroleum, sand and gravel, stone.
Karnes	11,455,833	11,728,366	Petroleum, natural-gas liquids, natural gas, uranium, gem stones.
Kaufman	3,368,600	2,804,687	Petroleum, stone, sand and gravel.
Kenedy	2,079,411	2,368,890	Natural-gas liquids, petroleum, natural gas.
Kent	30,886,792	19,600,077	Petroleum, natural-gas liquids, sand and gravel.
Kerr	----------	13,608	Sand and gravel.
Kimble	31,648	26,570	Sand and gravel, petroleum, natural gas.
King	5,835,800	3,404,700	Petroleum, natural gas.
Kleberg	34,196,585	20,828,990	Petroleum, natural gas, natural-gas liquids stone.
Knox	6,346,400	7,630,400	Petroleum.
Lamar	34,961	----------	
Lamb	4,047,300	3,778,500	Petroleum.
Lampasas	31,049	196,026	Stone, sand and gravel.
La Salle	961,600	922,300	Petroleum, natural gas.
Lavaca	11,005,099	6,957,589	Natural gas, natural-gas liquids, petroleum.
Lee	20,400	5,400	Petroleum.
Leon	3,101,096	2,302,316	Natural gas, petroleum, natural-gas liquids.
Liberty	56,975,904	59,906,736	Petroleum, Frasch sulfur, natural gas, natural-gas liquids, sand and gravel.
Limestone	1,516,152	1,604,772	Petroleum, stone, natural gas, natural-gas liquids.
Lipscomb	52,771	175,583	Petroleum, natural gas, natural-gas liquids.
Live Oak	12,393,328	14,369,126	Petroleum, natural gas, natural-gas liquids, gem stones.
Llano	583,239	987,092	Stone, feldspar, gem stones.
Loving	4,074,530	5,860,887	Petroleum, natural-gas liquids.
Lubbock	1,317,976	1,511,490	Petroleum, stone, sand and gravel.
Lynn	1,163,140	973,200	Petroleum.
McCulloch	51,700	128,556	Sand and gravel-petroleum.
McLennan	4,063,256	4,009,816	Cement, sand and gravel, stone, clays, petroleum.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Texas, by counties [1]—Continued

County	1957 [2]	1958	Minerals produced in 1958 in order of value
McMullen	$7,536,461	$7,015,209	Natural gas, petroleum, natural-gas liquids.
Madison	967,885	707,928	Do.
Marion	10,411,361	8,169,260	Petroleum, natural gas, natural-gas liquids.
Martin	1,839,000	2,061,700	Petroleum.
Mason	56,885	46,936	Sand and gravel, gem stones.
Matagorda	40,097,946	27,316,070	Petroleum, natural gas, natural-gas liquids, shell, clays, sand and gravel.
Maverick	95,968	97,269	Petroleum, natural gas, natural-gas liquids.
Medina	619,973	542,600	Petroleum, clays, natural gas.
Menard	4,300	4,000	Natural gas.
Midland	60,721,944	79,062,812	Petroleum, natural gas, natural-gas liquids.
Milam	4,150,958	3,709,802	Lignite, petroleum, stone, sand and gravel.
Mills	115,885	11,770	Stone.
Mitchell	9,724,798	7,336,906	Petroleum, sand and gravel.
Montague	22,262,787	20,646,781	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Montgomery	41,622,937	26,806,779	Petroleum, natural-gas liquids, sand and gravel.
Moore	36,475,895	35,661,657	Natural-gas liquids, natural gas, helium, petroleum.
Morris	(3)	(3)	Iron ore, sand and gravel.
Motley	280,476	471,035	Petroleum, sand and gravel.
Nacogdoches	1,925,620	1,837,626	Natural gas, clays, natural-gas liquids.
Navarro	6,537,708	6,835,752	Petroleum, stone, sand and gravel, clays, natural gas, natural-gas liquids.
Newton	5,473,918	4,971,839	Petroleum, natural gas, natural-gas liquids.
Nolan	37,884,888	35,958,276	Petroleum, cement, natural-gas liquids, gypsum, stone, clays, sand and gravel, natural gas.
Nueces	91,465,489	89,826,814	Natural gas, petroleum, natural-gas liquids, cement, shell, lime, sand and gravel, clays.
Ochiltree	5,761,014	8,088,661	Petroleum, natural gas, natural-gas liquids.
Oldham	(3)	(3)	Sand and gravel, petroleum.
Orange	16,661,714	13,679,982	Petroleum, natural gas, cement, natural-gas liquids, clays.
Palo Pinto	1,454,127	2,038,458	Natural-gas liquids, clays, petroleum, natural gas, sand and gravel, stone.
Panola	89,965,181	53,818,465	Natural gas, natural-gas liquids, petroleum.
Parker	980,155	1,761,100	Natural-gas liquids, stone, natural gas, clays, petroleum.
Pecos	59,815,942	66,298,609	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Polk	5,600,322	4,947,138	Do.
Potter	15,188,890	11,706,186	Natural gas, natural-gas liquids, helium, sand and gravel, stone.
Presidio	17,750	15,258	Sand and gravel, stone, gem stones.
Randall	172,999		
Reagan	32,288,829	39,652,362	Petroleum, natural-gas liquids, natural gas, stone.
Red River	45,000	47,400	Petroleum.
Reeves	2,532,116	17,150,678	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Refugio	74,989,879	65,299,548	Petroleum, natural gas, natural-gas liquids.
Roberts	5,649,258	4,987,592	Do.
Robertson	570,832	697,035	Sand and gravel, stone, petroleum, natural gas, natural-gas liquids.
Rockwall	16,250		
Runnels	27,680,764	24,268,974	Petroleum, natural-gas liquids, stone, natural gas.
Rusk	13,093,350	6,324,277	Natural-gas liquids, petroleum, natural gas, clays.
Sabine	2,000	2,000	Sand and gravel.
San Augustine	2,904		
San Jacinto	2,484,222	1,811,636	Petroleum, natural gas, natural-gas liquids, sand and gravel.
San Patricio	57,759,907	46,869,685	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone.
Schleicher	9,345,191	9,046,223	Petroleum, natural-gas liquids, natural gas.
Scurry	141,424,069	114,311,115	Petroleum, natural-gas liquids, clays.
Shackelford	10,572,938	10,253,828	Petroleum, natural gas, natural-gas liquids.
Shelby	1,668,880	1,247,144	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Sherman	14,210,500	6,406,800	Natural gas, petroleum.
Smith	12,255,647	11,904,910	Petroleum, natural-gas liquids, natural gas, clays, sand and gravel.
Starr	25,824,291	21,634,069	Petroleum, natural gas, natural-gas liquids, sand and gravel, pumicite, clays.
Stephens	11,733,297	10,757,916	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Sterling	1,853,700	1,788,508	Petroleum, stone.
Stonewall	29,733,525	23,920,079	Petroleum, natural-gas liquids, sand and gravel.
Sutton	861,304	584,811	Natural gas, natural-gas liquids, stone, petroleum.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Texas, by counties [1]—Continued

County	1957 [2]	1958	Minerals produced in 1958 in order of value
Tarrant	$8,101,152	$12,102,191	Cement, sand and gravel, stone.
Taylor	11,711,406	14,066,941	Petroleum, natural-gas liquids, sand and gravel, stone, clays.
Terrell	13,515	58,000	Natural gas.
Terry	19,331,700	13,940,538	Petroleum, natural salines, natural-gas liquids.
Throckmorton	11,589,200	12,099,800	Petroleum, natural gas.
Titus	12,460,400	11,060,500	Petroleum.
Tom Green	7,908,929	5,721,542	Petroleum, sand and gravel, stone, natural gas, natural-gas liquids.
Travis	2,399,766	5,665,781	Stone, sand and gravel, lime, petroleum.
Trinity	6,110	196,189	Stone, sand and gravel.
Tyler	2,538,317	3,062,064	Petroleum, natural gas, natural-gas liquids.
Upshur	65,460,400	32,986,000	Petroleum, sand and gravel.
Upton	78,260,354	49,055,195	Petroleum, natural-gas liquids, natural gas.
Uvalde	(3)	(3)	Asphalt, sand and gravel, basalt, natural gas.
Val Verde	25,888		
Van Zandt	30,042,611	22,987,355	Petroleum, salt, natural-gas liquids, natural gas.
Victoria	28,308,415	21,231,094	Petroleum, natural gas, sand and gravel, natural-gas liquids, stone.
Walker	203,214	177,656	Clays, petroleum, gem stones.
Waller	42,872,019	32,389,078	Natural-gas liquids, natural gas, petroleum, sand and gravel.
Ward	24,123,745	23,804,650	Petroleum, natural gas, natural-gas liquids, natural salines, sand and gravel, salt.
Washington	753,355	626,800	Petroleum, natural gas.
Webb	7,328,782	6,016,492	Petroleum, natural gas, natural-gas liquids, clays, sand and gravel, gem stones.
Wharton	70,835,553	57,148,737	Frasch sulfur, petroleum, natural gas, natural-gas liquids, sand and gravel.
Wheeler	7,475,714	6,534,656	Petroleum, natural gas, natural-gas liquids.
Wichita	35,303,131	34,878,398	Petroleum, natural-gas liquids, sand and gravel, stone, natural gas.
Wilbarger	20,080,737	19,525,042	Petroleum, natural-gas liquids, stone.
Willacy	8,434,744	6,105,670	Petroleum, natural gas, natural-gas liquids.
Williamson	1,711,294	1,815,933	Stone, lime, petroleum.
Wilson	3,263,802	2,422,982	Petroleum, clays, natural gas.
Winkler	94,225,864	113,079,911	Petroleum, natural gas, natural-gas liquids.
Wise	13,119,797	23,704,130	Petroleum, natural-gas, liquids, stone, natural gas, clays.
Wood	66,123,251	48,749,474	Petroleum, natural gas, natural-gas liquids.
Yoakum	61,824,812	48,507,041	Petroleum, natural-gas liquids, salt.
Young	21,697,724	20,702,330	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.
Zapata	2,779,600	2,216,733	Petroleum, natural gas, sand and gravel.
Zavala	256,066	380,533	Petroleum, natural gas, natural-gas liquids.
Undistributed	18,247,231	642,426	
Total	4,484,538,000	4,038,656,000	

[1] The following counties are not listed, because no production was reported: Bailey, Bandera, Castro, Delta, Fannin, Hood, Kendall, Kinney, Parmer, Rains, Real, San Saba, Somervell, and Swisher.
[2] Revised figures.
[3] Figure withheld to avoid disclosing individual company data: included with "Undistributed."

Mineral production was reported from 232 of the 254 counties in Texas in 1958. The five leading counties in order of mineral value were: Ector, Andrews, Brazoria, Gregg, and Crane.

Anderson.—Neches (Woodbine) oilfield produced 2.0 million barrels of crude. Tidewater Associated Oil Co. recovered natural-gas liquids at the Long Lake cycling plant near Palestine. Concrete pipe, block, and other concrete products were made at the J. W. Bowden concrete plant and the Palestine Concrete Co. Ready-mixed concrete was prepared by Brice Redi-Mix Concrete Co. Glass containers were manufactured by Knox Glass, Inc.

Andrews.—Andrews County was the second-ranking oil producer, with an output of 53.6 million barrels and the second-ranking producer in total mineral value with $199 million. Natural-gas liquids were recovered at six natural gasoline plants; the Midland Farms gasoline plant of Pan American Petroleum Corp. recovered sulfur.

Angelina.—Crude oil was produced. Bentonite was mined by open-

pit methods near Cavalla by Magnet Cove Barium Corp. and Bennett-Clark Co., Inc. Sandstone was quarried and crushed on contract for District 11 of the Texas Highway Department.

Aransas.—Natural-gas liquids were recovered at the West Rockport gasoline plant of Renwar Oil Corp. United Carbon Co., Inc., recovered carbon black at the Kosmos A & B plants. A plant burned natural gas, and B plant burned distillate. Heldenfels Bros. dredged 172,440 tons of shell from shallow bays bordering Aransas County.

Archer.—Three oilfields produced over 1 million barrels of crude each. Plant 27, of Warren Petroleum Corp., recovered natural-gas liquids. Production of 4,500 tons of paving gravel was reported by the city engineer of Wichita Falls.

Atascosa.—Three gasoline plants, with combined daily capacity of 42,100 gallons, recovered natural-gas liquids. A multimillion-dollar gas-purification plant, capable of treating 65 million cubic feet of gas daily, was completed in the Fashing field by Lone Star Gas Co. Two other purification units were already operative.

Austin.—The mineral economy of Austin County was centered around the oil and gas industry. Building and paving sand and gravel were produced by Brazos River Sand & Gravel Co. and by Austin County Highway Department and District 12 of the Texas Highway Department.

Bastrop.—Fire clay was mined by open-pit methods near Elgin by Elgin Butler Brick Co., Elgin Standard Brick Manufacturing Co., and Payne Brick Co. Crude oil production totaled 143,000 barrels.

Baylor.—Crude oil production amounted to nearly 3 million barrels, with Baylor County oilfield ranking as the top producer.

Bee.—Natural-gas liquids were recovered at three cycling plants. Danaho Refining Co. processed crude oil at the Pettus refinery. Heldenfels Brothers quarried and prepared 7,061 tons of limestone for aggregate and roadstone.

Bell.—Contract production of 1.3 million tons of crushed limestone and 34,612 tons of sand and gravel were reported by District 9 of the Texas Highway Department. Crushed limestone for aggregate and roadstone was produced by Fred Hall & Son. Building and paving sand and gravel were prepared by Belton Sand-Gravel Co., Inc., and Little River Gravel Co.

Bexar.—Texcrete Co. completed expansion of autoclave masonry units producing lightweight building blocks. CMC Pipe Co. was building a new $150,000 concrete-pipe manufacturing plant; Leon Sand & Gravel Co. will furnish concrete for the pipe. Bexar County was the third largest cement producer in the State. Limestone was quarried and crushed for cement manufacture by Longhorn Portland Cement Co. and San Antonio Portland Cement Co. Colglazier Construction Co., McDonough Bros., Inc., and Acme Crushed Stone Co. quarried and crushed 2.0 million tons of limestone. Contractors prepared nearly 5,000 tons of crushed limestone for Districts 1 and 15 of the Texas Highway Department. Eight producers prepared sand and gravel for structural and paving purposes. Four companies mined 131,000 tons of shale in open pits for manufacturing brick and tile, sewer pipe, and lightweight aggregate. Lithium hydroxide and lithium compounds were produced at the San Antonio plant of San Antonio Chemical Co., Inc. All

hydroxide production was destined for nuclear and defense projects of the Federal Government. Crude oil was processed at two refineries.

Bowie.—Mineral activity centered around the mineral fuels. Gifford-Hill & Co., Inc., produced building and paving sand and gravel, ready-mixed concrete, and asphaltic concrete.

Brazoria.—The total value of Brazoria County mineral production was the third largest in the State. Crude oil, natural-gas industrial and synthetic organic chemicals, and light metals were primary forces in the growing industrial economy of Brazoria County. Other natural resources included salt, sulfur, shell, magnesium, and bromine.

Three natural gasoline plants and one cycling plant with a combined daily products capacity of 1,223,600 gallons, recovered natural-gas liquids. Crude oil was processed at the Sweeny refinery of Phillips Petroleum Co.; its subsidiary, Phillips Chemical Co., operated the new ethylene plant adjacent to the refinery. Columbian Carbon Co. produced carbon black from natural gas at its Sweeny No. 204 roller-type plant. Frasch sulfur was recovered from the Hoskins mound by Freeport Sulphur Co. and the Clemons dome by Jefferson Lake Sulphur Co. Dow Chemical Co. produced lime from shell, recovered magnesium compounds from sea water, and recovered salt in brine from a local salt dome. Ethyl-Dow Chemical Co. recovered bromine from sea water to produce ethylene dibromide. Dow Chemical Co. continued the expansion program begun in 1957 by increasing its productive capacity for methyl chloride and methylene chloride, as well as by building a small aluminum chloride plant. Dow joined with Badische Anilin und Sodafabrik to form Dow-Badische Chemical Corp. The new organization will manufacture products derived from acetylene.

Brewster.—Carbonaceous shale, used as a soil conditioner and agricultural mineral supplement, was produced by Manning Minerals Corp. and Soyl-Aid, Inc. There were 5,625 tons of paving sand produced on contract for District 24 of the Texas Highway Department. Mercury was recovered from development ore in the Terlingua mercury district.

Brooks.—Natural-gas liquids were recovered at the cycling plant of LaGloria Oil & Gas Co. United Carbon Co., Inc., recovered carbon black from natural gas at its Dixie channel plant.

Brown.—Texas Brick Co. produced shale from open pits adjoining its brick plant at Brownwood. G. C. McBride, Inc., quarried and crushed 136,000 tons of limestone. Contractors produced 4,000 tons of limestone for District 23 of the Texas Highway Department.

Burnet.—Crystalline graphite was mined and milled at the Southwestern Graphite Co. open pit and flotation mill. Texas Construction Material Co. quarried and crushed limestone. Texas Granite Corp. quarried and prepared dimension granite. Crushed granite was prepared for District 23 and limestone prepared for District 14 of the Texas Highway Department.

Calhoun.—Aluminum was recovered from Surinam bauxite at the Point Comfort reduction works of Aluminum Company of America. The company resumed constructing a $25-million alumina plant adjacent to its Point Comfort reduction works. Initial production

was scheduled for early 1959. Natural-gas liquids were recovered at three gasoline plants. Shell was dredged by Bauer-Smith Dredging Co. and Smith Bros. Dredging Co. District 13 of the Texas Highway Department contracted for crushed limestone and paving sand for road construction.

Cameron.—Barite from Mexico was ground and processed into heavy drilling mud at the Brownsville plant of Magcobar, Inc. Crude oil was refined at the Port Isabel refinery of Delhi Taylor Oil Corp.

Carson.—Mineral-fuel production comprised the entire mineral economy of Carson County. Three natural gasoline plants with a total daily products capacity of 111,400 gallons recovered natural-gas liquids. The Panhandle-Carson County oilfield produced 4.2 million barrels of crude. Cabot Carbon Co. recovered carbon black from natural gas at its Schober channel plant.

Cass.—The mineral economy of Cass County centered around the oil, gas, and iron-ore industries. Sheffield Steel Division of Armco Steel Corp. recovered brown iron ore from open pits. Natural-gas liquids were recovered at the Rodessa gasoline plant of Breckinridge Gasoline Co. The Kildare oilfield produced 1.2 million barrels of crude.

Chambers.—Crude oil was refined at the Winnie refinery of Texas Gas Corp. Natural-gas liquids were recovered at the Anahuac gasoline plant of Humble Oil & Refining Co. W. D. Haden Co. and Parker Bros. Co., Inc., dredged 3.7 million tons of shell from Trinity and Galveston Bays. Diamond Alkali Co. recovered salt in brine from wells.

Cherokee.—Humble Oil & Refining Co. recovered natural-gas liquids at its Neches gasoline plant. Fire clay was mined from open pits near Troup by General Refractories Co. Two producers mined brown iron ore from open pits near Rusk.

Clay.—Natural-gas liquids were recovered at the Ringgold gasoline plant of Otha H. Grimes. Sandstone was quarried and crushed for district 3 of the Texas Highway Department.

Cochran.—Cities Service Oil Co. recovered natural-gas liquids at its West Levelland gasoline plant.

Coke.—Two oilfields—Jameson and Jameson (Strawn)—produced over 1 million barrels of crude each. Natural-gas liquids were recovered at two gasoline plants. Building and paving sand and gravel were produced by Montgomery Sand & Gravel Co.

Coleman.—Coleman County oilfield produced over 1 million barrels of crude oil. Two gasoline plants recovered natural-gas liquids. Martin Brick Co. recovered shale from open pits. T. E. Sanderford quarried and prepared limestone for aggregate and roadstone. Glass and industrial sands were prepared by Santa Anna Silica Sand Co. from deposits in the Santa Anna Mountains.

Colorado.—Colorado County was the second-ranking sand and gravel producer. Output of 4.8 million tons of building and paving sand and gravel was reported from eight plants by four companies and District 13 of the Texas Highway Department. Contracted production of limestone and sandstone was quarried and crushed for Colorado County Highway Department and District 15 of the Texas Highway Department. Three gasoline plants and one cycling plant recovered natural-gas liquids.

Comal.—Limestone was quarried from pits near New Braunfels and Ogden by United States Gypsum Co. and Servtex Materials Co. The New Braunfels lime plant of U. S. Gypsum Co. was the principal producer in Texas.

Cooke.—Cooke County oilfield produced 2.7 million barrels of crude oil. Crude oil was refined at the Gainesville refinery of Tydal Co. Two natural gasoline plants and one cycling plant recovered natural-gas liquids. District 3 of the Texas Highway Department contracted for paving gravel and crushed limestone. Armco Steel Corp. acquired the pump manufacturing plant of National Supply Co. located at Gainesville.

Crane.—Crane County ranked fifth in mineral-production value. Natural-gas liquids were recovered at four gasoline plants having a combined daily products capacity of 489,200 gallons. Warren Petroleum Corp. completed an $8 million expansion program at its Waddell gasoline plant in 1958. Sulfur was recovered from sour natural gas by Phillips Chemical Co. and Warren Petroleum Corp.

Crockett.—Crushed limestone for roadstone was prepared for District 7 of the Texas Highway Department. The World oilfield produced over 1 million barrels of crude oil. Continental Oil Co. recovered natural-gas liquids at its Todd Ranch gasoline plant.

Dallas.—Portland and masonry cements were produced at the Dallas plant of Lone Star Cement Corp. and Eagle Ford Nos. 1 and 2 plants of Trinity Portland Cement Division of General Portland Cement Co. from limestone and clay of their own production. The No. 1 plant was shut down during the latter part of the year. Shale was mined from open pits by Ferris Brick Co. and Dallas Lightweight Aggregate Co. Texas Lightweight Products Co. and Texas Vermiculite Co. expanded perlite mined in New Mexico and Colorado; the latter company expanded vermiculite also. The Dallas County Public Works Department and District 18 of the Texas Highway Department contracted for structural and paving sand and gravel and crushed limestone. Fifteen sand and gravel plants produced 5 million tons of building and paving sand and gravel; 78 percent of the material was washed or otherwise prepared.

Continued growth in population and industry in Dallas County and adjacent areas resulted in the start of an $18 million expansion program at the North Lake electric generating plant of the Dallas Power & Light Co., which included a second 175,000-kw. steam-electric generating unit. Gifford-Hill Pipe Co. completed a new 400-ton batching unit on a 1,200-foot railroad spur to substantially increase the output of concrete, sanitary, and stone sewer pipe at the company's Grand Ferry plant. Southwest Industrial Materials Corp. completed a new plant to manufacture industrial solvents, using clay from a deposit on the plant site. A $125,000 building expansion at the Garland plant of Continental-Emsco Co. included a new metallurgical laboratory and engineering building. The Irving refinery of Great Western Producers, Inc., which produced aromatic and aliphatic solvents, gasoline, and diesel fuels from crude oil and distillates, installed a Udex unit to increase its output of benzene, toluene, and xylenes. Abasco, Inc. converted aluminum scrap into ingots for use by the fabricating industry. Secondary lead and zinc smelters and refineries were operated by American Smelting & Refining Co. and National Lead Co.

Dawson.—The Welch oilfield produced 1.7 million barrels of crude oil. Limestone was quarried and crushed near O'Donnell by Lone Star Materials, Inc.

Denton.—Fire clay was mined from open pits near Denton by Acme Brick Co. Contractors produced 222,600 tons of paving gravel for district 18 of the Texas Highway Department.

De Witt.—Mineral activity in De Witt County consisted of mineral fuels, sand and gravel, and stone production. District 13 of the Texas Highway Department contracted for 33,180 tons of paving sand, 59,010 tons of paving gravel, and 10,800 tons of crushed limestone.

Dickens.—Pumicite was mined from open pits near McAdoo by the Caprock Chemical Co. R. W. Mize prepared paving gravel.

Duval.—Duval County was the second largest salt producer in the State. Salt in brine was produced from wells near Ellis by Columbia Southern Chemical Corp. Natural-gas liquids were recovered at the Hagist gasoline plant of Goliad Corp. and Sejita plant of Trinity Gas Corp.

Eastland.—The mineral economy of Eastland County centered around the oil and gas industry; clay and stone were also produced. Five gasoline plants, with a combined daily products capacity of 62,000 gallons, recovered natural-gas liquids. N. D. Gallagher Clay Products Co. mined fire clay from open pits near Cisco, and shale was mined from open pits near Ranger by American Aggregates Corp., Texas Lightweight Aggregate Co., and Texeramics, Inc. Contractors quarried and crushed limestone for District 23 of the Texas Highway Department.

Ector.—The mineral industry of Ector County attained four firsts in 1958: First in oil production, with 54.6 million barrels; first in total mineral value, with $209 million; first in total exploratory and development well drilling, with 689 wells completed; and first in development oil wells completed, with 650 wells. Three oilfields produced over 1 million barrels of crude each. Seven gasoline plants, with total daily products capacity of 1,443,000 gallons, recovered natural-gas liquids. El Paso Natural Gas Co. was building a crude-oil refinery at Odessa. Carbon black was recovered from natural gas at the channel plant of Sid W. Richardson Carbon Co. Over 36,000 tons of sulfur was recovered at five purification plants in the county. Production was begun at the $6 million, 40-million-pound-a-year styrene plant of El Paso Natural Gas Products Co. About half of the styrene production will be used at the adjacent copolymer plant of General Tire & Rubber Co. in producing 40,000 long tons annually of general-purpose synthetic rubber, the rest of the styrene will be used by United Carbon Co. and Seamco Chemical Co. Limestone was quarried near Notrees by Permian Sand & Gravel Co. and quarried near Odessa by F. M. Reeves & Son, Inc.

Ellis.—Clay was mined from open pits by Acme Brick Co., Barron Brick Co., and Ferris Brick Co. Paving gravel was prepared by Texas Bitulithic Co. Contractors quarried 88,700 tons of limestone and prepared 198,500 tons of paving gravel for Districts 12 and 18 of the Texas Highway Department.

El Paso.—Portland and masonry cements were manufactured from company-produced raw materials at the El Paso plant of Southwest-

ern Portland Cement Co. Limestone was quarried and crushed by McMillan Quarries, Inc., Vowell Material Co., and district 24 of the Texas Highway Department. Building, engine, and other sands were prepared by El Paso Sand Products Co.

El Paso Electric Co. began constructing a $11 million, 80,000-kw. generating plant at Newman. The total plant capacity of the Newman plant was estimated at 400,000 kw.

Fayette.—Bentonite and fuller's earth were recovered from open pits near Flatonia by Milwhite Co., Inc., and Flatonia Fuller's Earth Co. Building and paving sand and gravel were prepared at a fixed plant by Thorstenberg-Tamborello. Crushed sandstone and paving sand and gravel were prepared for district 13 of the Texas Highway Department.

Fisher.—Fisher County was the second-ranking gypsum producer. Gypsum was quarried and processed near Hamlin by the Celotex Corp. and near Rotan by National Gypsum Co. Natural-gas liquids were recovered at two gasoline plants.

Fort Bend.—Fort Bend was the third-ranking Frasch-sulfur producer. Frasch sulfur was recovered from Archer dome by Duval Sulphur & Potash Co. and from Long Point dome by Jefferson Lake Sulphur Co. Salt in brine was recovered from wells near Missouri City by United Salt Corp. Shale, used in manufacturing lightweight aggregate, was mined from open pits near Missouri City by Texas Lightweight Aggregate Co.

Franklin.—The mineral economy of Franklin County centered in the mineral fuels industry. Natural-gas liquids were recovered at the New Hope cycling plant of Tidewater Associated Oil Co.

Freestone.—Shale was mined from open pits by Teague Brick & Tile Co. District 18 of the Texas Highway Department contracted for 92,000 tons of sandstone for road construction and maintenance. Crude oil and natural gas were also produced.

Gaines.—Four oilfields produced more than 1 million barrels of crude oil each. Two gasoline plants recovered natural-gas liquids.

Galveston.—The mineral economy of Galveston County evolved around the mineral fuels, heavy chemical, petrochemical, sand and gravel, and stone industries; Galveston and Texas City were the focal points of the county economy. A 3,000-barrel-a-day sulfuric acid alkylation unit was built at the Texas City chemical plant of Petro-Tex Chemical Co. Expansion projects at the Texas City refinery of American Oil Refining Co. increased ultrafining capacity 21,000 barrels a day and hydrofining capacity 22,000 barrels a day. Monsanto Chemical Co. increased styrene-monomer capacity 40 million pounds a year and acetylene capacity 12 million pounds a year at its Texas City petrochemical plant. The plant used natural gas, propane, and benzene to produce a variety of petrochemical intermediates. A 5,000-barrel-a-day Udex unit to produce benzene, toluene, and xylene was added to the Texas City refinery of Republic Oil & Refining Co. Amoco Chemicals Corp. produced hydrocarbon resins, aromatic solvents, and other petroleum derivatives from refinery gases and petroleum fractions.

Crude-oil production amounted to 8.5 million barrels; two oilfields each produced over 1 million barrels. Shell was dredged from shallow bays surrounding the county for use in the chemical indus-

try and as aggregate and roadstone. The city engineer of Galveston and District 12 of the Texas Highway Department prepared 35,067 tons of paving sand for road maintenance. Crude oil was refined at three Texas City refineries.

Garza.—Nearly 6 million barrels of crude oil was produced in Garza County. Paving sand and gravel were prepared by Elliott Taylor. A trial shipment of uranium ore was sent to New Mexico uranium mills by Garza Mining Co.

Gillespie.—Southwestern Talc Corp. recovered 4,384 tons of soapstone from open pits near Willow City and processed the material at its Llano County mill. Five sand and gravel operators produced 62,139 tons of building and paving sand and gravel. Bear Mountain Quarries prepared rough granite for monumental use.

Gonzales.—Mineral activity in Gonzales County consisted of crude oil, clay, and sand and gravel production. The oil industry produced 55,000 barrels of crude oil. Baroid Division of National Lead Co. recovered bentonite from open pits for use in manufacturing heavy drilling mud. Gonzales Sand & Gravel Co. produced 32,000 tons of building and paving sand and gravel. District 13 of the Texas Highway Department had 117,464 tons of paving sand produced on contract.

Gray.—The Panhandle-Gray County oilfield yielded 13.7 million barrels of crude. Carbon black was recovered from natural gas at two channel plants and one roller plant, and from both distillate and natural gas at one furnace plant. The Pampa petrochemical plant of Celanese Corp. of America produced various ethyl, methyl, propyl, and vinyl derivatives from natural gas and LP-gases. Crude-oil output amounted to 14.1 million barrels. Ten gasoline plants, with total daily products capacity of 567,300 gallons, recovered natural-gas liquids.

Grayson.—Natural-gas liquids were recovered at two gasoline plants. Four producers prepared 275,000 tons of building and paving sand and gravel. Contractors produced 110,000 tons of crushed limestone for District 18 of the Texas Highway Department for aggregate and roadstone. Texas Enterprises, Inc., built a new plant between Sherman and Dennison to manufacture well-boring machinery and equipment.

Gregg.—Gregg County was the State's third-ranking oil-producing county and ranked fourth in total value of minerals produced. Crude-oil output amounted to 40.4 million barrels. The fabulous East Texas oilfield, extending into Cherokee and Upshur Counties, produced 52.1 million barrels in 1958 for a total of 3,358 million barrels since its discovery in 1930. Six gasoline plants, with a daily products capacity of 407,700 gallons, recovered natural-gas liquids. Crude oil was processed at two refineries in Longview.

Guadalupe.—Crude-oil production amounted to 3.9 million barrels. The Darst Creek oilfield yielded 3.4 million barrels of crude. Building and paving sand and gravel were prepared by Tiemann Sand & Gravel Co. Fraser Brick Co. recovered shale from open pits for manufacturing building brick and tile.

Hamilton.—Paving sand and gravel was prepared by Edward Craig. Contractors quarried and prepared 52,291 tons of limestone for District 9 of the Texas Highway Department.

Hansford.—Northern Natural Gas Co. completed a new refrigerator-type gasoline plant near Spearman. The plant processes 1 million cubic feet of gas daily; the dry gas being transferred to the company main gasline to Beaver, Okla. Crude-oil production totaled 1.6 million barrels. Natural-gas liquids were recovered at three gasoline plants.

Hardeman.—Crude gypsum was mined and calcined near Acme by Bestwall Gypsum Co. Underground mining was replaced by the open-pit operation. Contractors prepared 21,345 tons of structural gravel for District 25 of the Texas Highway Department. About 4,000 barrels of crude oil was produced during the year.

Hardin.—Crude oil produced totaled 7.5 million barrels. Natural-gas liquids were recovered at the Nos. 25 and 26 cycling plants of Sinclair Oil & Gas Co.

Harris.—An abundance of essential natural resources, excellent harbor facilities, and an adequate transportation system that includes the Houston Ship Channel and the Intercoastal Waterway made Houston and Harris County the nucleus of the largest industrial complex in Texas and the Southwest region and were the dominant factors for major resource-oriented industries: Petroleum refining, industrial and synthetic organic chemicals, steel, and cement.

The oil and gas industry produced 23.4 million barrels of crude oil. Natural-gas liquids were recovered at three gasoline plants and one cycling plant. Seven refineries, with a combined daily crude capacity of 656,400 barrels, processed domestic and imported crude oils.

Portland and masonry cements were produced at the Houston plants of Ideal Cement Co., Lone Star Cement Corp., and Trinity Portland Cement Division of General Portland Cement Co. from shell and clays. Lime, manufactured from shell by Champion Paper & Fibre Co. and Sheffield Steel Division of Armco Steel Corp., was used principally by the chemical, pulp and paper, and metallurgical industries. Four brick and tile companies mined 86,159 tons of shale from open pits for use in manufacturing brick, tile, and heavy clay products. Five commercial sand and gravel producers and District 12 of the Texas Highway Department produced 830,686 tons of building and paving sand and gravel. Slag was crushed and prepared by Houston Slag Material Co. Salt was mined by United Salt Corp. near Hockley and recovered as salt in brine from wells by Texas Brine Corp. Sheffield Steel Division of Armco Steel Corp. operated its Houston integrated iron and steel plant at reduced capacity, using Texas brown iron ore and foreign hematite as feed for the blast furnace.

Barite mills of Baroid Division, National Lead Co., and Milwhite Co., Inc., ground and prepared crude barite from other States and from foreign countries for use in heavy drilling muds. Crude perlite from adjoining States was expanded by Perlite of Houston, Inc., and Tri-Lite Corp. Crude vermiculite from Montana was expanded for lightweight aggregate in concrete and plaster by the Tri-Lite Corp. and Vermiculite Products, Inc. Sulfur was recovered from refinery gases for use in making sulfuric acid for the chemical and refining industries.

The capacity of Consolidated Chemical Industries, Inc., sulfur-recovery plant was increased 100 tons a day.

Armco Steel Corp. acquired the Houston Well Control Equipment plant of National Supply Co., one of the world's largest manufacturers and distributors of oilfield machinery and equipment. United States Gypsum Co. began constructing a $10-million gypsum-products plant at Galena Park. The plant will make gypsum wallboard and sheathing, rock lath, and plaster from crude gypsum shipped from Jamaica in the company fleet of six ocean cargo ships.

A pushbutton-operated plant that converted junked autos, refrigerators, washing machines, and other hard-to-handle materials into high-grade scrap began operating in May. The new process, developed by the Proler Steel Corp., removed all contaminating material, such as paint, porcelain, rubber, nonferrous adulterants, enamel, etc., to yield clean, dense fragments of fairly uniform size. The process could conceivably eliminate baling No. 2 bundles in the Houston area.

Ethyl Corp. produced tetraethyl lead, ethyl chloride, and ethylene dichloride from ethylene piped from the Sweeny plant of Phillips Chemical Co. Central Petroleum Corp., using refinery gas stream from the Shell Oil Co. refinery, processed a propane-propylene stream, which it sold to Shell Chemical Corp. Shell Oil Co. increased catalytic cracking capacity at its Deer Park refinery 43,000 barrels a day. The new facilities will permit producing three new solvents for industrial uses.

A 2-million-gallon-a-year high-purity isobutylene unit and a 3,000-barrel-a-day sulfuric-acid-akylation plant were built at the Houston works of Petro-Chemical Corp. New facilities for manufacturing acetylene, ammonia, and methanol was planned for the Deer Park plant of Rohm & Haas Co. The paraxylene unit of the Baytown refinery of Humble Oil & Refining Co. was expanded to 66 million pounds annually and a 40-million-pound-a-year polypropylene plant added, using gases from the refinery. National Petro-Chemicals Corp. was building a $20 million petrochemical plant on the Houston Ship Channel to produce 75 million pounds of polyethylene annually from high purity ethylene piped from Phillips Chemical Co.'s Sweeny plant. Construction was begun on a propylene unit at the Channel View petrochemical plant of Texas Butadienne & Chemical Corp. Eastern States Petroleum & Chemical Co., Inc., added a 600-barrel-a-day UOP aromatic alkylation unit to its Houston refinery. Aromatic and aliphatic solvents, benzene, toluene, and xylene were derived from a refinery gas stream at the company's Houston petrochemical plant.

Texcrete Co. of Houston completed a $230,000 expansion program at its Houston concrete-masonry works. New facilities included two autoclaves, an automatic loader, and a semiautomatic batching unit, permitting expansion of its product line. A $67-million expansion program of the Houston Lighting & Power Co. included a 285,000-kw. generator at the Smithers Lake station.

Harrison.—Crude-oil output totaled 2.3 million barrels. Four gasoline plants with a combined capacity of 410,500 gallons of products daily recovered natural-gas liquids. Acme Brick Co. and Marshall Brick Co. mined shale from open pits. Marshall Pottery recovered fire clay from open pits to manufacture ceramics. Darco Division of Atlas Power Co. recovered lignite from open pits near Marshall for use in preparing activated carbon.

Thiokol Chemical Corp. was awarded an $18 million Army contract to manufacture engines for solid propellant rockets and missiles. The plant is situated at the Army Longhorn Ordnance Works. The Libberman generating plant of Southwestern Gas & Electric Co. was increased 100,000 kw. as part of the company's $21-million expansion program. A catalytic unit to increase the output and octane rating of gasoline was installed at the Waskom plant of Waskom Natural Gas Corp.

Hays.—Contractors quarried and prepared 831,136 tons of limestone for District 14 of the Texas Highway Department. Hays County Gravel Co. produced building and paving sand and gravel.

Henderson.—The Trinidad gasoline plant of Lone Star Gas Co. and the Opelita cycling plant of Lone Star Producing Co. recovered natural-gas liquids. Turkey Creek Sand & Gravel Co. produced building and paving sand and gravel. Fire clay used in manufacturing firebrick, refractory shapes, and building brick was mined by the open-pit method by Harbison-Walker Refractories Co., Athens Tile & Pottery, and Texas Clay Products Co. Miscellaneous clay was mined from open pits by Athens Brick Co.

Hidalgo.—The McAllen cycling plant of Delhi-Taylor Oil Corp. and the Tabasco plant of Anchor Gasoline Corp. recovered natural-gas liquids. Crude oil was processed at two refineries. Valley Brick & Tile Co. mined shale from open pits. Building and paving sand and gravel were produced. District 9 of the Texas Highway Department had 77,100 tons of paving gravel produced on contract.

Hockley.—The prolific Slaughter oilfield, extending into Cochran and Terry Counties, produced 8.5 million barrels of crude oil. Natural-gas liquids were recovered at three gasoline plants. Pan American Petroleum Corp. recovered sulfur at its Slaughter gasoline plant.

Hopkins.—Humble Oil & Refining Co. recovered natural-gas liquids at the Pickton gasoline plant. A. P. Green Fire Brick Co. mined 11,713 tons of fire clay from open pits. Thermal Aggregate Engineers developed and patented a method of processing clay into synthetic gravel at its Sulfur Springs pilot plant. The company planned to use portable kilns to produce the gravel at construction sites in areas not having natural deposits, if the product meets highway specifications. Crude-oil output was 1.6 million barrels.

Howard.—Carbon black was recovered from distillates at the Dixon furnace plant of Cabot Carbon Co. Reef Fields Gasoline Corp. recovered natural-gas liquids at its East Vealmoor gasoline plant. El Paso Natural Gas Co. expanded the gas-dehydration unit of its Big Springs plant. Cosden Petroleum Corp. operated its 20-million-pound-a-year styrene plant at Big Springs, producing paraxylene and various chemical derivatives from naphtha fraction from the refinery. Crude oil was refined at the company's Big Spring refinery.

Hudspeth.—Hudspeth County was the leading talc producer in Texas with six producers recovering 56,423 tons of talc and soapstone from open pits near Allamoor; 25,589 tons were ground and processed. Southwestern Portland Cement Co. mined gypsum from open pits near Allamoor for use as a retarder in cement. Gifford-Hill & Co., Inc., quarried and crushed rhyolite for use as riprap, railroad ballast, and roofing granules.

Hutchinson.—The Panhandle-Hutchinson County oilfield produced 13.6 million barrels of crude oil. Seven gasoline plants recovered

natural-gas liquids. Crude oil was processed at Phillips Petroleum Co. refinery. Phillips Chemical Co. produced synthetic rubber at its Plains copolymer plant and butadiene, butylene, and propylene at its Plains butadiene plant. Building and paving sand was produced by Borger Redi-Mix Co. and Tri-City Sand & Gravel Co. District 4 of the Texas Highway Department had 167,280 tons of caliche quarried and crushed on contract.

Jack.—Crude oil was processed at the Bryson Pipeline & Refining Co. refinery. Natural-gas liquids were recovered at the Black Hawk cycling plant of Black Hawk Gasoline Corp. Districts 2 and 3 of the Texas Highway Department had 143,482 tons of limestone quarried and crushed for use as aggregate and roadstone.

Jackson.—Crude-oil production amounted to 10.4 million barrels. A cycling plant and a gasoline plant recovered natural-gas liquids.

Jasper.—Mineral activity consisted of oil, gas, and clay production. Bentonite was mined from open pits for use as a filtering medium by Bennett-Clark Co., Inc. Crude-oil output was 473,000 barrels.

Jefferson.—Jefferson County had the largest concentration of crude-oil-refining capacity in the Nation, and was the second largest Texas Frasch-sulfur producer. Jefferson County was an important part of a growing petroleum refining and petrochemical complex of the Gulf Coast area. Natural-gas liquids were recovered at the gasoline plant of Texas Gas Corp. Crude oil was refined at six refineries with a combined daily crude capacity of 959,400 barrels. Crude-oil output was 6.6 million barrels. Sulfur was recovered from cracked refinery gases at the Port Arthur refinery of Gulf Oil Corp. Frasch sulfur was recovered from cracked refinery gases at the Port Arthur refinery of Gulf Oil Corp. Frasch sulfur was recovered from the Fannett and Spindletop domes by Texas Gulf Sulphur Co. The multimillion-dollar Fannett-dome plant, designed to produce one-half million tons of sulfur annually, began production in June. Most of the sulfur was to be shipped molten to the company Spindletop facilities. Eight wells serve the Fannett plant. Olin-Mathieson Chemical Corp. moved a sulfur-recovery plant from Magnolia, Ark., to Beaumont, and added a new ammonium sulfate unit in the rebuilding process. C. A. McKinley Sons, Inc., prepared 84,069 tons of building sand. Miscellaneous clay was mined from open pits by Beaumont Brick Co., Inc.

A 2,600 barrel-a-day catalytic reformer to condition the reactor charge by removing sulfur and other impurities in gasoline production, was added to the Port Arthur refinery of Gulf Oil Corp. A 30-million-gallon-a-year benzene unit was under construction.

Magnolia Petroleum Co. was completing a multimillion dollar expansion at its Beaumont refinery to improve the quality of its products. New facilities included an 8,000-barrel-a-day alkylation unit, a 30,000-barrel-a-day Sovafiner unit for treating heating oils, a unit to recover hydrogen sulfide from liquid and gas feed stocks going to the alkylation unit, a 200-ton di-isobutanizer tower that would increase LP-gas capacity 6,500 barrels daily, and a 100-thousand-barrel-a-day crude distillation unit that would eventually replace seven smaller units. An auxiliary plant using petroleum fractions produced cresylic acid and sodium cresylate solutions. Atlantic Refining Co. added a 2,100-barrel alkylation unit to its Port Arthur refinery.

Expansion projects at the Port Neches synthetic rubber plant of Goodrich-Gulf Chemicals Corp., consisted of additional capacity to the copolymer plant and new facilities to produce carbon-black, masterbatch rubber. Usually the carbon black and other chemicals are mixed with synthetic rubber at the manufacturer's plant. Jamison Chemical Co. diversified its products line to eventually produce other organic chemicals based on ethylene and propylene through a $38-million expansion program at its Fort Neches plant. New facilities included units to raise ethylene capacity to 180 million pounds a year, ethylene glyco to 126 million pounds a year, and ethylene oxide to 165 million pounds a year.

Jim Wells.—Mineral activity in Jim Wells County centered around mineral fuels. The Falfurrias cycling plant of LaGloria Oil & Gas Co. and Seeligson plant of Magnolia Petroleum Co. recovered natural-gas liquids.

Johnson.—Lime used in the building and chemical industries was prepared by the Texas Lime Co. from high-calcium limestone of its own production. Districts 2 and 18 of the Texas Highway Department had 185,377 tons of limestone quarried and crushed under contract.

Jones.—Crude oil was processed at the Petroleum Products Refining Co. refinery. West Texas Stone Co. and Lueders Limestone Co. produced rough architectural and cut building limestone from quarries near Lueders.

Karnes.—Minerals activity consisted of crude oil, natural gas, natural-gas liquids, and uranium ore production. Natural-gas liquids were recovered at two gasoline plants and one cycling plant. A trial shipment of uranium ore was made to New Mexico uranium mills by Atkins & Luton.

Kaufman.—Contractors produced paving gravel and crushed limestone for District 18 of the Texas Highway Department. Limestone was also quarried by J. F. Buckner & Sons for use as aggregate and roadstone. Crude oil produced totaled 605,000 barrels.

Kenedy.—Mineral activity in Kenedy County consisted of mineral fuels only. Natural-gas liquids were recovered at the Julian cycling plant of Humble Oil & Refining Co. Crude-oil output was 248,000 barrels.

Kent.—Salt Creek oilfield produced 2.8 million barrels of crude oil. Senn Gravel Co. recovered 2,687 tons of building and paving sand and gravel.

Kleberg.—In all, 5.5 million barrels of crude oil was produced. Heldenfels Bros. produced 7,135 tons of crushed limestone from a quarry near Kingsville. Standard Oil Co. of Texas recovered natural-gas liquids at its Chevron gasoline plant.

Lampasas.—Mineral-industry activity consisted of industrial and special sand and gravel produced by Lampasas Sand-Gravel Co. and 181,694 tons of limestone quarried and crushed for District 23 of the Texas Highway Department.

Lee.—Hopwood Engineering Co. completed a pilot plant to manufacture chemicals from plants and minerals in the area. Crude oil was produced from the Tanglewood oilfield.

Liberty.—West Gasoline Co. recovered natural-gas liquids at its Hull gasoline plant. Celenese Corp. of America operated a large petro-

chemical plant at Bishop, using natural gas and liquefied-petroleum gases to produce synthetic organic chemicals, acetic acid, acetone, methanol, special solvents and numerous methyl, propyl, and butyl derivatives. Frasch sulfur was recovered from Moss Bluff dome by Texas Gulf Sulphur Co.

Limestone.—Mineral-industry activity was confined to production of mineral fuels, clay and stone. Barron Brick Co. recovered shale from open pits near Grossbeck. Districts 9 and 18 of the Texas Highway Department had 469,395 tons of limestone quarried and crushed for aggregate and roadstone.

Live Oak.—Mineral production consisted entirely of mineral fuels. Crude-oil output amounted to 1.7 million barrels. Natural-gas liquids were recovered at the Karon cycling plant and the Kittie and Clayton gasoline plants of Goliad Corp. Crude oil was processed by Three Rivers Refinery.

Llano.—Feldspar was shipped from stockpile for use in the ceramic industry. Dezendorf Marble Co. quarried and prepared marble for use as terrazzo, whiting, and roofing granules. Talc and soapstone mined in Hudspeth and Gillespie Counties were ground in Llano County. District 14 of the Texas Highway Department had 78,343 tons of limestone quarried and prepared as aggregate and roadstone. A graphitic schist was mined from open pits near Llano by Graphilter Corp. for use as a filtering medium. Magnetite for heavy aggregate was prepared by Boyd Callan, Inc.

Lubbock.—District 5 of the Texas Highway Department had 31,860 tons of limestone quarried and crushed for concrete and roadstone. Building and paving sands were produced.

Marion.—The Haynes (Mitchell) oilfield produced 1.1 million barrels of crude oil. The Jefferson gasoline plant of Arkansas-Louisiana Chemical Corp. recovered natural-gas liquids.

Matagorda.—Natural-gas liquids were recovered at the Markum gasoline plant of Ohio Oil Co. and the Blessing cycling plant of American Petrofina Co. Shell for aggregate and road surfacing was dredged from shallow bays by Matagorda Shell Co. Pal-Port Clay Products Co. mined shale from open pits. Crude oil and natural gas were also produced during the year.

Maverick.—Minerals produced were crude oil, natural gas, and natural-gas liquids. Crude fluorspar from Mexico was milled at the Eagle Pass flotation mill of Reynolds Metals Corp. for use in manufacturing cryolite.

McCulloch.—Industrial sands were prepared by San Saba Sand Co. at a new sand-processing plant near Brady. Crude oil was produced from the Dietz (Strawn), Siler, and Johnson (1,700') oilfields.

McLennan.—Portland and masonry cements were produced from limestone and clay was mined from open pits at the Waco plant of Universal Atlas Cement Co. Four sand and gravel producers prepared 924,502 tons of building and paving sand and gravel. Tonk Quarries quarried and prepared 10,455 cubic feet of sawed and 4,000 cubic feet of cut, dressed building limestone. District 9 of the Texas Highway Department had 344,332 tons of paving gravel and 143,057 tons of limestone quarried and crushed for use as aggregate and roadstone.

Crude oil was refined at the Premier Oil Refining Co. of Texas (Fort Worth plant). Astrodyne, Inc., a jointly owned firm of Phillips Petroleum Co. and North American Aviation, Inc., built a $2 million plant at MacGregor for developing and manufacturing high-energy fuels and propellants for use in rockets and missiles.

McMullen.—Mineral fuels composed the entire mineral industry of the county. A $2.5 million dehydration plant and auxiliary facilities for removing water and acid from 75 million cubic feet of natural gas a day were completed by Transcontinental Gas & Pipeline Corp. near Tilden.

Medina.—Crude oil and natural gas were produced. D'Hanis Brick & Tile Co. mined shale from open pits for use in manufacturing building brick, tile, and heavy clay products.

Midland.—The Spraberry Trend area oilfield, which extends into Glasscock County, produced 4.8 million barrels of crude oil. Crude-oil output amounted to 19.2 million barrels. Five gasoline plants recovered natural-gas liquids. Crude perlite from New Mexico was expanded for use in building plaster, as loose-fill insulation, and as filter aids by Perlite Industries, Inc.

Milam.—The Rockdale aluminum-reduction works of Aluminum Company of America operated at reduced capacity throughout 1958. Lignite, used as a fuel for generating electric power, was strip-mined by Industrial Generating Co. District 17 of the Texas Highway Department had 97,500 tons of limestone quarried and crushed for use as aggregate and roadstone.

Mitchell.—The Westbrook oilfield produced 1.6 million barrels of crude oil. Crude oil was refined at the Col-Tex Refining Co. plant at Colorado City. Building and paving sand and gravel were prepared by R. E. Janes Gravel Co., Inc., and Colorado Sand & Gravel Co.

Montague.—Montague County oilfield produced 2 million barrels of crude oil during the year. Watson Sand & Gravel Co. prepared 27,742 tons of building sand. Contractors prepared 26,438 tons of paving gravel and quarried and crushed 62,150 tons of sandstone for District 3 of the Texas Highway Department. The Bowie gasoline plant of Bowie Gasoline Co. recovered natural-gas liquids.

Montgomery.—Natural-gas liquids were recovered at one cycling and three gasoline plants. Crews of District 12 of the Texas Highway Department prepared 28,054 tons of paving gravel for use as aggregate and roadstone. The Conroe petrochemical plant of Gulf Oil Corp. produced methanol acetaldehyde and other synthetic organic chemicals from propane feed stock. Natural gas and distillates were burned to recover carbon black at the Conroe No. 63 furnace plant of Columbian Carbon Co.

Moore.—Continental Carbon Co. recovered carbon black from natural gas and distillates at its Continental furnace plant. Seven gasoline plants, having a combined daily capacity of 1,093,512 gallons of products, recovered natural-gas liquids. Sulfur was recovered from sour natural gas at the McKee plant of Shamrock Oil & Gas Corp. The Government owned and operated Exell plant recovered helium from natural gas.

Morris.—Lone Star Steel Co. completed most of its $8-million expansion program, which included a 6th open-hearth furnace, a new

stretch-reducing mill, and a rod mill. Basic annual steel capacity of the Lone Star works was raised to 800,000 tons. Brown iron ore was mined from open pits near Lone Star by Lone Star Steel Co.

Nacogdoches.—Crude oil, natural gas, and natural-gas liquids were produced. Acme Brick Co. mined miscellaneous clay from open pits.

Navarro.—The Corsicana Shallow oilfield produced 1.2 million barrels of crude oil. Natural-gas liquids were recovered. Contractors prepared 128,000 tons of paving gravel and quarried and prepared 417,465 tons of limestone for Districts 10 and 18 of the Texas Highway Department.

Nolan.—Nolan was the leading gypsum-producing county. Crude gypsum was mined from open pits near Sweetwater and prepared by Flintkote Co. and U.S. Gypsum Co. The Nena Lucia (Strawn Reef) oilfield produced 2 million barrels of crude oil. Four gasoline plants recovered natural-gas liquids. Lone Star Cement Co. quarried high-calcium limestone and mined clay from open pits for use at its Mary Neal plant in manufacturing portland and masonry cements. Gifford-Hill Pipe Co. began constructing a $250,000 concrete culvert and sewer-pipe plant at Sweetwater.

Nueces.—Nueces County was the third-ranking lime producer. The Corpus Christi No. 6 carbon-black plant of Columbian Carbon Co. was shut down on January 1. Ten gasoline plants and four cycling plants recovered natural-gas liquids. Crude oil was refined at six oil refineries. Suntide Refining Co. expanded orthoxylene facilities at its Corpus Christi refinery and petrochemical plant. Suntide merged with Sunray Mid-Continent Oil Co. the latter part of 1958. A new 5,000-barrel-a-day Unifiner was added to the Corpus Christi refinery of Pontiac Refining Corp. The crude unit at the refinery was redesigned and modified. Champlin Oil & Refining Co. began a $3-million expansion program at its Gulf Plains cycling plant to increase butane, propane, and ethane capacity. The company also operated the Coastal and the Wardner cycling plants, processing natural gas from the Stratton and Aqua Dulce gasfields. Benzene, toluene, xylene, and aliphatic and aromatic solvents were processed at the Great Southern Chemical Corp. petrochemical plant from petroleum fractions of the LaGloria Oil & Gas Co. refinery. Soda ash, liquid and solid caustic soda, chlorine, and other inorganic chemicals were prepared at the Corpus Christi chemical plant of Columbia-Southern Chemical Corp. Shell was dredged from shallow bays bordering Nueces County by Corpus Christi Shell Co., Heldenfels Bros., and Matagorda Shell Co. Halliburton Portland Cement Co. manufactured portland and masonry cements from shell. Lime was produced from shell by Columbia-Southern Chemical Corp. for chemical and industrial uses.

A new unit to produce a wide range of zinc alloys was completed at the Corpus Christi electrolytic zinc refinery of American Smelting & Refining Co. early in 1958. The new facilities will permit integration of refining and alloying operations and provide more rigid control of quality. The plant also produced sulfuric acid and recovered cadmium metal. Crude barite from domestic and foreign sources was crushed and ground at the Corpus Christi plant of Baroid Division of National Lead Co. for use in heavy drilling muds. Building and paving sand and gravel were prepared by Heldenfels Bros. and M. P. Wright from pits near Calallen.

Oldham.—Crude oil was produced. Building and paving sand and gravel were recovered from pits near Atascosa by Western Aggregates, Inc., and Western Sand & Gravel Co.

Orange.—The mineral economy of Orange County centered around mineral-fuels production, petrochemicals, cement, and clay. Natural-gas liquids were recovered at the 19,700-gallon-capacity Phoenix Lake gasoline plant of Ohio Oil Co. Portland cement was manufactured from oystershell and shale at the Echo plant of Texas Portland Cement Co. Polyethylene and methanol capacities were expanded at the Orange petrochemical plant of E. I. du Pont de Nemours & Co. The plant converted natural gas, propane, and benzene into methanol adipic acid, polyethylene, and nylon intermediates.

Palo Pinto.—The county was the third largest clay producer. Two gasoline plants recovered natural-gas liquids. A total of 344,558 tons of miscellaneous clay, used for manufacturing brick, tile, and heavy clay products, was mined from open pits near Strawn by Featherlite Corp. and Reliance Clay Products Co. and from pits near Mineral Wells by Texeramics, Inc. Texas Vitrified Pipe Co. installed a new hydraulic press and auxiliary equipment at its Mineral Wells plant to permit the manufacture of clay pipes of greater length and diameter. Mineral Wells Sand & Gravel Co. prepared building and paving sand and gravel from pits near Mineral Wells. Contractors quarried and prepared 50,380 tons of limestone for District 2 of the Texas Highway Department. Crude oil and natural gas were also produced.

Panola.—Five gasoline plants and one cycling plant, with daily products capacity of over 1 million gallons, recovered natural-gas liquids. Crude oil was produced. A new $1-million automatic methane unit was installed at the Carthage Co. gasoline plant.

Parker.—Lone Star Gas Co. recovered natural-gas liquids at its Springtown gasoline plant. District 2 of the Texas Highway Department had 400,637 tons of limestone quarried and prepared by contractors for use as aggregate and roadstone. Ben Roy Gholson quarried and prepared sandstone for rough construction. Acme Brick Co. and Mineral Wells Clay Products Co. mined miscellaneous clay from open pits for use in manufacturing brick and tile.

Pecos.—During the year the Yates oilfield produced 6.1 million barrels of crude oil and the Fort Stockton oilfield 1 million barrels of crude oil. Natural-gas liquids were recovered at the Santa Rosa No. 3 gasoline plant of Pecos Petroleum Co. Sand and gravel for use as building and paving material was produced.

An historic drilling event occurred in Pecos County, when Phillips Petroleum Co. drilled the world's deepest test, the University EE No. 1, to 25,340 feet. A total of 732 days was spent in drilling the University EE. Phillips Petroleum Co. also drilled two other deep tests; the Montgomery A No. 1 to 23,400 feet and the Harral A No. 1 to 19,020 feet. A new gas dehydration plant and 68 miles of pipeline were completed on the north edge of the Puckett gasfield by El Paso Natural Gas Co.

Potter.—Helium was recovered from natural gas at the Government owned and operated Amarillo plant. Crude oil was refined at the Amarillo refinery of Texaco, Inc. The Fain and Turkey Creek gasoline plants of Amarillo Oil Co. recovered natural-gas liquids. Con-

tractors quarried and prepared 884,730 tons of limestone for district 4 of the Texas Highway Department and 8,629 tons of paving gravel for the city of Amarillo. Texas Sand & Gravel Co., Ltd., produced 260,248 tons of building and paving sand and gravel and quarried and prepared 253,708 tons of limestone for aggregate, roadstone, and asphalt filler. A $2-million contract for 20 special tank cars to transport helium from the Government-operated Amarillo plant—new car deliveries to coincide with completion of the Government's new Keyes, Okla., helium plant late in 1959—was awarded to American Car & Foundry Co. Each car consists of 30 seamless steel cylinders mounted on standard railway trucks capable of holding 200,000 cubic feet of compressed gas. Nearly 80 percent of the helium produced at the plant is shipped by rail.

Zinc metal was recovered from zinc ores and concentrates shipped from Western States and Mexico at the horizontal retort smelter of American Smelting & Refining Co. Operations were curtailed owing to growing metal stocks and lower demand.

Reagan.—The Spraberry Trend area (Clear Fork) oilfield produced 1.2 million barrels of crude oil in 1958. Three gasoline plants recovered natural gas liquids. Sulfur was recovered from sour natural gas at the Big Lake plant of Barnhart Hydrocarbon Co. Contractors quarried and prepared 241,068 tons of limestone for District 7 of the Texas Highway Department.

Reeves.—Energy fuels and sand and gravel were produced. The Turnstill gasoline plant of the Pecos Petroleum Co. recovered natural-gas liquids. Building and paving sand were produced during the year.

Refugio.—Mineral activity of Refugio County consisted entirely of mineral fuel production. Natural-gas liquids were recovered at the Tom O'Connor gasoline plant of Humble Oil & Refining Co.

Robertson.—Mineral fuels, sand and gravel, and stone were produced. Gifford-Hill & Co., Inc., prepared building and paving sand and gravel from pits near Hearne. District 17 of the Texas Highway Department had 103,500 tons of limestone quarried and crushed by contractors.

Runnels.—The Fort Chadbourne oilfield, which extends into Coke County, produced 3.6 million barrels of crude oil. Three gasoline plants recovered natural-gas liquids. Contractors quarried and prepared 52,043 tons of limestone for aggregate and roadstone for District 7 of the Texas Highway Department.

Rusk.—Mineral-industry activity consisted of the production of crude oil, natural gas, natural-gas liquids, and clays. An $800,000 expansion program, which included a 420-foot tunnel kiln, two 184-foot twin driers, and auxiliary equipment, began at the Henderson brick plant of Henderson Clay Products Co. Brick output will be increased to 250,000 brick daily. Fire clay and shale were mined from open pits near Henderson by Henderson Clay Products Co., Major Brick Co., and J. M. Cordell & Sons. Five gasoline plants, with a combined products capacity of 283,300 gallons daily, recovered natural-gas liquids. Crude oil and natural gas were produced during the year.

San Jacinto.—Minerals produced were crude oil, natural gas, natural-gas liquids, and sand and gravel. Thorstenberg-Tamborello prepared building and paving sand and gravel from pits near Sheppard.

San Patricio.—Crude oil, natural gas, natural-gas liquids, sand and gravel, stone, and aluminum metal were produced. Reynolds Metals Co. expanded annual capacity of its Sherwin alumina plant to 730,000 tons. Two gasoline plants and one cycling plant having a combined products capacity of 219,500 gallons daily recovered natural-gas liquids. Heldenfels Bros. produced 144,385 tons of crushed limestone from a quarry near Mathis. Building and paving sand and gravel were produced during the year.

Schleicher.—The Hulldale (Penn Reef) oilfield produced 1.1 million barrels of crude. Plant No. 23 of Sinclair Oil & Gas Co. recovered natural-gas liquids. Natural gas was also produced.

Scurry.—Scurry County was the fourth-ranking oil producer. The Kelly-Snyder oilfield produced 18.9 million barrels of crude oil during the year and the Diamond M (Canyon Lime area) 5.9 million barrels. Four gasoline plants with a combined capacity of 816,435 gallons of products daily recovered natural-gas liquids. Southwestern Brick-Tile Co. mined 8,520 tons of shale for manufacturing brick and heavy clay products.

Shackelford.—Shackelford County oilfields produced 1.7 million barrels of crude oil. Natural-gas liquids were recovered at the Graridge No. 1 gasoline plant of Graridge Corp.

Smith.—Crude oil, natural gas, natural-gas liquids, clay, and sand and gravel were produced. General Electric Co. transferred the die-casting equipment from its Bridgeport, Conn., plant to its Tyler, Tex., plant, which manufactures gas valves for furnaces. Crude oil was refined by LaGloria Oil & Gas Co. A $2-million expansion program increased refinery output to 30,000 barrels daily through improvements to the catalytic cracking and gas-concentration units and increased propane recovery to 92 percent. Two gasoline plants and one cycling plant recovered natural-gas liquids. Fire clay and shale were mined from open pits by Tyler Pottery and Reliance Clay Products Co.

Starr.—Natural-gas liquids were recovered at three gasoline plants. Pozzolana, Inc., mined pumicite (volcanic ash) from open pits. Building and paving sand was produced during the year. Shale was mined from open pits by Valley Brick & Tile Co.

Stephens.—Four gasoline plants, with a combined daily capacity of 100,100 gallons of products, recovered natural-gas liquids. Taylor Bros. produced 16,230 tons of building sand and gravel. Contractors quarried and prepared 107,311 tons of limestone for District 23 of the Texas Highway Department.

Sterling.—Mineral activity in Sterling County consisted of crude oil and stone production. District 7 of the Texas Highway Department had 83,200 tons of limestone quarried and prepared for aggregate and roadstone by contractors. Crude oil was produced from 11 oilfields.

Stonewall.—Cities Service Oil Co. acquired the Stonewall gasoline plant and gathering system of Liquigas Co. in April. The Stonewall plant processed 15 million cubic feet of gas daily from 12 small oilfields in the southern part of the county to recover about 75,000 gallons of liquids a day. Liquigas Co. will continue to operate the Stonewall plant under contract. The Katz oilfield produced 1.5 million barrels of crude oil and the Flowers (Canyon Sand) oilfield

produced 1.2 million barrels of crude oil. Hamlin Sand & Gravel Co., Inc., produced 90,489 tons of building and paving sand and gravel.

Sutton.—Mineral activity included production of natural gas, natural-gas liquids, crude oil, and stone. District 7 of the Texas Highway Department had 20,000 tons of limestone quarried and prepared by contractors.

Tarrant.—Tarrant County was the third-ranking sand and gravel producer. The county is part of the industrial complex that includes Dallas County and the metropolitan areas of Fort Worth and Dallas. The economy consists primarily of transportation, metal fabrication, and defense industries and ranks second only to the large Harris County complex centered around Houston. Mineral activity almost entirely concerned materials of construction—cement, stone, and sand and gravel.

Portland and masonry cements were produced at the Fort Worth plant of Trinity Portland Cement Division of General Portland Cement Co. from limestone and clay produced by the company. Dimension limestone was quarried and prepared for dressed building stone by Carruthers Cut Stone Co. The city engineer of Fort Worth had 152,149 tons of paving gravel prepared under contract. Twelve sand and gravel plants operated by 11 companies produced 2.2 million tons of sand and gravel for building and paving purposes. Crude oil was refined at the Premier Oil Refining Co. Fort Worth plant.

Lead and aluminum scrap was smelted to pigs, blocks, and ingots at the Fort Worth secondary smelter of National Metal & Smelting Co. An anhydrous hydrochloric acid plant was built at Fort Worth by Consolidated Chemical Industries, Inc., to supply the oil refining and chemicals industries.

Taylor.—Taylor County oilfields yielded 1.2 million barrels of crude oil. Crude oil was refined at the Abilene refinery of Monarch Refining Co. Wimberly gasoline plant of Texas Natural Gasoline Corp. recovered natural-gas liquids. Shale was mined from open pits by the Abilene Brick Co. Atlas Sand-Gravel Co. and Caton Sand & Gravel Co. prepared building and paving sand and gravel. H. B. Zachary Co. produced 72,025 tons of crushed limestone for aggregate and roadstone.

Terry.—Sodium sulfate was recovered from brines at the Brownfield plant of Ozark-Mahoning Co. Carbon black was recovered from natural gas and distillates at the Seagraves No. 64 furnace plant of Columbian Carbon Co. Natural-gas liquids were recovered at two gasoline plants.

Tom Green.—Mineral activity centered around production of crude oil, natural gas, natural-gas liquids, sand and gravel, and stone. Building and paving sand and gravel were prepared by Montgomery Sand & Gravel Co. Contractors quarried and crushed 135,713 tons of limestone for District 7 of the Texas Highway Department.

Travis.—Marble for terrazzo, whiting, and roofing granules was prepared at the Austin mill of Dezendorf Marble Co. from stone originating in Llano and Burnet Counties. Granite was quarried and prepared for paving block by Texas Crushed Stone Co. High-calcium limestone was quarried and processed for lime manufacture

by Austin White Lime Co. Texas Quarries, Inc., quarried and prepared 40,333 cubic feet of limestone for dressed building stone. District 14 of the Texas Highway Department had 270,433 tons of limestone quarried and prepared by contractors. Grinding pebbles were prepared by the Dezendorf Marble Co. R. E. Janes Gravel Co., Inc., and Capital Aggregates, Inc., prepared building and paving sand and gravel.

Trinity.—The Polk County Highway Department and District 11 of the Texas Highway Department had 166,925 tons of sandstone quarried and crushed for use as aggregate and roadstone. The U.S. Forest Service produced 29,700 tons of paving gravel.

Upton.—Wilshire (Ellenburger) oilfield produced 1.4 million barrels of crude oil; the Spraberry Trend area, extending into Reagan County, produced 7.9 million barrels; McCamey produced 1.9 million barrels; and Pegasus (Ellenburger), extending into Midland County, produced 2.2 million barrels. Crude-oil production totaled 12.4 million barrels, with four fields producing more than 1 million barrels each. Four gasoline plants, with a combined daily capacity of 634,200 gallons of products, recovered natural-gas liquids.

Uvalde.—Three companies produced asphaltic limestone and basalt. The natural asphalt was used for road surfacing and repairing and the basalt for riprap and roadstone. D-D Gravel Co. prepared 33,900 tons of building and paving sand and gravel. A limited quantity of natural gas was reported.

Van Zandt.—Pure Oil Co. recovered natural-gas liquids at its Van gasoline plant. Morton Salt Co. recovered salt in brine from wells and mined salt by underground methods. Crude-oil production totaled approximately 5.9 million barrels. Natural gas was produced.

Victoria.—The mineral economy centered around the mineral-fuels industry, with sand and gravel and stone also produced. Natural gas and butadiene were processed to adiponitrile (nylon-salt basic) at the Victoria petrochemical plant of E. I. du Pont de Nemours & Co. Nearly 4 million barrels of crude oil was produced.

Building and paving sand and gravel were produced by Heldenfels Bros. and Fordyce Gravel Co. Contractors quarried and prepared 38,646 tons of limestone and 77,699 tons of gravel for road construction and maintenance in District 13 of the Texas Highway Department.

Walker.—Milwhite Co., Inc., mined bentonite from open pits for use in preparing heavy drilling mud. Approximately 4,600 barrels of crude oil were produced.

Waller.—Crude-oil production totaled 630,000 barrels. Natural-gas liquids were recovered at the Katy cycling plant of Humble Oil & Refining Co. The U.S. Forest Service and Waller County Road Department prepared 65,650 tons of paving gravel.

Ward.—The mineral industry comprised production of crude oil, natural gas, natural-gas liquids, sand and gravel, salt, and natural sodium sulfate. The Ward South oilfield produced 3.1 million barrels and the Shipley (Queen sand) 1 million barrels. Other fields produced 2.5 million additional barrels of crude oil. Three gasoline plants recovered natural-gas liquids. Crude oil was processed by Wickett Refinery Co.

Ozark-Mahoning Co. prepared salt cake from brine and dry salt beds at its Monahans plant. Building and paving sand and gravel were prepared by Permian Sand & Gravel Co. Salt in brine was recovered through wells by Montex Chemical Co.

Webb.—The mineral industry involved production of mineral fuels, clay, and sand and gravel. Crude-oil production amounted to approximately 1.8 million barrels. Antimony metal and other compounds were recovered from Mexican ores at the Laredo smelter of National Lead Co. E. C. Delachica Clay Co. mined 3,464 tons of shale from pits on the Chavana Ranch. Shale was mined from open pits near Laredo by the Laredo Brick & Tile Co. Building gravel was prepared by Aldape Sand & Gravel Co. The city of Laredo produced 29,025 tons of paving gravel for its road-maintenance program.

Wharton.—Wharton County was the largest Frasch sulfur producer. Sulfur was recovered by the Frasch process at Boling dome of Texas Gulf Sulphur Co. Natural-gas liquids were recovered by Tidewater Associated Oil Co. Crude-oil production totaled 5.2 million barrels. Paving sand was prepared for Wharton County Highway Department and District 13 of the Texas Highway Department.

Wheeler.—The mineral industry centered on mineral-fuels production. Panhandle Wheeler County field produced 1.4 million barrels of crude oil. Crude-oil production in the county amounted to approximately 1.7 million barrels. United Carbon Co., Inc., recovered carbon black from natural gas and distillates at its Norrick furnace plant.

Wichita.—Wichita County oilfield produced 6 million barrels of crude oil and KMA oilfield, 3.8 million barrels. Crude oil was refined in Wichita Falls by Continental Oil Co. and American Petrofina Co. of Texas refinery. Three gasoline plants recovered natural-gas liquids. Gravel, Inc., and Northwest Materials Co. prepared 93,825 tons of building and paving sand and gravel. District 3 of the Texas Highway Department had 59,400 tons of sandstone quarried and prepared for aggregate and roadstone by contractors.

Wilbarger.—Wilbarger County oilfields produced 3.7 million barrels of crude oil. Magnolia Petroleum Co. recovered natural-gas liquids at its Electra gasoline plant. Contractors quarried and prepared 41,800 tons of sandstone for District 3 of the Texas Highway Department.

Williamson.—Crude-oil production totaled more than 37,000 barrels. Round Rock White Lime Co. and Whitestone Lime Co. quarried and prepared high calcium limestone to manufacture quick and hydrated lime for building plaster, chemical, and industrial uses. Round Rock White Lime Co. tripled its plant capacity with installation of two rotary kilns and auxiliary equipment. Texas Quarries, Inc., quarried and prepared 194,965 cubic feet of rough building stone and 257,898 cubic feet of dressed building limestone. Dimension limestone for rough construction was also quarried and prepared by Leander Limestone Corp., and crushed limestone was quarried and prepared by Superior Stone Products, Inc., and by Texas Carbonate Co.

Winkler.—Crude-oil production amounted to about 33.7 million barrels. Five gasoline plants recovered natural-gas liquids. The Mona-

hans gasoline plant of Pan American Petroleum Corp., designed to process 4 million cubic feet of casinghead gas daily, was completed late in 1958. The capacity of the plant could be readily increased to 12 million cubic feet a day. Carbon black was recovered from natural gas at the Kermit furnace plant of Cabot Carbon Co. Sulfur was recovered at the Keystone plant of Sid Richardson Gasoline Co.

Wise.—The mineral industry involved production of crude oil, natural gas, natural-gas liquids, clay and stone. Crude-oil production amounted to 3.3 million barrels. Natural-gas liquids were recovered at three gasoline plants. Shale was mined from open pits by Acme Brick Co. Bridgeport Stone Co., Gifford-Hill Co., Inc., Southwest Stone Co., and Wesco Stone Co. quarried and crushed 3.3 million tons of limestone. Contractors produced 96,000 tons of crushed limestone for District 2 of the Texas Highway Department.

Yoakum.—Mineral-industry activity centered in the crude-oil and natural-gas liquids; significant quantities of salt were also produced Prentice oilfield produced 2 million barrels of crude oil and Prentice (6,700′) oilfield 2.3 million barrels. Natural-gas liquids were recovered at the Wasson gasoline plant of Shell Oil Co. and the Prentice plant of Honolulu Oil Corp. Frontier Chemical Co. recovered salt from wells for use in the chemical industry.

Young.—Young County oilfields produced 2.6 million barrels of crude oil. Natural-gas liquids were recovered at three gasoline plants. Contractors prepared 66,313 tons of paving gravel and quarried and prepared 10,644 tons of sandstone for District 3 of the Texas Highway Department.

Zapata.—Crude oil produced along with natural gas totaled 655,000 barrels. District 21 of the Texas Highway Department contracted for 7,879 tons of paving gravel.

Zavala.—Production of mineral fuels comprised the entire mineral industry activity. Approximately 66,000 barrels of crude oil was produced during the year. Natural-gas liquids were recovered at a gasoline plant outside of Zavala County.

The Mineral Industry of Utah

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Utah Geological and Mineralogical Survey.

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UTAH mineral industry in 1958 was distinguished by a decline in metal mining, offset by a sharp rise in mineral-fuels production and a significant gain in the nonmetals activity. The value of the metals-group output declined $52.8 million, whereas increases of $54 million and $5.4 million were recorded for the mineral-fuels and nonmetal groups, respectively. As a result, the total value of mineral production showed a net increase of $6.7 million (from $359.3 million in 1957 to $366 million in 1958).

The metal-mining industry throughout 1958 felt the effects of continued low prices for copper, lead, and zinc, which were caused principally by surplus stocks at the beginning of the year and by slackened demand during the first half of the year. By yearend, prices for copper and zinc had risen slightly above those at the start of the year; and lead, following a drop, had risen to the year's beginning price. However, the year's weighted average price for these metals for 1958 was far below those in 1957 and 1956. Metals supplied 58 percent of the State's total value of mineral production; copper furnished 27 percent, uranium ore 11 percent, and iron ore 7 percent. The value of output of each of the metals declined in 1958 except for uranium ore ($6.1 million increase) and manganese ore and concentrate ($72,000 increase). Copper alone dropped $43.7 million in value of output for a 31-percent decline, compared with 1957; gold fell $2.5 million, lead $3.3 million, and iron ore $5.2 million in value of production.

The significant rise in value of the mineral-fuels-group production resulted from a $63-million increase in the value of petroleum (crude) output brought about by completion of pipelines from a new field to markets, thus providing an outlet. The mineral-fuels group supplied 30 percent of Utah's total value of mineral production in 1958; petroleum furnished 20 and coal 8 percent. The value of coal production dropped $10 million because of a reduction in steel output early in the year and a decline in the demand for Utah coal for export.

Most of the overall increase in value of output for the nonmetals group came from the $5.4-million advance in the value of stone production, which resulted primarily from the quarrying of a substan-

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tial quantity of quartzite and limestone for use in construction of the Great Salt Lake railroad causeway. A $1.1 million decrease in value of sand and gravel output was offset by increases in lime, salt, and cement.

TABLE 1.—Mineral production in Utah [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Asphalt and related bitumens, native:				
Gilsonite	207,704	$4,259	317,280	$4,864
Clays [2] thousand short tons	164	473	157	488
Coal do	6,858	40,263	5,328	30,340
Copper (recoverable content of ores, etc.)	237,857	143,190	189,184	99,511
Fluorspar	11,087	387	16,109	564
Gem stones	(3)	12	(3)	40
Gold (recoverable content of ores, etc.) troy ounces	378,438	13,245	307,824	10,774
Iron ore (usable) thousand long tons, gross weight	4,156	30,383	3,514	25,202
Lead (recoverable content of ores, etc.)	44,471	12,719	40,355	9,443
Lime thousand short tons	53	821	80	1,513
Manganese ore and concentrate [4] (35 percent or more Mn) gross weight	142	12	1,043	84
Mica (sheet) pounds			12	(5)
Natural gas million cubic feet	16,824	2,473	19,247	2,829
Natural gasoline thousand gallons	(6)	(6)	240	15
Petroleum (crude) thousand 42-gallon barrels	4,367	9,913	[7] 24,386	[7] 72,914
Phosphate rock thousand long tons	114	756	(6)	(6)
Pumice thousand short tons	36	148	41	84
Salt (common) do	221	2,013	184	2,275
Sand and gravel do	26,958	15,485	25,304	14,379
Silver (recoverable content of ores, etc.) thousand troy ounces	6,199	5,610	5,278	4,777
Stone thousand short tons	7,854	8,540	13,126	13,949
Uranium ore	1,075,759	32,501	1,239,767	38,583
Vanadium thousand pounds	1,017	(6)	752	(6)
Zinc (recoverable content of ores, etc.)	40,846	9,476	[44,982	9,176
Value of items that cannot be disclosed: Carbon dioxide, cement, clay (halloysite), gypsum, molybdenum, perlite, potassium salts, and values indicated by footnote 6		27,651		25,219
Total Utah [9]		[8] 359,335		365,960

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes halloysite; value included with "Items that cannot be disclosed."
[3] Weight not recorded.
[4] Excludes shipments to Government purchase depot under the "low-grade program; quantity and value for this manganese and concentrate (which includes material of 5 to 35 percent Mn content) are as follows: 1957—1,501 short tons, $50,311; 1958—1,211 short tons, $49,357.
[5] Less than $1,000.
[6] Figure withheld to avoid disclosing company confidential data; value included with "Items that cannot be disclosed."
[7] Preliminary figure.
[8] Revised figure.
[9] Total has been adjusted to eliminate duplicating the value of raw material used in manufacturing cement and lime.

Items of particular interest concerning the mineral industry included the announcement that Kennecott Copper Corp. had completed negotiations for the purchase of the Garfield copper smelter from American Smelting and Refining Co. This gives the firm a completely integrated mine to market (mine-mill-smelter-refinery) operation. The United States Smelting Refining and Mining Co. closed its Midvale lead smelter, started dismantling it, and made arrangements to have its concentrate from the Midvale mill smelted at Tooele on a toll basis. International Smelting and Refining Co.

reopened its lead smelter and closed its Tooele concentrator, making arrangements to have its ore treated on a toll basis at Midvale mill. A plant at Green River for upgrading uranium ore was completed by Union Carbide Nuclear Co. and placed in operation in March. Portland Cement Co. received permission to double the capacity of its Salt Lake City cement plant. Utah Marblehead Lime Co.'s new dead-burned dolomite plant at Delle began production in June.

Employment and Injuries.—The annual average employment in the mining industry declined 9 percent and that of metal mining alone 16 percent, whereas total nonagricultural employment dropped only 1 percent. Monthly average employment in mining was 14,700 in January, dropped to a low of 13,400 in July, rose to 15,600 in November, then fell back to 14,500 in December. The metal-mining monthly average alone had a similar pattern, with 8,700 in January, 7,600 in August, 9,200 in November, and 9,000 in December. These data were based on figures compiled by the United States Department of Labor, Bureau of Labor Statistics, and the Industrial Commission of Utah, Department of Employment Security.

Legislation and Government Programs.—One Defense Minerals Exploration Administration (DMEA) contract was executed for exploration for lead-zinc-copper for a total amount of $564,880 (50-percent Government participation) and 3 for uranium for a total of $104,510 (2 for 50-percent and 1 for 75-percent Government participation). The lead-zinc-copper contract was for work at the Mayflower mine in Wasatch County. The three uranium contracts were for projects on the Uncle Ben and Pascal, Jean, and Fire Fly groups of claims, all in San Juan County. DMEA expired June 30 and was superseded later in the year by the Office of Mineral Exploration (OME).

TABLE 2.—Employment data in mining and other industries related to mining

[United States Department of Labor, Bureau of Labor Statistics and the Industrial Commission of Utah, Department of Employment Security]

Industry	Annual average employment		Percent of total nonagricultural		Average hourly earnings [1]		Average weekly hours [1]		Average weekly earnings [1]	
	1957	1958	1957	1958	1957	1958	1957	1958	1957	1958
Mining	15,800	14,300	6.6	6.0	$2.51	$2.61	39.6	39.1	$99.40	$102.50
Metal mining	9,900	8,300	4.1	3.5	2.34	2.45	40.6	41.3	95.00	101.18
Bituminous coal mining	(2)	3,000	(2)	1.3	3.08	3.08	34.8	32.1	107.18	98.87
Manufacturing [3]	36,500	36,100	15.3	15.3	2.22	2.29	39.8	39.4	88.36	90.23
Contract construction [4]	15,400	15,000	6.5	6.4	2.84	2.95	39.6	41.0	112.46	120.95
Total nonagricultural	238,800	236,500	100.0	100.0	(2)	(2)	(2)	(2)	(2)	(2)

[1] Production workers; excludes administrative and nonworking supervisory personnel.
[2] Data not available.
[3] Includes smelting and refining ferrous and nonferrous metals from ore and concentrate, which was part of the mineral industry.
[4] Includes some employees who mined, quarried, and removed overburden, where work was done by contractors conducting other types of construction work other than mining, where separate records were not kept for work in connection with the mineral industry.

REVIEW BY MINERAL COMMODITIES

METALS

Cobalt.—Calera Mining Co., subsidiary of Howe Sound Co., operated the cobalt refinery at Garfield throughout the year on concentrate from its Blackbird mining and milling operation at Cobalt, Idaho. A merger of Howe Sound Co. and Haile Mines, Inc., was effected on July 1, and company headquarters was transferred to New York. Research facilities remained in Salt Lake City.

Copper.—Copper production decreased 20 percent in quantity and 31 percent in value compared with 1957. The State was second only to Arizona in copper output, and production was double that of the third-ranking copper-producing State, Montana. The value of copper output accounted for 27 percent ($99.5 million) of the total value of mineral production ($363.1 million) compared with 40 percent in 1957.

The marked decline of $43.7 million in value of copper output resulted not only from the 49,000-ton decrease in copper production but also from the lower price for copper throughout the year. The Engineering and Mining Journal (E&MJ) price quotation for domestic refinery copper was 26.33 cents per pound average for the week of January 8, dropped to a low for the year 23.63 cents for the week of March 19, then rose gradually throughout the remainder of the year to 28.60 cents for the week of December 31. The weighted average price for copper was 26.30 cents for 1958 compared with 30.10 for 1957 and 42.50 cents for 1956.

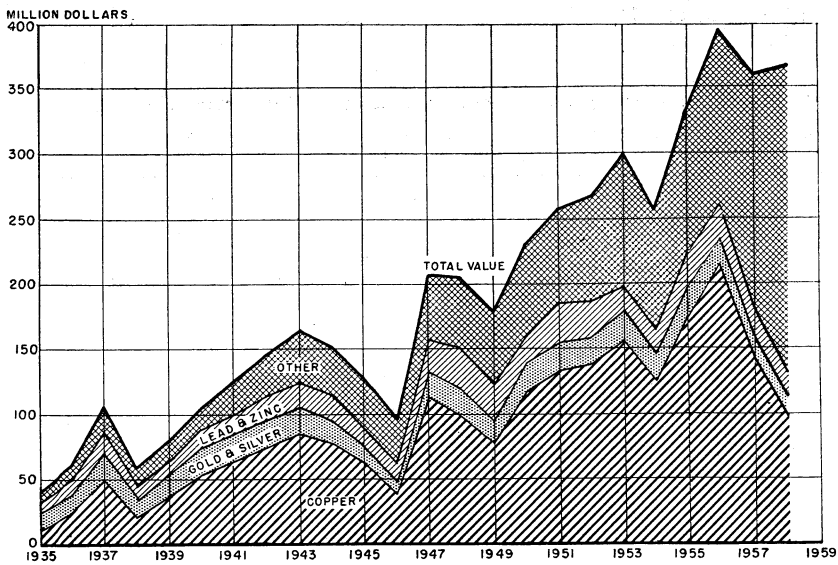

FIGURE 1.—Value of gold, silver, copper, lead, and zinc, and total value of all minerals in Utah, 1935–58.

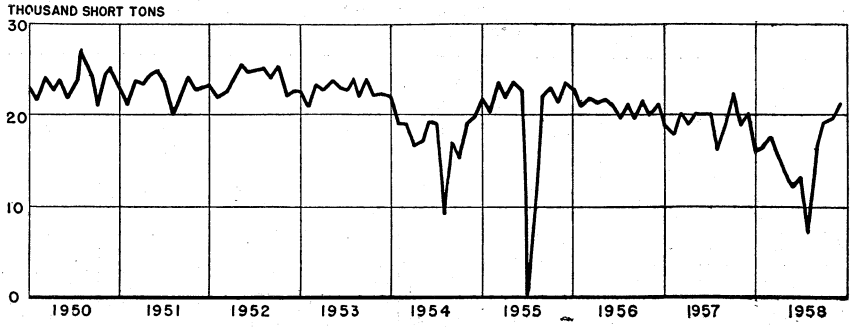

FIGURE 2.—Mine production of copper in Utah, 1950–58, by months, in terms of recoverable metals.

TABLE 3.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1949–53 (average)	75	1	29,753	424,552	$14,859	7,008	$6,343
1954	54	----------	24,847	403,401	14,119	6,179	5,592
1955	63	----------	28,599	441,206	15,442	6,251	5,657
1956	91	----------	33,232	416,031	14,561	6,572	5,948
1957	76	1	31,722	378,438	13,245	6,198	5,610
1958	61	2	24,871	307,824	10,774	5,278	4,777
1864–1958	----------	----------	[3] 917,762	15,502,724	442,821	800,515	597,705

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1949–53 (average)	259,870	$123,288	48,002	$14,671	33,759	$9,845	$169,006
1954	211,835	124,983	44,972	12,322	34,031	7,351	164,367
1955	232,949	173,780	50,452	15,035	43,556	10,715	220,629
1956	250,604	213,013	49,555	15,560	42,374	11,611	260,693
1957	237,857	143,190	44,471	12,719	40,846	9,476	184,240
1958	189,184	99,511	40,355	9,443	44,982	9,176	133,681
1864–1958	7,815,761	2,953,774	4,994,501	662,036	1,442,759	257,130	4,913,466

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings, or slimes retreated; and ore, old tailings, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Figures estimated for certain years before 1901.

TABLE 4.—Mine production of gold, silver, copper, lead and zinc, in 1958, by counties, in terms of recoverable metals

County	Mines producing [1]	Lode material sold or treated [2] (short tons)	Gold		Silver	
			Troy ounces	Value	Troy ounces	Value
Beaver	3	719	7	$245	1,164	$1,053
Box Elder	1	3			26	24
Davis	1	1			3	3
Emery	(3)	(3)	(3)	(3)	(3)	(3)
Garfield	[4] 2		4	140		
Juab	8	15,008	723	25,305	92,846	84,030
Morgan	1	8			15	14
Piute	4	460	92	3,220	6,800	6,154
Salt Lake	6	24,593,246	298,421	10,444,735	3,889,716	3,520,389
San Juan	[3] 3	[3] 3,862	[3] 9	[3] 315	[3] 4,935	[3] 4,466
Summit	9	150,867	2,328	81,480	831,594	752,635
Tooele	12	24,140	403	14,105	159,342	144,213
Uintah	2	22			36	33
Utah	7	9,422	395	13,825	50,441	45,652
Wasatch	1	51,249	5,420	189,700	184,630	167,099
Washington	3	22,348	22	770	56,145	50,814
Total: 1958	63	24,871,355	307,824	10,773,840	5,277,693	4,776,579
1957	77	31,721,990	378,438	13,245,330	6,198,464	5,609,923

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Beaver	6	$3,235	11	$2,656	2	$408	$7,597
Box Elder			1	176	(5)	41	241
Davis			(5)	35			38
Emery	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Garfield							140
Juab	28	14,807	397	92,804	19	3,815	220,761
Morgan			3	702			716
Piute	8	4,077	7	1,708			15,159
Salt Lake	188,158	98,970,976	28,878	6,757,394	32,429	6,615,526	126,309,020
San Juan	[3] 443	[3] 233,360	[3] 1	[3] 292			[3] 238,433
Summit	208	109,461	5,633	1,318,075	7,404	1,510,314	3,771,965
Tooele	118	61,542	1,771	414,391	957	195,157	829,408
Uintah	1	657	1	316	(5)	71	1,077
Utah	10	5,181	180	42,120	25	5,161	111,939
Wasatch	177	93,233	3,472	812,343	4,146	845,835	2,108,210
Washington	27	14,255	(5)	58			65,897
Total: 1958	189,184	99,510,784	40,355	9,443,070	44,982	9,176,328	133,680,601
1957	237,857	143,189,914	44,471	12,718,706	40,846	9,476,272	184,240,145

[1] Lode mines except for 2 placer mines in Garfield County. Operations at slag dumps and old mill or miscellaneous cleanups not counted as producing mines; various uranium mines from which copper was recovered as a byproduct not included as are in the mine count of uranium.
[2] Excludes tonnage of copper precipitates shipped.
[3] Emery and San Juan Counties combined to avoid disclosure of individual company confidential data.
[4] Placer mines only.
[5] Less than 1 ton.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, in 1958, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold-silver	13	12,797	861	66,348	45,900	332,200	3,400
Dry silver	10	50,251	974	262,155	134,500	761,200	----------
Total	23	63,048	1,835	328,503	180,400	1,093,400	3,400
Copper and uranium ore [2]	[3] 8	[4] 24,091,415	280,329	2,148,704	362,256,800	3,000	----------
Lead	24	13,318	686	117,664	68,000	2,631,300	415,600
Lead-zinc	15	497,652	18,704	2,359,142	3,428,000	73,741,400	75,931,600
Zinc	1	80	3	83	----------	6,300	34,000
Total	45	24,602,465	299,722	4,625,593	365,752,800	76,382,000	76,381,200
Other "lode" material:							
Silver and iron (pyrite) tailings [2]	6	107,901	6,242	312,190	413,100	1,506,500	6,100
Copper precipitates	3	7,613	----------	----------	11,974,700	----------	----------
Lead cleanings	([5])	56	11	708	200	9,800	----------
Lead and zinc slag [2]	([5])	97,885	10	10,699	46,800	1,718,300	13,573,300
Total	9	213,455	6,263	323,597	12,434,800	3,234,600	13,579,400
Total "lode" material	61	24,878,968	307,820	5,277,693	378,368,000	80,710,000	89,964,000
Gravel (placer operations)	2	----------	4	----------	----------	----------	----------
Grand total	63	24,878,968	307,824	5,277,693	378,368,000	80,710,000	89,964,000

[1] Detail will not necessarily add to totals because some mines produce more than 1 class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Copper mines only; excludes the mine count of uranium mines from which copper was recovered as a byproduct.
[4] Excludes uranium-ore tonnage.
[5] From properties not classed as mines.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, in 1958, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Concentration, and smelting of concentrates:					
Ore [1]	299,149	4,582,723	365,549,500	75,257,700	76,113,500
Old tailings	17	37,198	12,200	----------	----------
Total	299,166	4,619,921	365,561,700	75,257,700	76,113,500
Direct-smelting:					
Ore	2,408	371,373	383,700	2,217,700	271,100
Cleanings	11	708	200	9,800	----------
Copper precipitates	----------	----------	11,974,700	----------	----------
Old slag	10	10,699	46,800	1,718,300	13,573,300
Old tailings	6,225	274,992	400,900	1,506,500	6,100
Total	8,654	657,772	12,806,300	5,452,300	13,850,500
Placer	4	----------	----------	----------	----------
Grand total	307,824	5,277,693	378,368,000	80,710,000	89,964,000

[1] Includes uranium-ore concentrate.

Most of the decline in copper production resulted from curtailment of output from the leading producer, Utah Copper Division (Salt Lake County) operation of the Kennecott Copper Corp. In its annual report for 1958, Kennecott stated that copper production from all sources at this division dropped to 186,631 tons compared with 235,135 in 1957. This curtailment was imposed during the first half of the year because of the lower domestic demand for copper.

The U. S. and Lark mine of the United States Smelting Refining and Mining Co., second-ranking copper producer, was operated continuously. Copper was recovered from copper, lead-zinc, zinc, and iron (pyrite) concentrates produced from lead-zinc ore mined and milled by the company at its Salt Lake County operation. In addition, copper was recovered from ore (classed as silver and lead ores) and copper precipitate shipped directly to smelters from this operation. A substantial quantity of copper was recovered as a byproduct of lead-zinc ore produced from the Mayflower mine in Wasatch County.

Gold.—Gold output dropped 19 percent ($2.5 million) compared with 1957 and reflected directly the decline in copper production because gold was recovered primarily as a byproduct of copper recovery. Utah Copper, U. S. and Lark, and Mayflower mines were among the State's leading gold producers. Substantial quantities of gold were recovered by the United States Smelting Refining and Mining Co. from Midvale mill tailings high in iron (pyrite) shipped directly to the smelter, and from lead-zinc ore from the United Park City mines.

Iron Ore.—Production (shipments) of iron ore was 15 percent below that of 1957. This resulted from a decline in the demand for pig iron and steel. The output of iron ore came from eight mines in Iron County and one mine in Juab County.

In Iron County, Columbia Iron Mining Co. (subsidiary of United States Steel Corp.) shipped ore from the Desert Mound and Iron Mountain mines to the Columbia-Geneva Steel Division, United States Steel Corp., blast and open-hearth furnaces at Geneva and Ironton. It was the State's largest iron-ore producer. A $9 million section of the United States Steel Corp. Columbia-Geneva Steel Division plant designed to remove fluorine from the blast furnace and open-hearth-furnace stack gases was completed and placed in operation in January. This plant was installed because approximately 900 claims totaling $4.5 million have been made against the company for livestock and crop damage attributed to the fluorine in the gases.

The Colorado Fuel and Iron Corp. shipped iron ore (magnetite)—mined under contract by Utah Construction Co. from the Blowout, Comstock, and Duncan mines—to its plant at Pueblo, Colo., for making pig iron and steel. The Utah Construction Co. shipped iron ore (hematite) from the Excelsior mine to consumers in Utah and California. Helene E. Beatty shipped iron ore (float-material) from the Big Chance Placer No. 1 and Monta Rose claims.

Lynn Mining Co. shipped iron ore (brown ore) from the Iron Blossom mine in Juab County for use in the production of dead-burned dolomite.

TABLE 7.—Shipments of usable iron ore

Year	Thousand long tons	Value (thousands)	Year	Thousand long tons	Value (thousands)
1949–53 (average)	3,811	$12,363	1957	4,156	$30,383
1954	3,041	19,277	1958	3,514	25,202
1955	3,847	24,687			
1956	4,002	27,508	1906–58	54,322	212,934

Lead.—Compared with 1957, the quantity of lead (recoverable content of ore) produced decreased 9 percent, but the value of output declined 26 percent because of the lower weighted annual average price for lead. The E&MJ quoted price for lead was 13 cents a pound at the beginning of the year, dropped to a low of 10.75 cents in August, then rose to 13 cents in October, where it remained for the rest of the year. The weighted annual average price for lead was 11.7 cents a pound for 1958 compared with 14.3 cents for 1957 and 15.7 cents for 1956.

The U. S. and Lark mine at Bingham, operated by the United States Smelting Refining and Mining Co., was again by far the leading lead (and zinc) producer. It was followed by United Park City and Mayflower mines. These three operations supplied 89 percent of the State's total lead output. Other major producers of lead included the Ophir unit, owned by United States Smelting Refining and Mining Co. and operated by McFarland & Hullinger, lessee, and Calumet mine owned by Combined Metals Reduction Co. and operated by Calumet lease. A substantial quantity of lead was recovered from slag-dump material shipped to a smelter by United States Smelting Refining and Mining Co.

Bear Creek Mining Co., a domestic exploration subsidiary of Kennecott Copper Corp., continued its lead-zinc-copper-gold-silver exploration project begun in 1956 on 10,000 acres of claims in the East Tintic district. A 2½-compartment shaft 1,080 feet deep was completed, and a 2,000-foot crosscut to the west was in progress. Extensive drilling has been done both from the surface and underground.

Manganese and Manganiferous Ore and Concentrate.—The recorded production (shipments) of manganese ore and concentrate (35 percent or more manganese) came from six mines in Grand County and one mine in Juab County. It was shipped to the Government under the "carlot" program administered by the General Services Administration (GSA). The ore and concentrate had an average manganese content of 41.4 percent and an average value of $80.82 a short wet tons. The mine (Smitty No. 1 and 2 claims) in Grand County, operated by Lloyd W. Smith, was by far the major producer.

In addition, a total of 1,082 long dry tons containing an average manganese content of 30.9 percent with a total value of $50,000 was shipped from two mines in Juab County and one mine in Weber County to the GSA purchase depot, Butte, Mont., under the low-grade, manganese-ore-purchasing program. This ore will be credited as production in the year it is shipped from the depot, either as a useful product or to a beneficiation plant for processing.

Molybdenum.—The Utah Copper mine of the Utah Copper Division, Kennecott Copper Corp., continued to be the only producer of molybdenum in Utah. Molybdenum production declined commensurate with the drop in copper output because it was recovered as a byproduct of copper mining. Molybdenum concentrate was recovered by flotation as a byproduct of copper concentrate produced from Utah Copper ore at the Arthur and Magna mills.

Silver.—Silver production declined 15 percent compared with 1957. Eighty-eight percent of the silver output was recovered from ores classed as copper, lead, lead-zinc, and zinc ores, 6 percent from ores of gold and silver, and 6 percent from cleanup material, old slag, and old tailings. The five leading silver producers in order of output—Utah Copper, U. S. and Lark, United Park City, Midvale tailings dump, and Mayflower mines—supplied 89 percent of silver output.

Tungsten.—There was no recorded production of tungsten ore, treatment of ore, or shipment of ore or concentrate from Utah. On January 15 Salt Lake Tungsten Co. closed its Salt Lake City refinery for producing high-quality paratungstate. This firm was a joint affiliate of Minerals Engineering Co. and Sylvania Electric Products Co. Minerals Engineering closed its Calvert Creek mine and mill at Glen, Mont., the source of concentrate for this refinery.

Uranium.—Production of uranium ore was 15 percent greater than in 1957. The grade of ore mined was 0.36 percent uranium oxide compared with 0.35 percent in 1957. Four processing mills with a total daily milling capacity of 3,450 tons operated the entire year. Improvements in processing were completed at plants at Moab and Salt Lake City. An upgrading plant at Green River was completed, and operation began in March; the plant was designed to process 400 tons of crude ore daily.

Reserve of uranium ore estimated by the Atomic Energy Commission (AEC), as of December 31, 1958, was 5.6 million tons averaging 0.35 percent uranium oxide; this compares with a similar

TABLE 8.—Mine production of uranium ore [1]

County	1957				1958			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]
Beaver	5	4,047	17,520	$71,386	4	2,340	7,753	$26,200
Emery	55	81,625	411,893	1,688,389	67	66,941	322,604	1,319,391
Garfield	55	4,401	44,221	198,687	42	1,606	19,169	87,527
Grand	60	32,101	159,017	650,097	61	35,138	214,641	909,321
Iron					1	(3)	(3)	(3)
Juab	2	(3)	(3)	(3)	1	(3)	(3)	(3)
Piute	6	(3)	(3)	(3)	4	(3)	(3)	(3)
San Juan	184	913,705	6,721,327	[4] 29,289,663	196	1,109,448	8,239,554	35,801,208
Sevier					1	(3)	(3)	(3)
Uintah	2	(3)	(3)	(3)				
Washington	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Wayne	7	471	2,673	11,266	14	528	3,056	12,620
Undistributed		39,409	153,957	591,852		23,766	107,095	426,415
Total	377	1,075,759	7,510,608	[4] 32,501,340	392	1,239,767	8,913,872	38,582,682

[1] Based on data supplied to the Bureau of Mines by AEC.
[2] F.o.b. mine value, base price, grade premiums, and exploration allowance.
[3] Figure withheld to avoid disclosure of individual company confidential data; included with "Undistributed."
[4] Revised figure.

estimate, as of December 31, 1957, of 5.7 million tons averaging 0.37 percent uranium oxide. In April the AEC completed a study (begun in October 1957) of the adequacy of uranium-ore-milling facilities in selected producing areas. The study indicated that facilities in Utah were adequate to process the known ore reserve as of November 1, 1957, by the end of 1965, provided milling capacity was properly distributed to the various producers.

On May 24, 1956, AEC had announced it would guarantee the purchase of uranium oxide in concentrates from domestic ores produced and delivered during the period April 1, 1962, through December 31, 1966, at the previously established price of $8 a pound of uranium oxide in acceptable concentrate. On November 24, 1958, this program was modified to the extent that the previously announced guarantee would be limited to concentrate recovered from ores developed prior to November 24, 1958. The Commission could, however, make contracts to purchase concentrate recovered from ores developed after November 24, 1958, to the extent that conditions dictate and on such terms, conditions, and prices as it determines to be equitable both to the producer and the Government. The purpose of the revision was to prevent overproduction and to assure an adequate supply of uranium for military and domestic uses.

Reports of investigations of uranium deposits by the Atomic Energy Commission, the Federal Geological Survey, and Federal Bureau of Mines were published.[2]

Vanadium.—Vanadium was recovered from uranium ores containing enough of the metal to warrant recovery and processed at mills in southwestern Colorado. Utah mills were not equipped to recover vanadium. The quantity recovered was 26 percent below that in 1957.

Zinc.—Zinc output increased 10 percent in quantity but declined 3 percent in value compared with 1957. This reduction in value resulted from a lower weighted annual average price for zinc for the year. The price for 1958 was 10.2 cents a pound compared with 11.6 cents for 1957 and 13.7 cents for 1956. In 1958 the E&MJ quoted price remained at 10 cents a pound from the beginning of the year until the week of October 8, when it advanced slightly to 10.47 cents. By the middle of November the price had risen to 11.5 cents, where it remained for the remainder of the year.

Five operations (U. S. and Lark, United Park City, Midvale slag dump, Mayflower, and Ophir unit), in that order, were the major zinc producers. The combined output from these operations composed 99 percent of production.

MINERAL FUELS

Asphalt and Related Bitumens.—Gilsonite (uintahite) production by four operators increased 53 percent compared with 1957. American Gilsonite Co., the major producer, transported its gilsonite by pipeline to its plant near Fruita, Colo., where the mineral was converted

[2] Gilbert, Ray E., Notes on Geophysical Work at Marysvale, Utah: U.S. Atomic Energy Commission, Tech. Inf. Service, Salt Lake Branch of the Grand Junction Operations Office, RME–2050, May 1958, 24 pp.
Hunt, Charles B., Structural and Igneous Geology of the La Sal Mountains, Utah: Geol. Survey Prof. Paper 294I, 1958, pp. 305-364.
Trites, Jr., Albert F., and Hadd, George A., Geology of the Jomac Mine, White Canyon Area, San Juan County, Utah: Geol. Survey Bull. 1046H, 1958, pp. 165–181.

TABLE 9.—Production of coal, by counties (exclusive of mines producing less than 1,000 tons annually)

County	1957		1958	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Carbon	5,341,221	$6.17	3,956,396	$6.09
Emery	1,407,828	4.82	1,266,423	4.50
Garfield	1,213	4.71	1,034	5.20
Iron	39,612	4.65	34,714	5.24
Kane	1,228	4.71	1,291	5.20
Sevier	48,500	5.40	50,103	5.61
Summit	18,695	4.44	17,555	4.47
Total	6,858,297	5.87	5,327,516	5.70

[1] 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 as estimated by producer at average prices that might have been received if such coal had been sold commercially).

into gasoline and metallurgical coke. The company also developed a road-surfacing material with excellent wearing characteristics that can be applied at temperatures below 35°F. Gilsonite also was used as a base in the paint manufacture.

Carbon Dioxide.—Carbon dioxide output in Carbon County by Carbon Dioxide & Chemical Co. declined 28 percent from 1957. The gas was transported by pipeline to a plant at Wellington, where it was converted into dry ice.

Coal.—Coal production from 46 underground mines, producing 1,000 tons or more, in 7 counties was 22 percent less than in 1957. A reduction in steel production early in the year and a drop in the quantity of coal shipped to Asia explained much of the decline. Six cleaning plants were operated during the year; 74 percent of the total production was cleaned, and 28 percent was oil-treated to prevent dusting. Captive coal used in manufacturing coke for steel plants in Utah and California compose 46 percent of the total production.

Federal Bureau of Mines data collected from all operating mines in the State show that 2,659 employees worked 538,228 man-shifts with 5 fatal accidents and 183 lost-time injuries in 1958, compared with 2,967 employees, 662,578 man-shifts with 18 fatal accidents, and 211 lost-time injuries in 1957.

Natural Gas.—Natural gas from eight fields in seven counties and residual gas from a natural-gasoline plant in Daggett County was marketed through pipelines to consumers in Utah and California. The quantity marketed was 26 percent above that in 1957. Four successful exploratory wells were completed—one in Emery County, one in San Juan County and two in Uinta County. Thirteen successful development wells were completed. Connections to oil wells in the Paradox basin in San Juan County were completed in November by El Paso Natural Gas Co. The gas was processed at the company plant, Farmington, N. Mex., and the residual gas marketed to consumers through pipelines.

Natural Gasoline.—Natural gas from the Clay Basin field was processed by Mountain Fuel Supply Co. at its plant in Daggett County to recover natural gasoline and distillate.

Petroleum.—Petroleum production increased sixfold in quantity and sevenfold in value compared with 1957. The major change in output was in San Juan County, which increased from 1.6 million barrels in 1957 to nearly 21 million in 1958. Production in Uintah County also increased from 2.7 to 3.7 million barrels. Output was reported from 27 fields in 5 counties. Completion of the Four Corners pipeline to Los Angeles, Calif., late in 1957 and the Texas-New Mexico pipeline to Jal, N. Mex., in May provided the necessary outlets for crude oil from the San Juan basin. Exploratory drilling was definitely disappointing, with 1 oil and 4 gas discoveries from 84 completions; a success ratio of 5.9 percent. Development drilling, however, was highly successful, with 254 oil wells and 13 gas wells from 299 completions, a success ratio of 89.3 percent. The major portion of the development drilling was in the Aneth, McElmo Creek, White Mesa, and Ratherford fields in San Juan County. Other successful development was in the Red Wash field in Uintah County.

The four refineries at Salt Lake City and one at Jensen were operated at a lower rate than in 1957. Throughput declined from 31.3 million barrels in 1957 to 29.7 million in 1958. Capacity, however, increased from 86,500 to 94,000 barrels a day.

TABLE 10.—Production of crude petroleum, by counties [1]

(Thousand barrels)

County	1957	1958 (preliminary)	Principal fields in 1958 in order of production
Daggett	2		
Duchesne	6	1	Duchesne, Flat Mesa.
Grand	18	11	Big Flat, Seiber Nose.
San Juan	1,625	20,717	Aneth, Ratherford, McElmo Creek, White Mesa, Ismay.
Uintah	2,713	3,656	Red Wash, Ashley Valley, Roosevelt, Brennan Bottom.
Washington	3	1	Virgin.
Total	4,367	24,386	

[1] Distribution by counties effected by use of Utah Oil & Gas Conservation Commission data, adjusted to Bureau of Mines total.

TABLE 11.—Wildcat- and development-well completions in 1958, by counties

[Oil and Gas Journal]

County	Crude	Condensate	Gas	Dry	Service	Total	Footage
WILDCAT							
Box Elder				1		1	2,300
Carbon				2		2	23,600
Duchesne				1		1	8,600
Emery			1	10		11	46,900
Garfield				3		3	16,000
Grand				6		6	42,800
San Juan	1		1	45		47	257,500
Sanpete				1		1	10,000
Uintah		1	2	5		8	39,400
Wayne				4		4	23,000
Total	1	1	4	78		84	470,100
DEVELOPMENT							
Emery			1			1	5,100
Grand	1		5	4		10	28,100
San Juan	229		2	24	1	256	1,471,500
Uintah	24		5	2		31	172,500
Washington				1		1	4,500
Total	254		13	31	1	299	1,681,700
Total all drilling	255	1	17	109	1	383	2,151,800

NONMETALS

Cement.—Sales of types I, II, III, IV, waterproof-portland, and masonry cements were 5 percent greater than in 1957. The four kilns operated by Ideal Cement Co. and Portland Cement Co. of Utah were engaged for 327 and 306 days, respectively, compared with 327 and 318 days in 1957. Each company continued to mine its own cement rock and purchase other raw-material requirements. Utah was the principal market for the finished cement, although shipments were made to consumers in Arizona, Colorado, Idaho, Nevada, and Wyoming.

On the condition that new dust-collection equipment be built into the Portland Cement Co. of Utah operation, the Salt Lake City Planning Commission gave approval to a $1.5-million expansion program at the company Salt Lake City cement plant to double the plant capacity. Plans included a new kiln.

Clays.—The value of halloysite produced from the Dragon mine of Filtrol Corp. continued to make it the principal type of clay in Utah. Both the quantity of halloysite and other clays produced during the year continued to decline from 1957; but, because of an increase in the average price of clays other than halloysite, the total value of clays was 3 percent greater than in 1957; the average price for halloysite remained the same.

Miscellaneous clay used in manufacturing brick and other heavy clay products accounted for the bulk of the clay mined. Of the 157,000 tons of clay produced (excluding halloysite), 80 percent was miscellaneous clay, mined principally by brick manufacturers. Interstate Brick Co., with a brick plant at Salt Lake City and mines in Morgan, Tooele, and Utah Counties, was the principal miscellaneous clay producer. Utah Fire Clay Co., also with a brick plant at Salt Lake City and miscellaneous clay mines in Summit and Tooele Counties and a fire-clay mine in Utah County, was the second leading producer.

Utah Fire Clay Co. produced the bulk of the fire clay mined. Western Clay & Metals Co., producing fuller's earth and bentonite in Sevier County, was joined by American Mud & Chemical Corp. and Macco Corp.—the last two companies producing bentonite in Garfield and Sevier Counties, respectively. The American Mud & Chemical Corp. constructed a 40-ton-per-day mill for processing bentonite at Cannonville. The plant produced bentonite for use mainly in connection with irrigation canals, although some bentonite was sold for use as a constituent in rotary-drilling mud.

Fluorspar.—There was a 45-percent increase in the shipment of Metallurgical-grade fluorspar, principally to the Government stockpile. The gain in shipments was due to efforts by producers to ship as much fluorspar as possible before their contracts expired. The Government purchase program ended December 31, 1958.

Willden Bros., operating the Lost Sheep mine, and Chesley & Black, working the Fluorine Queen mine, were the principal producers. In addition to shipments to the Government stockpile, a small quantity of fluorspar was sold directly to a steel plant. The Quo Vadis Mines, Inc., Acid-grade plant, built in 1957, was not operated in 1958.

Gem Stones.—The value of gem and ornamental stones and mineral specimens collected rose to $40,000 from $12,000 in 1957. Collectors and dealers in 16 counties indicated that petrified wood was the most important stone, in terms of quantity and value. Other stones and mineral specimens collected included agate, jasper, obsidian, onyx, topaz, and azurite. Garfield County was the principal area from which material was collected, followed by Wayne and Millard Counties.

Gypsum.—The Sigurd area of Sevier County was again the only source of commercial gypsum. The Bestwall Gypsum Co. and United States Gypsum Co. operated mines and calcining plants, and total shipments for the period were 11 percent greater than in 1957.

Lime.—The output of quick and hydrated lime rose to 80,000 tons—51 percent more than in 1957—owing largely to shipments from the new Delle dead-burned dolomite plant of Utah Marblehead Lime Co. This company had been shipping dead-burned dolomite from its Thorton, Ill., plant to United States Steel Corp. at Geneva, since the steel plant began operating 15 years ago. In June 1958 shipments began from the new plant, which was operated by Material Service Corp. through its subsidiary. Dolomite was mined from the Lakeside Mountains near the plant site. The reserve of high-purity dolomite in the deposit reportedly totals 20 million tons. The calcining plant had a capacity of 410,000 tons of raw rock annually. Details on the plant process have been published.[3]

The output of quicklime by Kennecott Copper Corp. declined, owing to a reduction in the quantity of copper ores treated. Utah Lime & Stone Co., operating a limekiln near Grantsville, reported less output than in 1957, but Lakeside Lime & Stone Co. sold more lime than in 1957.

Mica.—For the first time since the Government mica-purchase program began in 1952 shipments of sheet mica from Utah were reported. During 1958, 516 pounds of hand-cobbed mica was sold to the Custer, S. Dak., purchase depot. From the 516 pounds sold, 12 pounds of block mica was recovered.

Perlite.—Acme Lite-Wate Products, Inc., operating a mine in Beaver County, was the only producer of crude perlite. The company expanded the crude material at its Salt Lake City plant. The finished product was used in building plaster, in concrete aggregate, and as a soil conditioner. Crude perlite from Nevada, expanded at Sigurd by the Bestwall Gypsum Co., was used in building plaster.

Phosphate Rock.—Mine production of phosphate rock was limited to the San Francisco Chemical Co. Bradley mine in Rich County. Output dropped 14 percent below 1957. San Francisco Chemical also developed the Vernal deposit and made shipments to the company plant at Leefe, Wyo., for testing.

Potash.—Production of potassium salts declined 5 percent below 1957. However, actual shipments of potash increased 17 percent because of a 38-percent withdrawal from stocks. Bonneville, Ltd., the only potash producer, conducted experiments on the recovery of

[3] Utley, Harry F., Marblehead's New Utah Plant Producing Dead-Burned Dolomite for Western Steel Markets: Pit and Quarry, vol. 51, No. 5, November 1958, pp. 122-125.

byproducts from potash brine produced at the plant. The firm also received royalties from the Utah Salt Co., which harvested, processed, and sold salt from the Bonneville ponds. No crude alunite was mined, although some shipments were made from stocks of alunite mined in previous years. Hydrocarbon Chemicals, Inc., New York, acquired the bulk of the common stock of Calunite Corp. In addition to its Marysvale mine, Calunite operated a fertilizer plant in Pomona, Calif.

Pumice.—A 14-percent increase in the output of pumice was more than offset by a 43-percent drop in the value of output. The quantity increase was due to a gain in output by Christensen Construction Co. and initial operation of Central Utah Block Co. at Flowell. Harborlite Corp. in Tooele County and Wm. H. Prince & Sons Block Co., Inc., Utah County, were both idle in 1958. The marked decline in value resulted from no output by Utah Lavalite, Inc., which, in previous years, produced high-quality pumice for abrasives.

Salt.—The output of evaporated and rock salt fell to 184,000 tons—17 percent below 1957. The decline can be attributed primarily to the reduction of output by Morton Salt Co. in Salt Lake County and Leslie Salt Co. (formerly Deseret Salt Co.) in Tooele County. The Utah Salt Co. was formed and began operating in 1958, recovering salt from the brine ponds of Bonneville, Ltd., potash operation in Tooele County. The Solar Salt Co. (formerly Stansbury Salt Co.) operated its Tooele salt plant the full year under its new management. Rock salt was produced by Royal Crystal Salt Co. in Sanpete County and Poulson Bros. Salt Co. in Sevier County, and evaporated salt was reported by Lake Crystal Salt Co. in Box Elder County.

Sand and Gravel.—Total production of all types of sand and gravel dropped 6 percent below 1957. The decrease was due in part to the economic recession, which resulted in smaller production of this commodity by both commercial producers and noncommercial contractors (mainly engaged in highway construction). The operation of sand and gravel pits by Morrison-Knudsen Co., Inc., working on the Great Salt Lake railroad causeway, resulted in Box Elder County being the principal-producing region in the State. Salt Lake County was the second-ranking producing area. Aside from the railroad causeway, highway construction continued to be the most important single factor that affected production. A report [4] showed that Utah ranked 35th in the Nation in mileage of all construction underway on the Federal Interstate Highway System during 1958, with 31.6 miles. In all mileage completed on the 41,000-mile superhighway network, Utah ranked 29th, with 17.4 miles.

Stone.—The continued production of stone (quartzite and limestone) by Morrison-Knudsen, Inc., for use on the Great Salt Lake railroad causeway primarily was responsible for the 67-percent increase in the total output of stone. Crushed-limestone production by a number of producers for use in manufacturing cement and lime was

[4] Bureau of Public Roads, Status of Federal-Aid Highway Programs, Dec. 31, 1958; BPR 59-2.

also an important factor in the stone industry. Crushed granite quarried by contractors for the Federal Bureau of Reclamation and dimension sandstone for building purposes also were reported. Box Elder County was the leading producing county, followed by Morgan and Utah.

TABLE 12.—Sand and gravel sold or used by producers, by classes of operations and uses, in thousands

Class of operation and use	1957		1958	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Molding	(1)	(1)	25	$30
Building	653	$567	707	652
Paving	361	350	556	524
Fire or furnace	(1)	(1)		
Engine	(1)	(1)	1	2
Other	9,070	4,619	8,000	4,007
Total	10,084	5,536	9,289	5,215
Gravel:				
Building	815	713	673	621
Paving	1,906	1,579	2,379	1,995
Railroad ballast	(1)	(1)	91	29
Other	11,124	5,567	10,033	5,037
Total	13,845	7,859	13,176	7,682
Total sand and gravel	23,929	13,395	22,465	12,897
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	3	6		
Paving	32	39	369	87
Total	35	45	369	87
Gravel:				
Building	753	636	46	63
Paving	2,241	1,409	2,424	1,332
Total	2,994	2,045	2,470	1,395
Total sand and gravel	3,029	2,090	2,839	1,482
ALL OPERATIONS				
Sand	10,119	5,581	9,658	5,302
Gravel	16,839	9,904	15,646	9,077
Grand total	26,958	15,485	25,304	14,379

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

TABLE 13.—Production of stone in 1958, by counties

County	Short tons	Value	County	Short tons	Value
Box Elder	(1)	(1)	Tooele	179,100	$411,600
Cache	41,300	$142,500	Utah	(1)	(1)
Daggett	105,500	132,000	Wasatch	78,200	149,700
Iron	(1)	(1)	Washington	(1)	(1)
Juab	(1)	(1)	Weber	800	800
Morgan	(1)	(1)	Other counties	12,711,687	13,056,184
Salt Lake	(1)	(1)			
Sanpete	5,100	21,600	Total	13,126,377	13,948,614
Summit	4,690	34,230			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

Sulfur.—A small tonnage of sulfur-bearing material was produced and processed at the Sulphurdale plant of American Sulphur & Refining Co. The plant was operated on an experimental basis for a short period.

Sulfuric Acid.—The Garfield Chemical & Manufacturing Corp. and Texas-Zinc Minerals Corp. produced sulfuric acid. According to the annual report to stockholders of the American Smelting and Refining Co., 408,699 tons of sulfuric acid was produced from smelter gases originated at the Garfield smelter of AS&R. This compared with 391,740 tons in 1957 which was the largest production previously attained by the corporation. Nearly all output was sold. The Texas-Zinc Minerals Corp. operated its 70-tons-per-day sulfuric acid plant at Mexican Hat throughout 1958. The acid, produced from sulfur from Wyoming was used in the treatment of uranium ore.

TABLE 14.—Stone sold or used by producers, by kinds

Year	Granite		Limestone		Sandstone	
	Short tons	Value	Short tons	Value	Short tons	Value
1954	148	$4,800	1,100,795	$1,395,122	26,518	$145,919
1955			1,444,517	2,149,799	218,551	359,331
1956			1,694,217	2,563,741	321,588	430,101
1957			1,723,300	2,359,600	123,175	155,150
1958	77,300	146,100	2,958,000	3,648,900	10,090,877	10,153,414

Year	Other stone		Total	
	Short tons	Value	Short tons	Value
1954			1,127,461	$1,545,841
1955	262,799	$141,350	1,925,867	2,650,480
1956	305,831	304,164	2,321,636	3,298,006
1957	6,007,400	6,025,300	7,853,875	8,540,050
1958	200	200	13,126,377	13,948,614

TABLE 15.—Stone sold or used by producers, by uses

Use	1957		1958	
	Short tons	Value	Short tons	Value
Dimension stone [1]	1,075	$28,350	1,477	$33,914
Crushed and broken stone:				
Riprap	27,300	59,800	81,600	155,800
Metallurgical	876,900	1,148,400	571,700	706,300
Concrete and roadstone	130,900	80,600	122,300	145,800
Railroad ballast	2,500	2,000	(2)	(2)
Chemical	49,800	153,900	59,900	236,600
Miscellaneous	[3] 6,765,400	7,067,000	[4] 12,289,400	12,670,200
Total	7,852,800	8,511,700	13,124,900	13,914,700
Grand total	7,853,875	8,540,050	13,126,377	13,948,614

[1] Includes rough construction and rubble, dressed, and sawed stones.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Miscellaneous."
[3] Includes stone used in coal dust, poultry grit, cement, lime, roofing chips, and fill.
[4] Includes stone used in coal dust, cement, lime, fill, roofing chips, feed supplement, and soil conditioner.

Talc.—Tri-State Minerals Co. continued to operate its Ogden plant on ore received from company mines in California and Montana.

Vermiculite.—Crude vermiculite from Montana was used to produce exfoliated vermiculite at the Salt Lake City plant of Vermiculite-Intermountain, Inc. Output in 1958–9 percent below 1957—was used for insulation.

REVIEW BY COUNTIES

Beaver.—Half of the value of mineral production was from uranium ore produced by four operators from three mines. The principal mine was Wallace R. O'Keefe (Mystery Sniffer mine). All of the uranium ore was processed at the Vitro Uranium Co. plant at Salt Lake City. The State's only perlite producer, Acme Lite-Wate Products, Inc., mined crude perlite shipped to Salt Lake City for expanding. A small output of gold, silver, copper, lead, and zinc with a combined value of $8,000 came from three mines.

Box Elder.—Except for a small quantity of silver, lead, and zinc, the entire mineral production in Box Elder County was nonmetals. Stone used in constructing a railroad causeway across Great Salt Lake by Morrison-Knudsen Co., Inc., was the principal commodity produced. The Lake Crystal Salt Co. produced solar-evaporated salt at its Saline facility, and output was nearly double the amount produced in 1957. A small quantity of hand-cobbed mica was shipped to the Government purchase depot at Custer, S. Dak.

Carbon.—Coal production from 28 underground mines in Carbon County (accounting for 74 percent of the total coal production in the State) was 26 percent below that of 1957. The value of coal output supplied 93 percent of the county's total value of mineral production. Because of a decline in steel production early in the year, the Sunnyside coal mines of Kaiser Steel Corp. were idle in February, and on February 28 all coke ovens operated by the corporation at Sunnyside were closed temporarily. Other mines in the county curtailed operations, and full production was not resumed until July. A sharp decline in shipments to Asia also contributed to the drop in production. The Columbia-Geneva Division, United States Steel Corp., completed a 9,000-foot new main entry at its Columbia mine into coking coal that previously could not be recovered economically. The entry went into service on September 30, replacing the old entry at a higher elevation, and a tramway that had been in service since the mine opened in 1923. Support for the new opening was reinforced concrete through the alluvium zone and roof bolts and gunite through shale and sandstone. It was part of a major program of modernization of the corporation's Utah operations.

Independent Coal & Coke Co. began two major development projects designed to lower the cost of producing coal at its Carbon County operations. These involved mining coal from the C seam at the Castle Gate mine, and the driving of a 3,400-foot haulageway to connect the Kenilworth mine with the Castle Gate mine. The connection will reduce haulage costs to the Utah Power & Light Co. Carbon No. 1 powerplant at the portal of the Castle Gate mine. The plant consumes approximately 200,000 tons of coal annually.

TABLE 16.—Value of mineral production in Utah, by counties

County	1957	1958 [1]	Minerals produced in 1958 in order of value
Beaver	$180,218	$57,075	Uranium ore, sand and gravel, perlite, copper, lead, gem stones, silver, zinc, gold.
Box Elder	16,300,907	21,055,170	Stone, sand and gravel, salt, gem stones, lead, zinc, mica (sheet), silver.
Cache	987,035	436,000	Sand and gravel, stone.
Carbon	[2] 34,843,773	25,840,203	Coal, natural gas, sand and gravel, carbon dioxide, gem stones.
Daggett [3]	[2] 294,940	470,700	Natural gas, stone, sand and gravel.
Davis	267,800	365,938	Sand and gravel, lead, silver.
Duchesne	[2] 13,620	28,790	Sand and gravel, natural gas, petroleum.
Emery [4]	[2] 8,482,778	7,051,398	Coal, uranium ore, natural gas, sand and gravel, copper, gem stones, lead, silver.
Garfield [4]	207,456	132,041	Uranium ore, clays, gem stones, sand and gravel, coal, gold.
Grand [4]	[2] 836,984	1,329,511	Uranium ore, natural gas, manganese ore and concentrate, sand and gravel, petroleum, gem stones.
Iron	30,650,540	25,363,180	Iron ore, coal, sand and gravel, stone, uranium ore, gem stones.
Juab [5]	2,599,942	1,990,727	Clays, fluorspar, lead, silver, iron ore, gold, stone, copper, uranium ore, manganese ore and concentrate, zinc, gem stones.
Kane	22,134	245,413	Sand and gravel, coal, gem stones.
Millard	[5] 184,909	78,079	Pumice, gem stones.
Morgan	6,481,694	6,966,399	Cement, stone, sand and gravel, clays, lead, silver.
Piute	[6]	[6]	Uranium ore, silver, copper, gold, lead.
Rich	775,602	[6]	Phosphate rock.
Salt Lake	194,608,203	144,334,874	Copper, molybdenum, gold, lead, zinc, silver, sand and gravel, salt, cement, stone, lime, gem stones.
San Juan [4]	[2] 33,211,055	98,255,452	Petroleum, uranium ore, copper, natural gas, sand and gravel, silver, gold, lead.
Sanpete	[2] 174,048	322,034	Natural gas, sand and gravel, salt, stone.
Sevier	1,067,880	1,205,668	Gypsum, coal, clays, sand and gravel, salt, gem stones, uranium ore.
Summit	4,795,778	4,000,058	Zinc, lead, silver, copper, sand and gravel, gold, coal, stone, clays.
Tooele	4,419,688	4,304,859	Potassium salts, lime, salt, lead, stone, zinc, silver, clays, sand and gravel, copper, gold, pumice, gem stones.
Uintah	[2] 10,782,951	16,265,417	Petroleum, gilsonite, natural gas, sand and gravel, copper, lead, zinc, silver.
Utah	2,384,193	1,775,975	Stones, sand and gravel, clays, lime, silver, lead, gold, copper, zinc, gem stones.
Wasatch	2,800,557	2,257,910	Zinc, lead, gold, silver, stone, copper.
Washington	[2] 169,588	138,230	Sand and gravel, silver, copper, petroleum, stone, gold, gem stones, lead, uranium ore.
Wayne [4]	[6]	19,970	Uranium ore, gem stones.
Weber [5]	381,201	177,707	Sand and gravel, clays, fluorspar, stone.
Undistributed [7]	[2] 2,404,000	2,556,000	
Total [8]	[2] 359,335,000	365,960,000	

[1] Values of petroleum are preliminary.
[2] Revised figure.
[3] Excludes natural gasoline.
[4] Excludes vanadium.
[5] Excludes value of manganese ore sold and blended at Government low-grade stockpiles for future beneficiation.
[6] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[7] Includes all vanadium and natural gasoline, some sand and gravel and gem stones and values indicated by footnote 6.
[8] Total has been adjusted to eliminate duplication in the value of raw materials used in the manufacture of cement and lime.

Natural gas produced from 14 wells in the Clear Creek field was marketed through pipelines to consumers in the Salt Lake area. Carbon dioxide from the Coconino and Navajo formations in the Farnham Dome field was transported to Wellington by pipeline where it was converted into dry ice by the Carbon Dioxide & Chemical Co.

Daggett.—Natural gas from 10 wells in the Clay Basin field in Daggett County was processed at the Mountain Fuel Supply Co. plant to recover natural gasoline. Residual gas was delivered through company pipelines to consumers in the Salt Lake area and the

natural gasoline and distillate recovered at the plant was used by Salt Lake refineries as blending stock. The construction activities of two Federal Bureaus—Public Roads and Reclamation—resulted in the production of 56,000 tons of paving gravel and 106,000 tons of crushed limestone and sandstone.

The contractors who conducted quarry operations were Wansgaard-Peterson Construction Co., Union Construction Co., and Witt Construction Co.

Emery.—Coal output from 11 mines accounted for 81 percent of Emery County's value of mineral production and 24 percent of the Utah coal production but was 10 percent below that of 1957. Major producers were Columbia-Geneva Steel Division, United States Steel Corp., at its Geneva mine, United States Fuel Co. at the King mine, and Bookcliffs Coal Co. at the Bookcliffs mine.

Natural gas production in the county was from three wells in the Flat Canyon field. One new gas discovery was recorded. The discovery well (nearly 2 miles northeast of a 1957 discovery) was completed at a depth of 922 feet, and initial daily production was 400,000 cubic feet from the Ferron formation at a depth of 702–718 feet. The wells were designated as a part of the Ferron field.

Uranium ore was produced at 67 locations in the county and supplied 19 percent of the county's total value of mineral production. The principal operators were Union Carbide Nuclear Co. at the AEC, Flat Top, and North Mesa groups, Four Corners Uranium Corp. at the Incline group; and Uranium Industries, Inc., at the Vanadian King group. Shipments were made to mills in Colorado, to mills at Monticello and Salt Lake City, and to the Union Carbide Nuclear Co. upgrading plant (completed in March) at Green River.

The plant, which began full-scale operation late in the same month, was designed to treat 400 tons of crude ore daily. Crude ore to the plant came from the Temple Mountain and Polar Mesa districts. Plant feed was crushed and ground to 35-mesh in a rod mill, and discharge from the rod mill was separated into sand and slime products. The sand product was leached with sulfuric acid and the uranium precipitated. The recovered uranium was then combined with the slime product, filtered, dried, and shipped to the company plant at Rifle, Colo., for further processing. Operation of the upgrader provided a twofold advantage; freight costs were reduced and, because of the higher grade product treated at the Rifle mill, the capacity of the latter plant, in terms of uranium oxide recovered, was substantially increased.

Garfield.—Uranium-ore output supplied two-thirds of the county's total value of mineral production. It came from 42 operations of which the major producers were Industries & Mines, Inc., operating the Congress and Delmonte groups; Trident Mining Co. at the H & H group; and Bade Mining Co. at the Uranium No. 1 and Woodruff group. Shipments by individual operators were small, ranging from 2 to 150 tons. The grade, however, was high averaging 0.60 percent uranium oxide. The ore was shipped to mills in Colorado and Utah and to the upgrading plant at Green River for processing. Twitchell-Munson Coal Co. produced coal at the Alvey mine for local consumption. A portion of this output was treated

with oil to prevent dusting. The demand for bentonite for use in canal linings connected with the Glen Canyon Dam project stimulated greater production. The American Mud & Chemical Corp. built a bentonite-processing mill at Cannonville and shipped a total of 1,800 tons of bentonite to the Glen Canyon Dam contractors and rotary-drilling mud producers.

Grand.—Uranium-ore output composed two-thirds of the county's total value of mineral production. Production came from 61 operations and increased slightly over that of 1957. Major producers were Union Carbide Nuclear Co., operating 18 properties; Utah Alloy Ores, Inc., at 10 properties; and Climax Uranium Co., at 3 properties. The Yellow Cat, Polar Mesa, and Cane Canyon districts were the principal producing areas. Uranium Reduction Co. operated its 1,500-ton-a-day processing plant at Moab the entire year. Crude ore originated principally in the Big Indian area, San Juan County. The company requested an extension of its concentrate-purchase contract with AEC through December 31, 1966. The current contract expires on March 31, 1962. A major plant-expansion program, dependent on revision of the contract with AEC, was scheduled to begin in August. The program, estimated to cost $2.5 to $3 million, would include a new alkaline leach circuit, using sodium carbonate for treating high-lime-content ores. The original mill, completed late in 1956, was the first in the United States to use the resin-in-pulp process for extracting the uranium from the leach liquors.

Petroleum production in the county, which came from eight wells in the Big Flat, Cisco, and Seiber Nose fields, declined 39 percent compared with the preceding year. Natural gas was produced from eight wells in the Bar X field. Six successful development wells were completed—five gas wells in the Bar X field and one oil well in the Cisco field.

Six of the seven mines operated from which manganese ore and concentrate was shipped under the "carlot" Government purchase program administered by the GSA were in Grand County. A total of 934 short wet tons of ore valued at $76,000 and having an average manganese content of 41.4 percent was shipped from these mines. Loyd W. Smith, Gene F. Tom, South Western Minerals Co., and Zenda Manganese, Inc., were the major producers.

Iron.—Except for a small quantity from Juab County, the entire output (shipments) of iron ore from Utah in 1958 came from eight mines in Iron County west of Cedar City. Columbia Iron Mining Co., subsidiary of United States Steel Corp., operated the Desert Mound and Iron Mountain mines and was the leading producer. The ore was used in the company Utah steel plants. The Colorado Fuel and Iron Corp. followed Columbia in output, which came from three mines—Blowout, Comstock, and Duncan—and went to its Colorado steel plant at Pueblo. Utah Construction Co. shipped ore from its Excelsior mine to buyers in Utah and California. Helene E. Beatty recovered iron ore (float-material) from the Big Chance Placer No. 1 and Monta Rose groups of claims on a royalty basis and shipped it to various eastern and western markets. Iron ore comprises 99 percent of the value of minerals produced in the county. Coal output (all from the Jones Bulloch, Tucker, and Webster

mines) declined 12 percent compared with 1957. The entire production was consumed locally. A small quantity of uranium ore was produced by Gaus Brothers and shipped to the processing plant at Salt Lake City.

Juab.—Nonmetals composed 86 percent of the value of mineral output. The principal mineral, in terms of value, was clay (halloysite) mined by Filtrol Corp. at its Dragon mine. The raw clay was shipped to the company plant at Salt Lake City for processing. The finished product was used as a catalyst in oil refining. Fluorspar was the second-ranking mineral, and output rose to 16,000 tons—45 percent above 1957. Juab County continued to be the principal fluorspar-producing region in Utah. Nearly all output was shipped to the Government stockpile. General Refractories Co. was responsible for the entire stone output in 1958. The company operated its Jericho quarry, producing crushed sandstone for use in manufacturing refractories. Murray Refractories Co. abandoned its Eureka sandstone quarry.

The value of the metals output, comprising gold, silver, copper, lead, zinc, and iron, manganese and uranium ores, declined considerably, principally because of the curtailment and inactivity at former major lead-zinc producers. Gold, silver, copper, lead, and zinc came from eight mines in the county. The major producer was the Centennial-Beck-Victoria group, owned by United States Smelting Refining and Mining Co. and operated by Brennan Hannifin, lessee. Crude ore from this group was shipped to the Midvale, Garfield, and Tooele smelters. Other major active mines included the Mona, Empire, Godiva, and Iron Blossom. Fluxing ore containing gold, silver, copper, and lead was shipped from the Mammoth and Swansea dumps. Brown iron ore was shipped from the Iron Blossom mine by the Lynn Mining Co. for use in manufacturing dead-burned dolomite. Manganese ore and concentrate were produced from one mine in Juab County and shipped under the GSA "carlot" purchase program. Topaz Uranium Co. shipped uranium ore produced at the Yellow Chief mine to the Vitro Uranium Co. at Salt Lake City for treatment.

Millard.—Mining activity declined to the lowest value since 1952. There was no gold, silver, or copper mining, and the value of pumice (the principal mineral) dropped from $148,000 in 1957 to $75,000 in 1958. Christensen Construction Co. increased its output of volcanic scoria, but there was no production of higher value pumice by Utah Lavalite, Inc. Central Utah Block Co. began initial production of scoria in 1958. The company used the crude material in manufacturing of cinder block at its Flowell plant.

Morgan.—Nonmetals continued to compose all but a small portion of the total value of mineral production. The Devil's Slide cement plant, owned and operated by Ideal Cement Co., was once again the principal support of the region's mineral industry. Ideal Cement Co. also operated its Devil's Slide cement-rock quarry, which produces nearly all the stone reported. The Henefer miscellaneous clay pit of Interstate Brick Co. was the only active clay operation in the county; the raw clay was shipped to the company plant at Salt Lake City for use in manufacturing brick and other heavy clay products. Highway- and reclamation-construction activities by the

Utah State Road Commission, Morgan County Highway Department, and the Federal Bureau of Reclamation were responsible for 107,000 tons of sand and gravel produced.

Piute.—Uranium ore, the principal mineral product, came from four mines. Output was 37 percent below that in 1957, when production was reported from six mines. The major producer was Vanadium Corp. of America, operating the Farmer John, Freedom, and Prospector mines. The entire output was milled by the Vitro Uranium Co. at Salt Lake City. The value of output of other minerals produced including gold, silver, copper, and lead, declined $8,000 (36 percent). Production was from four mines, of which Deer Trail was the largest.

Rich.—Phosphate rock from the Bradley mine of San Francisco Chemical Co. was shipped to the company plant at Leefe, Wyo., for processing.

Salt Lake.—Salt Lake County continued to be one of the leading mining and mineral processing and refining centers. Mine-output value declined from $194.6 million in 1957 to $144.3 million in 1958—a 26-percent reduction, mostly because of a 30-percent drop ($43.4 million) in value of output of copper (from $142.4 million to $99 million). Other commodities with substantial decreases in output included gold ($2.4 million), lead ($1.7 million), and molybdenum ($2.8 million).

The Utah Copper and the U. S. and Lark were the first- and second-ranking gold-silver-copper-producing mines in Utah. The U. S. and Lark mine was also the leading lead and zinc producer in the State. In addition, the United States Smelting Refining and Mining Co. recovered substantial quantities of gold, silver, copper, lead, and zinc from slag and tailings (pyrite) shipped to the Tooele fuming plant and Garfield smelter, respectively, from dumps in Salt Lake County.

According to the Kennecott Copper Corp. annual report, 24.1 million tons of ore was mined and milled from the Utah Copper open-pit mine in 1958, compared with 30.9 million tons in 1957. The content of the ore was unchanged at 16.5 pounds of copper a ton. The ore also contained molybdenum recovered as a molybdenum concentrate from the copper concentrate and gold and silver recovered from the slag or residue from electrolytic refining of the copper anodes.

In January the operating schedule of the Utah Copper Division was reduced from 7 days a week to 6, then to 5 in March, and finally to 4 in May, because of the declining domestic demand for copper. With increased demand for copper in the second half of the year, schedules were increased from 4 to 5 days a week in September, 6 in October, and to 7 in November.

Throughout the year work was continued by Utah Construction Co., the contractor, on an 18,000-foot, $11-million concrete-lined, ore-haulage tunnel from the mouth of Bingham Canyon to the bottom of the Utah Copper open pit. Upon completion, scheduled in the first half of 1959, the tunnel will eliminate uphill ore haulage from the pit. Construction of the $16-million expansion of the central power station by the contractor, Rust Engineering Co., continued throughout the year; the new plant was scheduled to be in operation

early in 1960. The addition was expected to increase capacity at the Magna steam-electric plant to 175,000 kw.

Negotiations were completed for the purchase by the Kennecott Copper Corp. of the Garfield smelter of the American Smelting and Refining Co., which for many years smelted the copper concentrate produced by the Utah Copper Division. The smelter adjoins the division's mills and refinery and completes an integrated processing plant of ore to refined metal. The copper smelter is the world's largest, with an annual input capacity of 1.2 million tons of concentrates, precipitates, and fluxes. It has five reverberatory furnaces, eight converters, four anode furnaces, and two anode casting wheels. As a byproduct of the smelter gases, more than 1,000 tons of sulfuric acid was produced daily by the Garfield Chemical and Manufacturing Corp., jointly owned by Kennecott and American Smelting and Refining Co. (Asarco). Kennecott was scheduled to take over operation of the Garfield smelter on January 1, 1959. The corporation reportedly will not treat custom ore at the smelter, as did Asarco.

Operations at the U.S. and Lark mine of the United States Smelting Refining and Mining Co. continued throughout 1958 on an alternate 5- and 6-day-week basis. The Lark section was operated two shifts a day and the U.S. section was on a one-shift-a-day basis. Tonnage of ore produced was somewhat less than in 1957, but the grade was better. Ore developed exceeded the tonnage of ore extracted, according to the company. Exploration continued on the deepest level at the U.S. section in search of ore-bearing formations, which were productive on the higher levels of the mine. Several important new ore runs were developed in the Lark section. The company lead smelter at Midvale (where concentrate from this operation and purchased custom ore and concentrate were smelted) was operated without interruption until June 27, when it was shut down. Most of the equipment from the smelter was transferred to other company plants and the remainder salvaged. This company made arrangements whereby lead ore and concentrate from the U.S. and Lark operation and purchased material will be smelted on a toll basis at the Tooele lead smelter of International Smelting and Refining Co. The Midvale flotation mill continued to operate on ores from the U.S. and Lark mines and purchased material. In addition, the mill treated ores on toll from International, which closed its concentration mill and reopened its lead smelter at Tooele coincident with closing of the Midvale smelter.

The four petroleum refineries in the Salt Lake City area processed 29.5 million barrels of crude oil, 2 million barrels or 6.5 percent less than in 1957. Salt Lake Refining Co., a subsidiary of Standard Oil Co. of California, completed installing an 8,000-barrel-a-day UOP platformer early in the year. The unit processed a straight-run naphtha in the 200° to 400° F. boiling range. Utah Oil Refining Co. completed installing a $2.5-million, 35,000-barrel-a-day fractionating unit and a new boiler. Phillips Petroleum Co. completed installing a 3,700-barrel-a-day reforming unit at its Woods Cross refinery; increases in throughput were recorded at this refinery and at the Western States Refining Co. North Salt Lake refinery. The

total daily capacity of the four plants at year end was 92,500 barrels, compared with 85,500 barrels in 1957.

Vitro Uranium Co., a division of Vitro Corp., operated its 600-ton-a-day uranium-processing plant at Salt Lake City the entire year. Operation of the solvent-extraction process for recovering uranium from sulfuric acid leach liquors (installation completed in August 1957) was highly successful. Recovery of the uranium from the ore was increased substantially. Crude ore for the plant was from the San Rafael-Green River and Marysvale districts in Utah and from the company's mine in Wyoming.

The value of nonmetals produced was $5.8 million, the same as in 1957; however, there were some changes in distribution of this value. The output of cement and cement rock by the Portland Cement Co. of Utah declined, as did the quantity of lime produced by Kennecott Copper Corp. On the other hand, increased construction activity in Salt Lake County resulted in a 17-percent increase in the output of sand and gravel.

Production of solar-evaporated salt by the Morton Salt Co. at its Saline facility dropped 23 percent from 1957, but the value increased 18 percent.

San Juan.—San Juan County led the State in the production of petroleum. Output, which comprised 63 percent of the total value of mineral production in the county, increased from 1.6 million barrels in 1957 to 20.7 million in 1958. The Four Corners pipeline from the Aneth field to refineries in Los Angeles, Calif. (completed late in 1957 and operating at full capacity in January 1958), and the Texas-New Mexico pipeline (completed in May) from the Aneth field to Jal, N. Mex., provided the necessary outlets for crude oil from the highly productive Paradox basin. Daily capacity of the two pipelines was 120,000 barrels. Production from fields in the Paradox basin on Federal and Indian lands was suspended by the Secretary of the Interior on November 10 to halt the flaring of natural gas from the wells. The order was issued at the request of the Navajo Tribal Council to conserve natural gas resources of the area being flared at an estimated rate of 64 million cubic feet a day. This order shut down 327 wells; however, El Paso Natural Gas Co. rushed to completion a 76-mile, 20-inch, gasline gathering system, and by November 19 all the wells had been connected to the system and resumed operations. Only those wells where connection to the gathering system would not be economical were exempted from the order. The gas was processed at the El Paso Natural Gas Co. treatment plant at Farmington, N. Mex., and the residual gas transported through company pipelines to consumers in California. At year end the company was taking over 65 million cubic feet a day from the area and expected to increase that to 100 million cubic feet.

Exploratory drilling was disappointing, with only 1 discovery compared with 10 in 1957. The number of wildcat wells completed was 47 compared with 66 in 1957. Development drilling, however, more than doubled that in 1957 in the number of completions and successes. The discovery in 1958 (1.5 miles southeast of the Bluff Bench field discovered in 1957) was completed at a depth of 5,585 feet in the Paradox formation. Initial daily production was 264 barrels from the Hermosa formation at a depth of 5,344–5,376 feet.

The major portion of the development drilling was in the Aneth field, where 82 oil wells and 5 dry holes were completed. The productive area of the field was extended for about 1 mile along the western and southern parts of the field and about 2 miles toward the southeast. At the McElmo Creek field 61 successful development wells were completed. Development in 1958 appeared to have joined the McElmo Creek and Aneth fields. A 2-mile gap separates the two fields, with one producing well in about the center of the gap.

Development in the White Mesa field added 4 square miles of producing area to the southern portion of the field and nearly 4 square miles on the west and northwest portion. Twenty-seven producing wells were completed in the Ratherford field, extending the field some 3 miles to the south. Successful drilling between the Ratherford and White Mesa fields and between the Ratherford and McElmo Creek fields indicates the possible connection of the Aneth, McElmo Creek, White Mesa, and Ratherford fields into a single producing area. New producing wells also were completed in the Bluff, Boundary Butte, and Tahonadla fields. Ismay field, the most easterly of the new fields in the Paradox basin, was expanded substantially with completion of seven producing wells.

A successful gas well was completed west of the Boundary Butte field. Initial production was 19 million cubic feet from a depth of 5,181 feet. Two successful development wells were completed in the Boundary Butte gasfield; initial production was 15 and 3 million cubic feet daily.

Uranium-ore production from 196 operations increased 22 percent over that in 1957 and accounted for 36 percent of the county's total value of mineral production. Major producers included Standard Uranium Corp., at the Big Buck group; Hidden Splendor Mining Co., at the Far West; Texas-Zinc Minerals Corp., at the Happy Jack; Utex Exploration Co., at Mi Vida; La Sal Mining & Development Co., at the North Alice, Dissipation, and Richardson; Jen, Inc., at the Jen Jackie and Pasco Jen Jackie; Hecla Mining Co., at the Radon and Hot Rock; and Lisbon Uranium Corp., at the Dixie Fraction, Ike, Ike Nixon, Judy Lee, Judy Lee 1, Nixon, and Nixon No. 2.

Hecla Mining Co. developed an unusual system of longwall mining at the Radon mine, using Becorit D yieldable steel props. These props were developed in Germany and have been used extensively in European coal mines since 1928. The system, as developed at the Radon, was highly successful. Lisbon Uranium Corp. delivered one load of ore weighing 22 tons to the Grand Junction receiving station. The ore contained 23.18 percent uranium oxide and qualified for the $10,000 bonus offered in Circular 2 by AEC. The bonus offered in 1948 provided for payment of $10,000 for 20 tons of uranium ore that contained 20 percent or more uranium oxide. The shipment was made just 2 days before the offer expired. The total amount received by the shipper was $61,016; this shipper was the only one who qualified for the super bonus of $10,000.

Contracts for Government assistance in the exploration for uranium minerals were approved by DMEA for Stocks-Gramlich, Inc., at the Firefly claims; Royal Corp., at the Jean group; and Jen, Inc., at the Uncle Sam and Pascal claims. The total amount of

the contracts was $104,500, with Government participation limited to $59,300.

The Government-owned, 350-ton-a-day processing mill at Monticello, operated by National Lead Co., was active all year. Receipts of ore from shippers declined, and more ore was drawn from stockpiles. Indications were that the mill would be closed but maintained on a standby basis, if daily receipts continued to decrease; at the end of the year no definite date had been announced for possible closing of the mill.

Texas-Zinc Minerals Corp. operated its 1,000-ton-a-day plant at Mexican Hat throughout the year. Crude ore was from the company Happy Jack mine and independent producers in Utah and Arizona. The company contract with AEC was amended to provide for treating increased amounts of ore from independent producers. The amendment also provided for purchase of the Commission-owned ore stockpile at White Canyon and extension of the contract to December 31, 1966. The amendment was based on a survey by the Commission, which showed that milling capacity in the area was sufficient if ores of independent producers could be treated at a higher rate. The original contract required treatment of 4,600 tons of custom or independent ores a month, whereas the amendment provided a market for 13,000 tons a month. The survey, made late in 1957, estimated the ore reserve in the White Canyon-Monument area to be approximately 1.9 million tons.

Substantial quantities of copper and lead were recovered from fluxing ore produced from the Climax mine by McFarland & Hullinger and shipped to the Garfield smelter. In addition, gold, silver, and copper were recovered as byproducts of the treatment of uranium ores from San Juan County at the Texas-Zinc Minerals Corp. Mexican Hat uranium mill.

Sanpete.—Natural gas output in Sanpete County increased nearly twofold and accounted for half of the value of mineral production. All came from two wells in the Joe's Valley field and was transported by pipeline to the Clear Creek pipeline system for distribution. Rock-salt production from the Axtell mine by Royal Crystal Salt Co. also was reported. Sand and gravel production rose from 56,000 tons in 1957 to 189,000 tons in 1958. Paving gravel quarried by Cox Bros. and Thorn Construction Co. comprised the commercial output. The Ephraim City Corp. reported production of 2,200 tons of paving gravel by its construction and maintenance crews.

Sevier.—Clays, gypsum, salt, sand and gravel, and gem stones made up 77 percent of the $1.2 million mineral value. For each of the minerals listed an increase in both quantity and value was recorded. Bentonite from the Macco Corp. Bosshardt property was the reason for the gain in clay output; Western Clay & Metals Co. continued to produce bentonite and fuller's earth at its Aurora and Redmond pits. Bestwall Gypsum Co. and United States Gypsum Co. both operated gypsum mines and plants in the Sigurd area. Poulson Bros. Salt Co. of Redmond increased production. More construction in the county resulted in a gain in the output of sand and gravel by Elmo R. Herring and Redmond Sand & Gravel Co., the only producers in the county.

Coal production by the Southern Utah Fuel Co. at its No. 1 mine on the Ivie seam was 3 percent greater than in 1957. The entire output was consumed locally. El Reca Uranium Co. produced a small quantity of uranium ore at the Flat Tire group and shipped it to Salt Lake City for processing.

Summit.—The value of the output of gold, silver, copper, lead, and zinc represented $3.8 million of the $4 million combined value of all minerals produced in the county. This was down considerably from the $4.6 million and $4.8 million, respectively, in 1957. United Park City Mines Co. operation was the principal producer of each of these metals and was the second largest lead and zinc producer in Utah. George W. Wortley shipped material to smelters from the Atkinson, Gilmore, and Pacific Bridge tailings dumps, and from the Daily West mine. McFarland & Hullinger shipped fluxing ore from the Daly and Ontario dumps to the Garfield smelter.

Nonmetal output in the county consisted of miscellaneous clay quarried from the Henefer pit of Utah Fire Clay Co. The raw clay was shipped to the company brick plant in Salt Lake City. In addition, 101,000 tons of paving gravel was produced, mainly by contractors, for the Federal Bureau of Public Roads, Utah State Road Commission, and Summit County Highway Department. Dimension sandstone used for building construction and crushed sandstone used for riprap on a Federal Bureau of Reclamation project also were reported.

Chappel Coal Co. produced coal at its Chappel mine for local consumption. The quantity was slightly below that in 1957.

Tooele.—Output of nonmetals—clays, lime, potash, salt, sand and gravel, stones, pumice, and gem stones—was $3.5 million of Tooele County's $4.3 million total value of mineral production. Substantial increases were reported for some of the nonmetals, especially lime, sand and gravel, and stones. The gain in lime and limestone production resulted from operation of the new dead-burned-dolomite plant of Utah Marblehead Lime Co. The increase in sand and gravel was the result of a concentration of highway construction in the county. Tooele County continued to be the only source of potash in Utah and although production declined in comparison with 1957, shipments exceeded the 1957 total by a small margin. According to the company annual report to stockholders, the mechanical performance of the prilling plant continued to improve during the season but the operating cost remained high and the production of prilled potash was discontinued. The potash refinery was completely overhauled during the summer months and 200,000 cubic yards of material was handled in rebuilding evaporating-pond walls.

Output of each of the metals—gold, silver, copper, lead, and zinc—produced from Tooele County declined compared with 1957. Production of these metals was recorded from 12 active mines, of which the Ophir unit, operated by McFarland & Hullinger, lessees, and Calumet, operated by the Calumet Lease, were the major producers. International Smelting and Refining Co. reclaimed cold slag from the Tooele lead smelter dump and treated it in its zinc-fuming plant. Less than 100 tons of ore was produced from each of the remaining active mines.

Uintah.—Petroleum, which made up two-thirds of the value of mineral production, came from 117 wells in 5 fields, and output increased from 2.5 million barrels in 1957 to 3.7 million in 1958. Major output was from the Red Wash and Ashley Valley fields, followed by the Roosevelt, Brennan Bottom, and Gusher fields. Two gas discoveries recorded were later classified as a part of the Bitter Creek field discovered in 1956. Both wells were completed in the Wasatch formation at depths of 5,000 to 5,400 feet. Initial daily production was at a rate of 460,000 and 2.2 million cubic feet. A natural gas and condensate well was completed in the Southman Canyon field at a depth of 6,031 feet in the Mesaverde formation. Initial daily production was 4.7 million cubic feet of gas and 121 barrels of high-gravity oil. Development drilling was confined largely to the Red Wash field, where 22 oil wells and 3 gas wells were completed. Two successful development wells were completed at the Brennan Bottom field. The Utah Cooperative Refining Co. operated its 1,500-barrel-a-day refinery at Jensen the entire year. Throughput was 8 percent below that of 1957.

Gilsonite (uintahite) composed 30 percent of the value of mineral production. All was produced by four operators from six mines. The major producer was American Gilsonite Co. (Bonanza mine). Operation of the hydraulic system of mining developed by the company was highly successful and greatly reduced or eliminated the hazard of gilsonite-dust explosions. The entire production of the Bonanza mine was transported by a 70-mile pipeline to the company plant near Fruita, Colo., where the mineral was processed to recover high-octane gasoline, fuel oil, and high-grade metallurgical coke. The capacity of the plant was 700 tons a day, and plans were announced for an increase to 850 tons. Facilities at the mine were adequate to meet the increased production rate without additional equipment. The company also developed a product that has been used as a base for a new road-surfacing material. The new material can be laid at temperatures below 35°F. and has excellent wearing qualities. Other operators marketed their production in the Salt Lake area. A substantial quantity was used as a base in the manufacture of paint.

Utah.—Ninety-four percent of the value of mineral production came from nonmetals. The county was the leading producer of clays with eight clay pits operated. Murray Refractories Co. leased the Lake Mountain pit from Western Fire Clay Co. and produced 4,300 tons of fire clay, mainly for use at its Murray refractory plant. Loyd R. Stubbs operated his North, Northeast, and South claims for miscellaneous clay. Interstate Brick Co. and Utah Fire Clay Co. worked their captive Powell and Clinton pits, respectively; the raw clay was shipped to the company brick plants in Salt Lake City. Fire clay was quarried by the United Brick Co. and R. D. Wadley Clay Co. Lakeside Lime & Stone Co. continued to be the only producer of lime; the company also operated a limestone quarry near Grantsville. The William H. Prince & Sons Block Co., Inc., pumice operation was idle throughout the year. Utah County ranked fourth in the State in terms of sand and gravel output. Nine commercial sand and gravel operations reported the production of 585,000 tons of aggregate and one Government-and-contractor producer 14,000 tons.

The bulk of the total stone produced was crushed limestone from the Keigley quarry of United States Steel Corp. The crushed stone was used as flux, riprap, railroad ballast, concrete and road metal, and as a refractory material.

The county's metal output—gold, silver, copper, lead, and zinc—came from seven operations at mines where ore was produced from underground workings and material was shipped from the dumps. Major activity was at the Colorado Consolidated mine followed by the Tintic Standard, Eureka Lilly, Mountain View, and Yankee Consolidated.

Wasatch.—Most of the value of mineral output was accredited to lead and zinc from the Mayflower mine, owned by New Park Mining Co. and operated by leasers throughout the year. Eighty-five lessees worked the mine with their own operating organization, which managed all phases of exploration, development, production, and maintenance. According to the company, this lease arrangement proved to be efficient, the number of tons mined per man-shift worked was higher than previous years, and the ore was mined more selectively which resulted in the production of higher grade ore. Development by the lessees doubled the ore reserve.

Production of stone from the county increased fourfold. All was supplied by The Contracting Corp., Plant-Dartnell Corp., and Vern Dunn Excavating Co. under contract to the Federal Bureau of Reclamation for use as riprap.

Washington.—The value of gold, silver, copper, lead, and zinc output made up half of the value of mineral production. All was recovered from three mines, of which the Silver Reef, operated by Western Gold & Uranium, Inc., was the major producer. Three thousand tons of mine ore and nineteen thousand tons of old tailings were treated in the company mill. The concentrate value was chiefly in silver with lesser values of gold and copper. It was shipped to the Garfield copper and Tooele lead smelters. Small quantities of silver and copper ores were shipped from the Old Holt and Apex mines, respectively, to the Garfield smelter.

Wayne.—Uranium ore from 14 locations was shipped to mills in Colorado and Utah for processing. Principal producers were Industries & Mines, Inc. (Congress group), Uranium Industries, Inc. (Vanadium King 1 & 3), and A B & H Mining Co. Quantities from individual operations were small; however, the grade of some shipments was unusually high, ranging from 0.14 to 2.20 percent uranium oxide.

Weber.—The construction materials—clays, sand and gravel, and stone—comprised all but $1,600 of the $177,700 recorded as the value of all minerals produced. In terms of value, sand and gravel produced by five commercial operators and two contractors for the Federal Bureau of Public Roads and Utah State Road Commission was the most important commodity. Crushed limestone and miscellaneous stone was quarried by two contractors for the Federal Bureau of Reclamation and used as riprap. The operation of the Harrisville Brick Co. plant at Ogden was responsible for all the clay produced in the county. The Norman Mining Co. produced 46 tons of Metallurgical-grade fluorspar, which was sold to the Government for stockpiling.

The Mineral Industry of Vermont

By James R. Kerr[1]

THE VALUE of Vermont mineral output in 1958 decreased slightly as a result of the closing of the Elizabeth mine of Appalachian Sulphide, Inc., and the subsequent loss of mineral wealth in copper, pyrites, gold and silver. The value of stone production (including slate) increased 8 percent to comprise almost three-quarters of the total State mineral income. The value of sand and gravel, asbestos, clays, and talc output increased during the year. Lime was the only mineral production decreasing in value.

The Rutland County marble and slate deposits led in value of mineral output; the Washington County large granite output was followed by significant asbestos production in Orleans County.

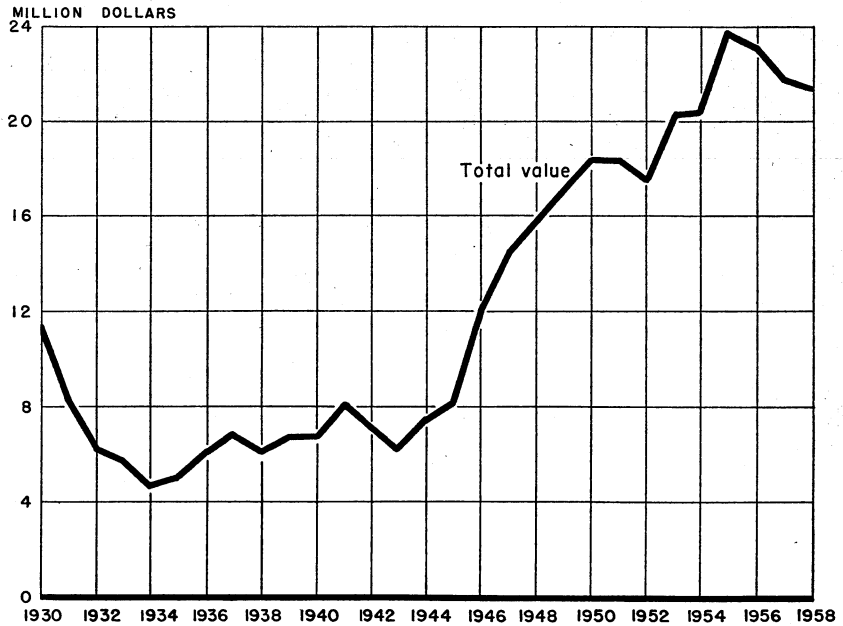

FIGURE 1.—Total value of mineral production in Vermont, 1930–58.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

TABLE 1.—Mineral production in Vermont [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Copper (recoverable content of ores, etc.)	3,405	$2,050	475	$250
Gold (recoverable content of ores, etc.)—troy ounces	62	2		
Pyrites—long tons	9,609	56		
Sand and gravel	2,215,553	1,051	1,881,990	1,316
Silver (recoverable content of ores, etc.)—troy ounces	36,794	33	5,101	5
Slate	(2)	3,269	(2)	(2)
Stone	556,999	11,404	808,169	15,789
Value of items that cannot be disclosed: Asbestos, clays, gem stones, lime, talc		4,058		4,106
Total Vermont [4]		21,893		21,443

[1] Production as measured by mine shipments, sales or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Included with stone in 1958.
[4] Total adjusted to eliminate duplicating value of stone.

REVIEW BY MINERAL COMMODITIES

METALS

Copper and Silver.—Only a small output of copper was reported as production in Vermont ceased in February. Appalachian Sulphides announced the official closing of its Elizabeth mine owing to depletion of ore. It was one of the Nation's oldest copper mines, worked since 1793; its plant will be dismantled and shipped to its North Carolina operations. A small quantity of silver was recovered as a byproduct of the copper.

TABLE 2.—Mine production of recoverable copper, gold and silver, in terms of recoverable metals

Year	Copper		Gold		Silver	
	Short tons	Value	Fine ounces	Value	Fine ounces	Value
1949–53 (average)	3,597	$1,710,592	151	$5,285	37,088	$33,567
1954	4,352	2,567,680	185	6,475	48,572	43,960
1955	4,305	3,211,530	181	6,335	50,447	45,657
1956	3,403	2,892,550	(1)	(1)	(1)	(1)
1957	3,405	2,049,810	62	2,170	36,794	33,300
1958 [2]	475	249,850			5,101	4,617

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Final production data. Mine closed in February 1958.

NONMETALS

Asbestos.—Chrysotile asbestos was mined at virtually the same rate as in 1957. Output from the open-pit mine of Vermont Asbestos Mines, Division of the Ruberoid Co. at Belvidere Mountain in Orleans County was valued at $93.14 a ton, compared with $94.20 in 1957.

Twenty-three different grades of asbestos with wide variety in prices were produced.

Clays.—Increased output of miscellaneous clay, used almost entirely for manufacturing building brick, was reported.

Lime.—Both quick and hydrated lime, chiefly for chemical and industrial uses, were produced. A small output of hydrated building lime was also reported. Production decreased 18 percent, marking the third consecutive year of decreased lime output.

Mica, Reconstituted.—The Samia Corp. (subsidiary of Minnesota Mining & Manufacturing Co.) at Rutland continued to produce reconstituted mica. This sheet material is formed by papermaking procedures from specially delaminated mica scrap and is substituted for built-up mica in many applications.

Sand and Gravel.—Output of commercial sand and gravel decreased 20 percent but its value increased 9 percent because the average price increased from $0.70 to $0.96 a ton. A most notable change was the large decrease (34 percent) in consumption of paving gravel. Production of building gravel also decreased (29 percent), but the output of sand for both building and paving purposes increased 34 percent during the year.

Output of Government-and-contractor sand and gravel was reported from all 14 counties in Vermont. Although two more counties were represented than in 1957, production decreased 10 percent. Total value rose, however, because the value per ton assigned to this production increased. The output entirely for paving purposes was 19 percent sand and 81 percent gravel.

The trend toward greater preparation of sand and gravel was shown by the fact that 61 percent of total output was washed, screened, and otherwise prepared, compared with 42 percent in 1957.

Operating costs in the State were reported higher causing limited profits and making difficult the replacement of obsolete equipment.

Stone.—Total output of stone rose 17 percent chiefly because production of crushed granite for concrete aggregate and roadstone increased; significant Government-and-contractor production was reported for the first time. Crushed marble output also increased slightly. Production of crushed limestone decreased 12 percent, because demand for agstone and flux decreased, and railroad ballast was not produced.

Production and value of dimension stone increased significantly owing to greater output of marble. Less dimension granite, chiefly for monumental work, was produced than in 1957. Output of both cut and sawed dressed building marble increased; production of rough building and dressed monumental stone continued as in the preceding year.

The slate industry stopped its steady decline and increased production for the first time since 1954. Eighteen producers reported output for granules, structural and sanitary, flagging, roofing, and other purposes.

Talc.—Production of talc increased for the first time since 1954. Two producers were active in four counties. The processed ground talc was used in rubber, paper, roofing, insecticides, paint, asphalt, and

other applications. Production was centered in Lamoille and Washington Counties.

REVIEW BY COUNTIES

Almost 1 million tons of sand and gravel was produced by Government-and-contractor crews in the State as road construction and improvement continued at a rapid pace. The Vermont State Highway Department produced either with its own crews or with contractors in each of the State's 14 counties. The city of Barre, the city of Montpelier in Washington County, and the Forest Supervisor in Bennington and Rutland Counties also reported production. Government-and-contractor operations are not summarized in the individual county reviews but rather are listed in table 3.

Addison.—Vermont Associated Lime Industry, Inc., produced crushed limestone for concrete aggregate and roadstone and for agricultural purposes. The lime-burning facilities of its New Haven plant remained inactive during the year, but its Winooski plant hydrated a portion of the New Haven plant lime.

TABLE 3.—Government-and-contractor sand and gravel, by counties, in short tons

County	1957	1958	County	1957	1958
Addison	91,504	14,000	Orange	72,251	142,934
Bennington	55,138	60,913	Orleans	115,135	81,476
Caledonia	12,312	39,347	Rutland	8,700	111,054
Chittenden	100,778	10,150	Washington	17,563	93,237
Essex	107,446	54,000	Windham	134,260	102,392
Franklin	189,569	37,753	Windsor	203,121	213,480
Grand Isle		3,500			
Lamoille		31,167	Total	1,107,777	995,403

TABLE 4.—Value of mineral production in Vermont, by counties

County	1957	1958	Minerals produced in 1958 in order of value
Addison	$116,571	$126,406	Stone, lime, sand and gravel.
Bennington	(1)	(1)	Sand and gravel.
Caledonia	(1)	(1)	Do.
Chittenden	381,778	372,296	Sand and gravel, stone, lime, clays.
Essex	50,469	(1)	Sand and gravel.
Franklin	(1)	(1)	Stone, sand and gravel.
Grand Isle	(1)	1,250	Sand and gravel.
Lamoille	(1)	(1)	Talc, sand and gravel.
Orange	2,925,344	1,090,320	Stone, copper, sand and gravel, silver.
Orleans	(1)	(1)	Asbestos, sand and gravel.
Rutland	9,077,469	10,533,484	Stone (slate), sand and gravel, clays.
Washington	(1)	(1)	Stone, talc, sand and gravel.
Windham	(1)	(1)	Sand and gravel, talc.
Windsor	175,673	171,944	Do.
Undistributed [2]	9,165,984	9,147,008	
Total	21,893,000	21,443,000	

[1] Figure withheld to avoid disclosing individual company confidential data, included with "Undistributed."
[2] Includes value for counties indicated by footnote 1.

Bennington.—Production of building and paving sand and gravel was reported by William E. Dailey, Jr., and Burgess Bros. at stationary plants near North Bennington. The Bennington Brick Co., former producer of miscellaneous clay, was reported out of business.

Caledonia.—The county continued as the leading sand and gravel producing area in the State. Production used entirely for paving purposes was centered near St. Johnsbury; Caledonia Sand & Gravel Co. was the major producer.

Chittenden.—Sand and gravel was produced at one portable and four stationary plants. W. C. Kirby, Burlington, Vermont Paving Co., Richmond, and Cass-Warner Corp., Hinesburg, led in production, which was used chiefly for building and paving.

Vermont Associated Lime Industries, Inc., completed installing a 10-foot by 125-foot, coal-burning rotary kiln at Winooski late in the year and placed three shaft kilns on a standby basis. Its limestone quarry at Winooski yielded agstone and fluxing stone in addition to the stone used in lime manufacture.

Drury Brick Co. mined miscellaneous clay from an open pit near Essex Junction for use in brickmaking.

Essex.—Sand and gravel for paving was produced for the Vermont State Highway Department.

Franklin.—Swanton Lime Works, Inc., quarried limestone near Swanton for a wide variety of markets, chiefly road building, paper manufacturing, agricultural and mineral foods.

Paving sand and building gravel were produced near Swanton by S. H. Evanson and Ray Dubois.

Grand Isle.—The Vermont Marble Co. Isle La Motte quarry was idle.

Lamoille.—Eastern Magnesia Talc Co., Inc., No. 4 mine and grinding mill at Johnson produced and ground talc for rubber, paper, roofing, insecticide, and paint manufacturing, and other uses. A small tonnage of crude was shipped to a foundry in Cleveland, Ohio.

Paving sand and gravel was produced near Johnson by Albert Nadeau. V. C. Farr produced sand and gravel for miscellaneous uses at Morrisville.

Orange.—Appalachian Sulphides, Inc., in February closed the Elizabeth mine near South Stratford owing to depletion of the copper ore. This property, one of the Nation's oldest copper mines, was first worked in 1793.

Some copper and silver were recovered from ore obtained in final cleanup. Output of copper from the mine since it started exceeds 110 million pounds; more than 50 percent was recovered in 1943–57. The brief history of the mine is related in a 1954 report, describing its geology.[2]

The Rock of Ages Corp. produced rough dimension granite for monuments and mausoleums from the Pirie quarry near Williamstown.

Willar Martin produced paving gravel at a portable plant near East Corinth, and Levi Lemieux produced paving sand and gravel at a stationary plant near Barre Town.

Orleans.—Vermont Asbestos Mines, Division of the Ruberoid Co., continued mining its open pit on Belvidere Mountain near Lowell. The ore was processed at the company mill near the mine to produce 23 grades of asbestos fiber at a wide range of prices.

Lyell & Howard Reed, Partners, did not quarry granite.

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[2] McKinstry, H. E., and Mikkolo, Aimo K., The Elizabeth Copper Mine, Vermont: Econ. Geol., vol. 49, No. 1, January–February 1954, 30 pp.

Rutland.—Rutland County again led in Vermont mineral production, mostly because of the output from its valuable marble and slate deposits.

Vermont Marble Co. and the Green Mountain Marble Corp. produced marble, chiefly cut and sawed dressed exterior building marble; output of cut and dressed interior building marble was also important.

Eighteen producers, chiefly Central Commercial Co., increased output of slate in 1958. Granules were the most important end use.

White Pigment Corp. crushed limestone chiefly for whiting; a small quantity was used for paper and chemical manufacture.

Vermont Marble Co. produced sand for sawing and rubbing marble at Brandon. Three other active stationary plants produced chiefly paving material.

Rutland Fire Clay Co. used miscellaneous clay mined in previous years to produce a small quantity of refractory mortar.

Washington.—The Graniteville and Websterville area again yielded significant quantities of both crushed and dimension granite. Output by the Rock of Ages Corp. (three quarries) and Wells Lamson Quarry Co. was rough dimension stone for monuments and mausoleums. A small quantity of rough architectural stone was also produced. Output of commercial crushed granite for concrete aggregate and roadstone almost doubled. Government-and-contractor production was reported by the State of Vermont Highway Department.

Eastern Magnesia Talc Co. continued mining underground near Waterbury and produced crude talc, which was ground and sold for a wide variety of uses including rubber, paper, roofing, insecticide, and paint manufacture. Considerable quantities were also sold to dealers.

King's Pit and Wells Lamson Quarry Co., two commercial sand and gravel operations near Barre, produced paving sand and gravel and other sand.

Windham.—Increased output of sand and gravel was reported; the entire production was used for road paving. Brattleboro Sand & Gravel Co. and West River Sand & Gravel Co. reported output near Brattleboro.

Vermont Talc Co. continued mining at Windham and milling near Chester, Windsor County; it produced talc for use in insecticides, and for rubber and paint manufacture plus other miscellaneous uses.

Windsor.—Colonial Sand & Gravel, Inc., and Vermont Concrete Pipe produced paving sand and gravel near Sharon in the northern part of the county.

During the entire year, the Eastern Magnesia Talc Co. Hammondsville Quarry produced crude talc, which was ground at the Gassets mill for use as roofing material.

Vermont Marble Co. closed its quarry in Windsor County in March.

The Mineral Industry of Virginia

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Virginia Division of Mineral Resources.

By Robert W. Metcalf,[1] James L. Calver,[2] and Stanley A. Feitler[1]

VALUE of Virginia's mineral production in 1958 declined 11 percent to $203 million from the record year 1957 but still was the third highest on record. The lower business activity and a slackening in foreign demand due to accumulated stocks resulted in substantial declines in production of coal and most other minerals.

The output of sand and gravel, stone, clays, gypsum, salt, and iron oxide pigments was larger than in 1957. Most other minerals showed small to large declines. Measured by value, coal, stone, cement, and sand and gravel ranked highest. Coal supplied over 60 percent of Virginia's mineral production.

The value of fuel was 65 percent of the total value, that of nonmetals about 32 percent, and that of metals about 3 percent.

Trends and Developments.—The increase in road building in Virginia led to opening of several new stone quarries and a large increase in paving-sand and gravel production.

A growing trend in road construction was in the use of soil aggregate in constructing roads. The demand for this controlled base material increased, and consumption may have reached 400,000 tons in 1958, according to one large aggregate producer. In response to the increased demand for roadmaking materials and to the construction of a new airport, several new aggregate plants were started, particularly in the counties adjoining or near the District of Columbia.

A highlight of the year was construction of the new Moss No. 3 mine and coal-preparation plant at Carbo, southwestern Virginia, by Clinchfield Coal Co., a division of the Pittston Co. This project, to cost $20 million, included erection of a $1.5 million lightweight-aggregate plant adjacent to the coal-preparation plant. The two-kiln lightweight-aggregate plant, which will use shale from the coal-preparation plant as raw material, was to be in operation in January 1959.

Because of the continued growth of salt-derived chemicals, Olin-Mathieson Chemical Co. placed in operation at Saltville a new plant for making soda ash.

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[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.
[2] State geologist, Virginia Division of Mineral Resources, Charlottesville, Va.

Legislation and Government Programs.—Mica was purchased from producers by the Government for the strategic minerals stockpile through the General Services Administration (GSA) Spruce Pine (N.C.) Materials Purchase Depot. The Government also purchased some Metallurgical-grade manganese ore of 35 percent or more manganese content under the Defense Production Act carlot purchase program.

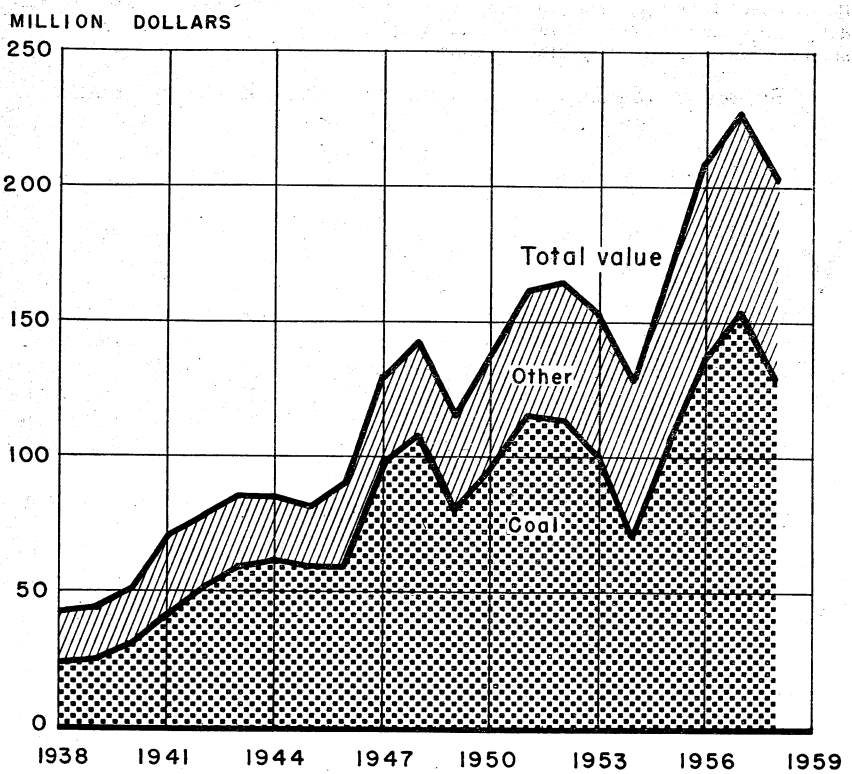

FIGURE 1.—Value of coal and total value of mineral production in Virginia, 1938–58.

TABLE 1.—Mineral production in Virginia [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays	893,255	$986	1,152,850	$1,143
Coal	29,505,579	153,959	26,826,067	130,319
Gem stones	[2]	[3]	[2]	3
Lead (recoverable content of ores, etc.)	3,143	899	2,934	687
Lime	510,216	6,029	471,313	5,533
Manganese ore (35 percent or more Mn)--gross weight	12,655	1,058	8,128	647
Manganese ore, ferruginous (10 to 35 percent Mn) gross weight	----------	----------	56	1
Mica, sheet--pounds	529	6	147	2
Natural gas--million cubic feet	2,465	661	2,521	681
Petroleum (crude)--thousand 42-gallon barrels	6	[3]	6	[3]
Sand and gravel	[4] 7,046,869	[4] 9,877	7,158,228	10,834
Silver (recoverable content of ores, etc.)--troy ounces	1,745	2	2,023	2
Slate	[3]	1,003	[5]	[5]
Stone	[6] 14,243,510	[6] 21,158	15,412,947	27,504
Zinc (recoverable content of ores, etc.)	23,080	[7] 5,277	18,472	[7] 3,808
Value of items that cannot be disclosed: Perlite, portland cement, masonry cement, feldspar, gypsum, iron oxide pigments, kyanite, pyrites, salt, stone (dimension miscellaneous, dimension sandstone, and calcareous marl, 1957), talc and soapstone, titanium concentrate (ilmenite and rutile), and values indicated by footnote 3	----------	29,745	----------	25,420
Total Virginia [8]	----------	[9] 227,108	----------	203,226

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Revised; supersedes figure in commodity chapter.
[5] Beginning with 1958, slate included with stone.
[6] Excludes certain stone, value for which is included with "Items that cannot be disclosed."
[7] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at the mine.
[8] Total adjusted to eliminate duplication in value of clays and stone.
[9] Revised figure.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Output declined owing to slower business activity and was 9 percent below the peak year 1957. The average value a ton dropped 7 percent in 1958. Despite the loss in output, Virginia remained the sixth ranking coal-producing State. Coal comprised 65 percent of the value of the total mineral production of the State. Low- and high-volatile coals for domestic and industrial use and some semi-anthracite for domestic heating were mined. Four counties in southwestern Virginia produced 89 percent of the tonnage valued at 88 percent of the total coal output. Increasing tonnages were recovered by strip and auger mining, although most of the coal was mined at underground mines.

Petroleum and Natural Gas.—Production of petroleum and natural gas was important locally. No new oil wells were completed, and no discoveries of new oil or gas fields were made. The only output of oil came from the Rose Hill field in Lee County. Production of natural gas was chiefly from wells in Dickenson and Buchanan Counties, with a small output from Wise County. Production from the Old Early Grove field in Scott and Washington Counties virtu-

TABLE 2.—Production and value of bituminous coal, by counties, in thousands

County	1957		1958	
	Short tons	Value [1]	Short tons	Value [1]
Buchanan	10,481	$50,179	9,570	$43,196
Dickenson	5,268	28,337	5,166	24,926
Lee	550	3,380	364	2,062
Montgomery	25	190	12	75
Russell	2,745	14,307	2,672	13,163
Scott	16	55	2	11
Tazewell	3,994	26,355	2,752	18,192
Wise	6,427	31,156	6,288	28,694
Total	29,506	153,959	26,826	130,319

[1] 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 as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

ally ceased. According to the American Gas Association, reserves of natural gas, as of December 31, 1958, totaled 38,421 million cubic feet (14.65 p.s.i.a., at 60° F.) compared with 37,421 million cubic feet on December 31, 1957. All reserves were nonassociated—that is, free gas not in contact with crude oil in the reservoir. Four field wells for natural gas and 11 unsuccessful wildcats were completed. The wells were drilled by cable-tool methods to depths of 3,750 to 5,000 feet. Drilled footage totaled 19,711 feet, an average footage of 4,928 feet per well.

NONMETALS

Aplite.—Two firms mined aplite near Piney River for sale chiefly to glass manufacturers because of its high alumina content. A third company was building a mill. Sales of ground aplite were 7 percent higher than in 1957.

Cement.—Shipments of masonry and portland cement combined decreased 10 percent in quantity and 7 percent in value compared with 1957. Portland-cement shipments also declined 10 percent in tonnage and 7 percent in value, while masonry shipments dropped 14 percent compared with 1957. No hydraulic lime was made in Virginia, as the firm formerly reporting this product converted its output to masonry cement. Two companies operating three plants produced portland cement; masonry cement also was produced at two of these operations, and one other company produced masonry cement only. Two plants in Augusta and Botetourt Counties were dry-process plants and utilized captive limestone and shale and captive limestone, respectively, in making cement. One plant in Norfolk County used wet-process methods and captive calcareous marl and clays. The fourth plant in Warren County consumed local shales to make masonry cement. General-use and moderate-heat portland cement comprised the bulk of the shipments, although smaller quantities of high-early-strength and other cements were also manufactured and shipped.

Clays.—Greater building activity and higher lightweight-aggregate output resulted in a 29-percent increase in clay production. Common or miscellaneous clay or shale comprised all of the output and was consumed mostly in manufacturing building brick and other heavy clay products, lightweight aggregate, and portland cement. Four-

teen firms produced clays at 17 plants in 14 counties. One new plant started operations. The leading clay-mining counties, in order of value of output, were: Botetourt, Buckingham, Chesterfield, Henrico, and Prince William.

TABLE 3.—Clays sold or used by producers

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	777,931	$765,146	1956	1,000,019	$1,032,665
1954	704,843	723,292	1957	893,255	986,302
1955	935,941	873,348	1958	1,152,850	1,143,160

Feldspar.—The production of both crude and ground feldspar was approximately the same as in 1957. One firm in Bedford County produced potash, soda, and mixed feldspar, which, after grinding, was used chiefly in manufacturing pottery and enamel.

Gem Stones.—A large increase in the recorded value and variety of gems and mineral specimens collected was due both to the widening interest in mineral collecting and lapidary materials in recent years and to a much broader coverage in 1958 of possible producers. The principal areas of reported stones and mineral specimens were Amelia and Madison Counties, where amazonite from the Amelia Court House region and unakite from the Rose River region, respectively, predominated. Other reported minerals were gathered in five other counties.

Gypsum.—United States Gypsum Co. mined and calcined crude gypsum at Plasterco (Washington County) and operated a mill and plasterboard plant there and a calcining plant at Norfolk. Both domestic and imported gypsum was treated at the Norfolk plant. Imported gypsum was sold for use as land plaster by certain fertilizer companies in the Norfolk area.

Iron Oxide Pigments.—Crude iron oxide pigments were produced by one firm in Pulaski County and finished natural and manufactured pigments at two plants, also in Pulaski County and at one plant in Franklin County. Crude pigments included sienna, ocher, and natural yellow oxides. Finished pigments included mineral blacks, browns, reds, and yellows. Crude-pigments output did not change appreciably from 1957, but finished pigments dropped nearly one-fourth because of lowered construction and slower business activity.

Kyanite.—Owing to the smaller demand for refractories and ceramic ware, output of the Kyanite Mining Corp. declined 19 percent compared with the active year 1957. Production continued at mines and mills in Buckingham and Prince Edward Counties and at the finer grinding plant at Pamplin, Prince Edward County. Special refractories, insulators, and porcelain were the more important uses for this material.

Lime.—Production of lime in Virginia declined moderately compared with 1957. Chemical and industrial uses comprised 93 percent of the total lime, while quicklime totaled 89 percent of the total. Sales of building lime decreased, and marketed production of agricultural lime gained compared with 1957. Oyster or other shell was consumed by two companies in the Norfolk area for making lime.

Three companies—two in Giles County and one in Shenandoah County—burned the bulk of the lime manufactured in Virginia. Other counties in which lime was produced in 1958 were Frederick, Isle of Wight, Norfolk, and Tazewell.

A good account of the lime industry of Virginia and the manufacture, types, and uses of lime was published.[3]

TABLE 4.—Lime (quick and hydrated) sold and used by producers, by types

Year	Agricultural		Building		Chemical and other industries		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	21,103	$259,717	9,671	$110,669	399,302	$3,834,379	430,076	$4,204,765
1954	11,146	91,616	14,781	180,802	419,231	4,338,227	445,158	4,610,645
1955	26,945	333,464	4,355	52,034	462,993	4,663,199	494,293	5,048,697
1956	25,125	322,644	3,572	41,914	483,649	5,561,357	512,346	5,925,915
1957	[1] 17,897	354,287	[1] 4,190	51,995	[1] 35,250	5,622,860	510,216	6,029,142
1958	[2]	[2]	[2]	[2]	438,449	5,119,929	471,313	5,532,833

[1] Excludes production of quicklime to avoid disclosing individual company confidential data; included in total.
[2] Figure withheld to avoid disclosing individual company confidential data; included in total.

Mica.—Sales of mica were approximately one-third those in 1957. All was full-trimmed and sold through the Government GSA Spruce Pine (N.C.) Purchase Depot. Mica was produced in Amelia, Bedford, and Henry Counties. No scrap mica was sold. The Richmond Mica Corp., Newport News, wet-ground domestic and imported scrap and flake mica for use in paints, rubber, wallpaper, plastics, and unspecified products.

Nitrogen Compounds.—Synthetic sodium nitrate, ammonia, urea solutions, ammonium sulfate, and other nitrogen compounds were manufactured by Allied Chemical & Dye Corp., Nitrogen Division, at Hopewell (Prince George County). These products were used chiefly as fertilizer or fertilizer ingredients.

Perlite.—Perlite from New Mexico was expanded by one firm at Hopewell, Prince George County. The expanded perlite was consumed largely for building plaster and concrete aggregate. Sales were nearly one-fourth greater than in 1957.

Pyrites.—General Chemical Division, Allied Chemical Corp., produced lump and fine pyrites concentrate at its Gossan mine in Carroll County. The product was shipped to Pulaski for use in the manufacture of sulfuric acid.

Roofing Granules.—The Blue Ridge Slate Corp. produced natural granules in Albemarle and Buckingham Counties for use in prepared roofing.

Salt.—Olin-Mathieson Chemical Corp. pumped brine from underground salt beds at Saltville. Output was 6 percent greater than in 1957. The brine was used in manufacturing chlorine, soda ash, and other chemicals.

[3] Wood, Robert S., Lime Industry in Virginia; Virginia Minerals, vol. 4, No. 2, April 1958, pp. 1-8.

Sand and Gravel.—The active road-construction program in Virginia was reflected in the large increase in the use of sand and gravel for paving and resulted in a small overall increase in output of sand and gravel. The decline in consumption of sand and gravel for structural use, however, followed the business recession and reduced construction starts characteristic of the year as a whole. The value of production rose to nearly $11 million and reflected the gradually rising average prices a ton over the last 3 years. Most of the sand and gravel was mined by commercial operators, as only 3 percent was obtained by State, Federal, or local governmental agencies.

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and uses

Uses	1957		1958	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Building	[1] 1,501,870	[1] $1,934,470	1,424,811	$1,928,977
Paving	[1] 841,067	[1] 905,087	1,077,708	1,145,371
Engine	80,879	93,251	35,516	46,482
Filter	35,258	34,100	29,247	44,467
Other, including fill	325,322	167,257	543,722	657,548
Total	2,784,396	3,134,165	3,111,004	3,822,845
Gravel:				
Building	[2]	[2]	1,455,729	2,767,734
Paving	[1] [2]	[1] [2]	2,138,450	3,446,796
Total	[2]	[2]	3,594,179	6,214,530
Undistributed [3]	[1] 4,053,081	[1] 6,613,847	224,710	624,190
Total sand and gravel	[1] 6,837,477	[1] 9,748,012	6,929,893	10,661,565
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving	57,924	33,905	139,596	75,589
Gravel:				
Building			2,635	922
Paving	151,468	94,492	86,104	96,397
Total	151,468	94,492	88,739	97,319
Total sand and gravel	209,392	128,397	228,335	172,908
Grand total	[1] 7,046,869	[1] 9,876,409	7,158,228	10,834,473

[1] Revised figure; supersedes figure given in commodity chapter.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes glass sand, molding sand (1958), filter sand (1957), and grinding and polishing sand (1958).

Paving and structural uses of sand and gravel comprised 88 percent of the sand and gravel produced. Other types or uses of sand and gravel in Virginia were glass, molding, grinding, and polishing and engine sands and railroad ballast, fill sand and gravel, and "other" sand and gravel, consisting mostly of material for ice control and other miscellaneous uses. Sand and gravel was reported from 34 counties compared with 26 in 1957. The principal counties producing commercial sand and gravel were Henrico, Chesterfield, Fairfax, Prince George, and Princess Anne.

Soapstone.—Mine production of soapstone for grinding was slightly less and sales of ground material were over 10 percent less than in

TABLE 6.—Stone sold or used by producers, by kinds and uses

Kind and use	1957		1958	
	Short tons	Value	Short tons	Value
Dimension stone: Sandstone, all uses	(1)	(1)	437	$5,215
Crushed and broken stone:				
Granite: Concrete and roadstone [2]	2,416,689	$3,508,744	2,815,440	4,298,385
Basalt: Concrete and roadstone [2]	973,568	1,609,120	1,149,643	1,900,508
Limestone:				
Fluxing stone	564,491	945,608	517,861	866,313
Concrete and roadstone	5,325,510	7,451,638	5,446,882	7,703,025
Railroad ballast [3]	489,225	577,704	258,216	328,233
Agriculture	585,751	1,131,716	648,735	1,309,775
Miscellaneous	3,678,358	5,103,158	3,909,878	6,155,923
Sandstone: All uses	131,508	382,346	238,951	510,777
Shell: Miscellaneous uses	19,874	215,939	19,627	139,421
Undistributed [4]	58,536	231,794	407,279	4,286,297
Total	[5] 14,243,510	[5] 21,157,767	15,412,949	27,503,872

[1] Figure withheld to avoid disclosing individual company confidential data; not included in total.
[2] Includes riprap and railroad ballast.
[3] Includes riprap.
[4] Includes crushed and broken marble, miscellaneous dimension and crushed and broken stone, dimension and crushed and broken slate (1958), and crushed and broken calcareous marl.
[5] Incomplete total—excludes dimension miscellaneous stone, dimension sandstone, and calcareous marl.

1957. Two firms, in Franklin and Nelson Counties, respectively, sold ground soapstone, chiefly for roofing, rubber, foundry facings, and insecticides. Statistics on dimension soapstone are included in the stone section.

Stone.—Increased highway and street construction resulted in higher output of stone and consumed 62 percent of the total stone produced. Stone remained in second place in both tonnage and value among Virginia minerals. Stone quarried or mined consisted of basalt, granite, marble, sandstone, miscellaneous stone, calcareous marl, and slate (the latter included for the first time in this discussion under stone). Oyster and other shell used as agstone, in lime burning, and for various other purposes also was included. Limestone furnished 70 percent of the stone output and granite and basalt comprised most of the remainder. All production was crushed and broken stone, except for some quantities of dimension sandstone and miscellaneous stone. Measured in terms of total tonnage, stone-producing counties ranked as follows: Botetourt, Giles, Augusta, Campbell, and Frederick.

Stone was mined or quarried in 45 counties, in 41 of which commercial operations were active. There were 85 commercial producers and 8 State or municipal agencies in these 45 counties in addition to 4 companies producing and marketing shell. Commercial stone producers were distributed as follows: Limestone, 45 companies (50 quarries); granite, 15 companies (15 quarries); basalt, 9 companies (9 quarries); sandstone, 6 companies (6 quarries); marble, 1 company (1 quarry); miscellaneous stone, 2 companies (2 quarries); calcareous marl, 3 companies (3 quarries); and slate, 4 companies (4 quarries).

Sulfur, Recovered Elemental.—The American Oil Company began to recover sulfur at its Yorktown refinery. The sulfur was obtained from fuel gas by removing hydrogen sulfide which was converted to sulfur. Production was somewhat over 11,000 long tons valued at about $320,000.

METALS

Aluminum.—Reynolds Metals Co., Richmond, operated five plants in Virginia, rolling aluminum foil, making aluminum extrusions, printing on aluminum foil, producing aluminum packaging materials, manufacturing aluminum yarn, and producing plastic films. A description of the South Plant, at Richmond, which rolls aluminum foil, was published.[4] Reynolds Metals Co. new aluminum-extrusion plant at Richmond continued operations. This $5.5 million plant contained four 2,300-ton extrusion presses and had a rated capacity of up to 2 million pounds a month.

Ferroalloys.—L. J. Lavino Co., Lynchburg, produced a sizable quantity of standard-grade ferromanganese. Equipment consisted of two blast furnaces, six stoves, three steam blowing engines, and one turbo blower.

American Brake Shoe Co. at three division plants at Portsmouth produced brake shoes, iron and alloy castings, bronze and copper bearings, railroad and diesel-engine bearings, and cast iron and steel freight-car wheels. Materials consumed included scrap iron and steel, primary metals, chrome, and all grades of pig iron and ferroalloys. At Winchester this firm also manufactured sintered metallic friction materials.

Tredegar Co., Richmond, consumed foundry grades of scrap, railroad scrap, ferromanganese, ferrosilicon, and spiegeleisen in manufacturing railroad construction items, iron castings, and projectiles. Equipment included cupolas, rolling mills, heating furnaces, forging press, three forging hammers, and three bore mills.

Virginia had a thriving foundry industry, which consumed a wide variety of primary metals, many grades of iron and steel scrap, pig iron, and various ferroalloys in manufacturing castings, bearings, and other metal products. In the 58 active foundries the following products were made (the figures do not add, as many of the foundries manufactured more than one kind of casting): Aluminum and magnesium castings, 28 (including one firm using magnesium); brass and bronze castings, 33; die casting, 3; gray iron or white iron castings, 50; and steel and malleable castings, 4. In addition, the National Advisory Committee for Aeronautics maintained a research laboratory at Langley Field, specializing in the above-mentioned phases of casting problems, except for die casting.

Lead and Zinc Ores.—Owing to lower demand and oversupply, lead and zinc output declined radically, accompanied by an even sharper drop in average value per pound. Zinc-lead ore was concentrated from mines at Austinville, Wythe County, and zinc ore from Timberville, Rockingham County. In Wythe County production at the Ivanhoe mine was suspended on July 1 because of reduced demand and low realizations. Lead and zinc concentrates were shipped to Palmerton, Pa., for smelting and lead concentrate to East Chicago, Ind., and Federal, Ill. Because of the low zinc prices, output at the Tri-State Zinc, Inc., Timberville mine ceased indefinitely on January 16.

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[4] Eichner, F. L., Aluminum Foil Rolling at Reynolds Richmond Plant: Min. Ind. Jour. (Virginia Poly. Inst.), vol. 5, No. 3, September 1958, pp. 4-5.

One secondary-lead-smelting firm (Hyman Viener & Sons, Richmond) treated lead wool, scrap pipe, sheet, and traps, and zinc ashes, drosses, and skimmings to produce lead pig ingot and zinc ingots.

TABLE 7.—Mine production of recoverable silver, lead, and zinc

Year	Silver		Lead		Zinc	
	Troy ounces	Value	Short tons	Value	Short tons	Value [1]
1949–53 (average)	[2] 1,169	[2] $1,058	2,931	$879,747	12,596	$3,548,350
1954	1,773	1,605	4,320	1,183,680	16,738	3,615,408
1955	1,850	1,674	2,997	893,106	18,329	4,508,934
1956	1,874	1,696	3,035	952,990	19,196	5,180,616
1957	1,745	1,579	3,143	898,898	23,080	5,277,476
1958	2,023	1,831	2,934	686,556	18,472	3,807,853

[1] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.
[2] 1953 only; no output reported, 1949–52.

Lithium.—An article on the Foote Mineral Co. plant at Sunbright, Va., describes the entire mining and manufacturing sequence from the mining and concentration of the spodumene ore at Kings Mountain, N.C., through the processing of lithium hydroxide at Sunbright.[5] A discussion of lithium's uses and possible applications is included, as well as an extensive bibliography, particularly of Virginia references.

Manganese Ore.—Manganese-ore production decreased more than one-third in tonnage and value compared with 1957. Twelve firms or individuals reported sales to GSA under the Government carlot program. Two of these discontinued mining in July. The leading county in the output of manganese ore was Augusta, followed by Bland, Smyth, Giles, and Wythe. For a small quantity of the production, the county was not specified. Most of the manganese ore produced was Metallurgical grade, of 35 percent or more manganese content. Some ferruginous manganese (30 percent Mn) also was mined and shipped.

TABLE 8.—Manganese ore and manganiferous ores shipped from mines

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	[1] 1,904	$145,108	1956 [2]	20,231	$1,901,983
1954	22,678	1,780,934	1957	12,655	1,057,462
1955	32,654	2,779,337	1958 [3]	8,184	648,479

[1] In addition, in 1949–53 there was an average output of 258 tons of ferruginous manganese ore, and an average output of 45 tons of miscellaneous ore.
[2] Incomplete total; excludes a small quantity of ferruginous manganese ore.
[3] Includes 56 tons of ferruginous manganese valued at $1,120.

A bibliography of references (with selected excerpts) to occurrences of manganese minerals and ores was published.[6]

Silver.—Recoverable silver was obtained as a byproduct from the zinc-lead ore concentrate produced at Austinville, Wythe County.

[5] Donahey, John W., Foote Mineral Company Operates World's Largest Lithium Plant: Min. Ind. Jour. (Virginia Poly. Inst.), vol. 5, No. 3, September 1958, pp. 1–3.
[6] Pegau, Arthur A., Virginia Manganese Minerals and Ores—a Selected Bibliography With Excerpts: Div. of Mineral Resources, Dept. of Conservation and Development, Circ. 7, Charlottesville, Va., 1958.

Titanium Concentrate.—Ilmenite was produced at Piney River, Amherst County, by American Cyanamid Co. for use in the adjacent company-owned mill. This concentrate was used in manufacturing titanium pigments. The Metal & Thermit Corp. plant in Hanover County, in its first year of commercial production, produced ilmenite and rutile. A description of the latter plant, a brief history of the company, and the industrial applications of its products were published.[7]

REVIEW BY COUNTIES

Government-and-contractor sand and gravel, mostly for paving use, was produced in 18 counties by the Virginia Department of Highways, both by its own crews and under contract. Counties in which 20,000 or more tons were mined were Accomack, Henrico, Northumberland, Rockbridge, and Russell. Other counties were Augusta, Buckingham, Campbell, Charlotte, Cumberland, Halifax, Nansemond, Northampton, Pittsylvania, Prince Edward, Roanoke, Rockingham, and Shenandoah. In addition, one county highway department (Henrico) reported an output of paving sand and gravel by its own crews.

Albemarle.—S. L. Williamson Co., Inc., Charlottesville, recovered bank-run sand and gravel by dragline for use as road material. S. A. Jessup, Charlottesville, reported production of a small quantity of bank-run sand and gravel for miscellaneous uses.

Basalt was mined, crushed, and screened for concrete aggregate and roadstone by Charlottesville Stone Corp. (Charlottesville). Superior Stone Co. continued to mine and process granite for building and highway construction at its Redhill quarry (Redhill). The Esmont plant of Blue Ridge Slate Corp. was idle.

Amelia.—Small sales of full-trimmed mica were made through GSA by two miners from six mines to the Materials Purchase Depot at Spruce Pine, N.C. Some 20 individuals reported collecting gem stones or mineral specimens in Amelia County. Most of these gathered amazonite from the famous Rutherford area near Amelia Court House. Other minerals collected included moonstone, cleavelandite, and spessartite.

Amherst.—Aplite was mined near Piney River by Riverton Lime & Stone Co. Division, Chadbourn Gotham, Inc. The material was processed by grinding and magnetic separation at the company Nelson County mill and shipped for use principally in glass manufacture. Competition of foreign window glass and lower output of automobiles and television apparatus reduced sales to these industries but development of new uses counterbalanced this trend to a great extent. Roadstone and concrete aggregate were also prepared from granite mined by this firm in a plant built during 1958 at Amherst.

American Cyanamid Co. mined ilmenite at Piney River. Output remained high, although it was slightly less than in 1937. All material was consumed in the company nearby titanium-pigment plant. Smiley Sand Co. washed and screened building sand recovered by dredging at a location north of Lynchburg.

[7] Virginia Minerals, New Titanium Plant: Vol. 4, No. 1, January 1958, pp. 1-7.

Appomattox.—Limestone was mined, crushed, and ground for agricultural purposes by the Virginia Department of Agriculture and Immigration.

Augusta.—Limestone was mined and sized for building and highway construction by three companies at quarries near Staunton. All of the producers had stationary plants and shipped by truck. Lehigh Portland Cement Co. mined limestone and shale for use in manufacturing cement in its plant in Fordwick. Portland cement for general use, high-early-strength cement, and mortar cement were produced and marketed, principally in Virginia, North Carolina, and West Virginia. Limestone was mined and ground for use as agstone by the Virginia Department of Agriculture and Immigration in a plant near Staunton. The Virginia Highway Department reported production of crushed limestone for highway construction and maintenance in Augusta County.

TABLE 9.—Value of mineral production in Virginia, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value [2]
Accomack		$9,450	Sand and gravel.
Albemarle	(3)	(3)	Stone, sand and gravel.
Amelia	$3,252	(3)	Mica, gem stones.
Amherst	(3)	(3)	Titanium concentrate, aplite, stone, sand and gravel.
Appomattox	(3)	39,732	Stone.
Augusta	(3)	(3)	Cement, stone, manganese, sand and gravel.
Bedford	(3)	(3)	Feldspar, mica.
Bland	(3)	73,032	Manganese, stone.
Botetourt	(3)	(3)	Cement, stone, clays.
Brunswick	(3)	(3)	Stone, clays.
Buchanan	50,178,827	43,196,102	Coal.
Buckingham	(3)	(3)	Stone, kyanite, clays, sand and gravel.
Campbell	(3)	(3)	Stone, sand and gravel.
Caroline	6,850		
Carroll	(3)	(3)	Pyrites, stone.
Charlotte	34	392	Sand and gravel.
Chesterfield	(3)	(3)	Sand and gravel, clays.
Clarke	13,500	16,000	Stone.
Culpeper	(3)	(3)	Stone, sand and gravel.
Cumberland	(3)	969	Sand and gravel.
Dickenson	28,336,606	24,926,148	Coal.
Fairfax	[4] 2,348,671	3,185,218	Sand and gravel, stone.
Fauquier	(3)	545,760	Stone.
Franklin	(3)	(3)	Soapstone.
Frederick	1,720,849	1,605,788	Stone, lime, sand and gravel, clays.
Giles	(3)	(3)	Lime, stone, manganese ore.
Goochland	(3)	307,000	Stone.
Greensville	(3)	(3)	Do.
Halifax	65	935	Sand and gravel.
Hanover	(3)	(3)	Stone, titanium concentrate.
Henrico	(3)	(3)	Sand and gravel, stone, clays.
Henry	28,341	(3)	Stone, mica.
Isle of Wight	(3)	80,099	Lime.
King William		62,000	Sand and gravel.
Lee	[5] 3,380,377	[5] 2,061,903	Coal, stone.
Loudoun	444,612	(3)	Stone.
Louisa		20	Gem stones.
Madison	60	231	Do.
Mecklenburg	415,000	(3)	Stone.
Montgomery	731,791	648,137	Stone, coal, sand and gravel, clays.
Nansemond	(3)	(3)	Clays.
Nelson	(3)	(3)	Stone, soapstone (talc), sand and gravel.
Norfolk	(3)	(3)	Cement, lime, sand and gravel, stone.
Northampton		5,180	Sand and gravel.
Northumberland		20,000	Do.
Nottoway	225,000	117,000	Stone.
Orange	(3)	(3)	Clays.
Page	658	14	Gem stones.
Patrick		(3)	Stone.
Pittsylvania	(3)	(3)	Stone, sand and gravel.
Powhatan		123,614	Stone.
Prince Edward	(3)	(3)	Kyanite, sand and gravel, gem stones.
Prince George	(3)	708,484	Sand and gravel.
Prince William	(3)	137,860	Clays, stone.
Princess Anne	326,982	353,785	Sand and gravel.

See footnotes at end of table.

TABLE 9.—Value of mineral production in Virginia, by counties[1]—Continued

County	1957	1958	Minerals produced in 1958 in order of value[2]
Pulaski	(3)	$64, 516	Iron oxide pigments, stone.
Roanoke	(3)	(3)	Stone, clays, sand and gravel.
Rockbridge	$987, 368	(3)	Sand and gravel, stone, clays, gem stones.
Rockingham	(3)	(3)	Stone, zinc, sand and gravel.
Russell	14, 306, 507	13, 719, 033	Coal, stone, sand and gravel.
Scott	[5] 55, 337	[5] 11, 371	Stone, coal.
Shenandoah	1, 938, 195	(3)	Lime, stone, sand and gravel.
Smyth	[4] 3, 041, 464	3, 575, 359	Salt, stone, sand and gravel, manganese ores, clays.
Spotsylvania	329, 185	(3)	Sand and gravel, stone.
Stafford	----------	(3)	Sand and gravel.
Surry	2, 640	(3)	Stone.
Tazewell	27, 334, 703	18, 967, 626	Coal, stone, lime, clays.
Warren	1, 319, 361	1, 117, 047	Cement, stone.
Washington	(3)	(3)	Gypsum, stone.
Wise	31, 155, 622	28, 694, 315	Coal.
Wythe	[6] 5, 294, 365	[6] 4, 474, 997	Zinc, lead, stone, sand and gravel, manganese ore, silver.
	----------	2	Gem stones.
York	----------	----------	
Undistributed[7]	53, 182, 377	54, 377, 655	
Total[8]	[4] 227, 108, 000	203, 226, 000	

[1] The following counties are not listed because no production was reported: Alleghany, Arlington, Bath, Charles City, Craig, Dinwiddie, Essex, Floyd, Fluvanna, Gloucester, Grayson, Greene, Highland, James City, King and Queen, King George, Lancaster, Lunenburg, Mathews, Middlesex, New Kent, Rappahannock, Richmond, Southampton, Sussex, and Westmoreland.
[2] Value of fuels, including natural gas and petroleum, included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Revised; supersedes figure given in commodity chapter.
[5] Coal only; value of stone included with "Undistributed."
[6] Excludes stone, value for which may not be disclosed; value of stone included with "Undistributed."
[7] Includes value of natural gas and petroleum, and part of value of manganese ore (35 percent or more Mn), and gem stones, stone (1957), mica (1958), sand and gravel (1958), and values indicated by footnote 3; for these commodities complete distribution by counties not available.
[8] Total adjusted to eliminate duplicating the value of clays and stone used in making cement and lime.

South River Mining Co., Inc., the leading producer in Virginia, mined ore containing 35 percent or more manganese near Vesuvius, as well as a small quantity of ferruginous manganese (30 percent Mn). This ore was purchased through the Government carlot program.

Bedford.—Feldspar was mined at three open-pit mines near Bedford by Clinchfield Sand & Feldspar Corp. This feldspar was processed at the company mill at Bedford and sold for use in making pottery, enamel, and welding rods. States to which sizable tonnages were shipped included Ohio, New York, New Jersey, Pennsylvania, and Wisconsin. A small quantity of full-trimmed mica was sold through the GSA by one operator.

Bland.—Canva Mining Corp. near Bastean produced manganese ore (35 percent or more Mn) for sale to the GSA. A quantity of limestone riprap was produced at Bland Correctional Farm near White Gate.

Botetourt.—Botetourt continued to be the leading county in limestone production. Value was approximately the same as in 1957, but tonnage dropped about 14 percent. Five companies mined, crushed, and sized over 2 million tons of limestone for a wide variety of uses. Cement, concrete aggregate, and roadstone consumed 67 percent of the total output. Limestone used as a filler in fertilizer, agstone, and stone sand composed 20 percent of the total. The remaining 13 percent was used as chemical reagent, railroad ballast, mineral filler, and metallurgical flux; for coal-mine rock dust, and as a mineral additive in livestock feed.

Botetourt County ranked first in value of clay production. Roanoke-Webster Brick Co., Inc., and Virginia Lightweight Aggregate Corp. mined miscellaneous clay or shale at Webster near Roanoke for use in heavy clay products and lightweight aggregate, respectively.

Brunswick.—Granite was mined, crushed, and sized for use as concrete aggregate and roadstone at the Rawlings quarry by Bryan Rock & Sand Co. Miscellaneous clay or shale for making building brick was mined by Brick & Tile Corp., Lawrenceville.

Buchanan.—Buchanan County again was the first-ranking coal-producing county, although sales declined 9 percent from 1957. More than one-third of Virginia coal production, measured both by quantity and value was mined in this county. The number of mines totaled 796. Nearly 99 percent of the coal tonnage was from underground mines. Small tonnages were recovered by both strip and auger methods. Leading producers included Pocahontas Fuel Co. (Amonite mine), Island Creek Coal Co. (Keen Mountain mine), Harman Mining Corp. (Harman mine), and Jewell Ridge Coal Corp. (No. 2 mine).

The United Producing Co. and the United Fuel Gas Co. produced natural gas from the Berea sand in Buchanan County. Virtually the total gas flow was delivered to pipelines for distribution by Hope Natural Gas Co.

Buckingham.—Kyanite Mining Corp. continued to operate its mine and mill (opened in 1957) on Willis Mountain near Dillwyn. The kyanite was consumed principally for special refractory and ceramic products.

Slate was quarried, split, and trimmed for roofing, flagging, structural, and sanitary uses by three companies near Arvonia. Blue Ridge Slate Corp. produced roofing granules at its Dutch Gap slate quarry near New Canton.

Miscellaneous clay and shale was mined near New Canton (Bremo Bluff) for use in making lightweight aggregate near the mine by Southern Lightweight Aggregate Corp.

Campbell.—Rockydale Stone Service Corp. (Concord) and Blue Ridge Stone Corp. (Lynchburg) mined and prepared limestone for use as concrete aggregate and roadstone. Miscellaneous stone quarried by Virginia Greenstone Co., Inc. (Lynchburg), was sold under the trade name "Virginia Greenstone," as rough and dressed dimension stone and rubble.

Caroline.—Sand and gravel for building was prepared in a stationary plant by Dyson Sand and Gravel Co. at Milford.

Carroll.—Pyrite was mined at the Gossan mine near Galax by General Chemical Division, Allied Chemical Corp. The mineral was shipped to Pulaski for use in making sulfuric acid. Sandstone was mined by the city of Galax for road maintenance and repairs.

Chesterfield.—Chesterfield ranked as the third county in tonnage and value of sand and gravel produced, although output was less than in 1957. Material prepared in a stationary plant at Dutch Gap and by dredge at Kingsland Reach was used for building and paving. Part of the sand was used as a filter medium. Two companies across the James River from Richmond produced miscellaneous clay or shale for use in manufacturing building brick.

Clarke.—Calcareous marl was produced by J. C.. Digges & Sons, Old Chapel Lime Marl Plant (White Post), and Elmer Kinney (Berryville) for agricultural purposes.

Culpeper.—Culpeper Sand Co. processed sand in a stationary plant for building and paving purposes. Culpeper Stone Co. (Culpeper) mined and crushed quartzite for use as concrete aggregate and roadstone.

Dickenson.—Dickenson County remained third in rank among coal-producing counties. The number of active mines numbered 153. Over 90 percent of the tonnage came from underground mines. A sizable tonnage was produced by strip mining and a small quantity by auger. Leading producers were: Clinchfield Coal Corp. (five underground mines and one strip mine), Baker Coal Co. (one underground mine), Contracting Enterprise, Inc. (one strip mine), and Bolling Coal Co. (one strip mine).

Natural gas production by the Clinchfield Coal Co. was obtained from Devonion shale and Beria sand. Sales were to Kentucky-West Virginia Gas Co. for distribution by pipeline.

Fairfax.—Fairfax County ranked second in output of sand and gravel. Seven producers were active, and all of the output was consumed in building and highway construction. Approximately 79 percent of the production was washed and screened. Unwashed bank-run material was used in highway construction. The principal producers were Northern Virginia Construction Co., Inc., Virginia Sand & Gravel Co., Inc., and Alexandria Sand & Gravel Corp., all of Alexandria.

Granite was mined and sized for use as riprap, concrete aggregate, roadstone, and railroad ballast by Graham Virginia Quarries, Inc., near Occoquan. Fairfax Quarries, Inc., mined basalt for building and highway construction near Fairfax. Oystershell prepared by Herbert Bryant, Inc. (Alexandria), was used as poultry grit and in the production of lime.

Fauquier.—Stone production in Fauquier County was approximately the same in tonnage and value as in 1957. W. W. Saunders (Warrenton) scrapped an old plant and built a new one at a new quarry site on the same property. W. W. Saunders, as well as Riverton Lime & Stone Division, Chadbourne Gotham, Inc. (Paris), produced crushed basalt for building and highway construction. Crushed limestone was prepared by Millbrook Quarries, Inc. (Broad Run), for roadstone and concrete aggregate. Sandstone, for flagging and facing stone, was produced by James Edward Corum at Halls quarry near Broad Run and J. W. Costello at the Costello quarry near The Plains.

Franklin.—Blue Ridge Talc Co., Inc., Henry, produced soapstone from its King Ramsey quarry and ground it for insecticides, foundry facings, and other uses. The same firm marketed finished pigments, including natural and manufactured finished red oxides, manufactured black and browns, ochers, siennas, umbers, and various blended colors. Pigment processing included crushing, grinding and drying.

Frederick.—Virginia Glass Sand Corp. operated a quarry and the Shenandoah Silica Co., Inc., a processing plant near Gore, from which a large quantity of glass sand was produced and shipped by rail. A small quantity of sand for building was shipped by motortruck.

Shenandoah Brick & Tile Corp. produced shale near Winchester for consumption in building brick.

M. J. Grove Lime Co. operated quarries at Stephens City and Middletown. The quarry at Stephens City furnished limestone for use in manufacturing building lime and for use as flux, coal-mine rock dust, agstone, crushed-stone aggregate, and other uses. The Middletown quarry furnished dolomite for use as furnace flux. Stuart M. Perry, Inc. (Winchester), produced crushed and sized limestone for building, paving, and agstone.

Giles.—The second-ranking stone (limestone) production in Virginia was reported from Giles County, although tonnage and value were 13 and 17 percent lower, respectively, than in 1957. Virginia Limestone Corp. (Koltz) quarried, crushed, and screened limestone for riprap, metallurgical uses, concrete aggregate, roadstone, and railroad ballast. National Gypsum Co. (Kimballton), Ripplemead Lime Co., Inc. (Ripplemead), and Standard Lime & Cement Co. (Kimballton) all mined limestone for manufacturing lime in their respective plants and sold undersize and excess stone for a variety of uses.

J. Gordon Gusler produced manganese ore from the H. M. Reynolds mine near Newport during the first part of 1958. During the balance of the year this mine was leased to the Monterey Mining Co. of Newport.

Goochland.—Granite was mined and prepared for use as concrete aggregate and roadstone by Boscobel Granite Corp. at a stationary plant in Richmond. Royal Stone Co. transferred its operation from Orange County to Hylas in Goochland County. Production of crushed quartzite for road material was begun July 10 at the new plant with an hourly capacity of 175 tons.

Greensville.—Trego Stone Corp. (Skippers) mined, crushed, and sized granite, principally for roadstone, although part of the production was used as railroad ballast and riprap.

Hanover.—The new titanium concentrate plant at Montpelier near Beaverdam, constructed by Metal & Thermit Corp., New York, N.Y., operated the full year and produced both ilmenite and rutile.

Basalt was prepared for use in building and highway construction, railroad ballast, and riprap by J. E. Baker Co. at its Verdon quarry near Doswell.

Henrico.—Henrico County was the leading sand and gravel producer. Sand and gravel for building and paving construction, filter sand, and fill was washed and screened. The sand mined for use as molding sand was shipped run-of-pit. The Tidewater Crushed Stone Co. mined and prepared granite for use in building and highway construction.

Daniels Brick & Tile Co., Inc., produced drain tile, flue lining, and fittings from river clay. Redford Brick Co., also of Richmond, manufactured building brick from shale (miscellaneous clay) mined near the city.

Henry.—Granite was mined and prepared for use in building and highway construction by Snider Stone Quarry and Martinsville Stone Corp., both of Martinsville.

A small quantity of full-trimmed mica was sold through GSA by one miner to the Materials Purchase Depot at Spruce Pine, N.C.

Isle of Wight.—Oystershell was burned for use as agricultural lime by Battery Park Fish & Oyster Co. (Battery Park).

King William.—A quantity of sand and gravel was produced near Aylett.

Lee.—Although output of coal declined more than one-third the number of mines reporting output rose from 36 in 1957 to 61 in 1958. Most of the coal came from underground mines, although a small quantity each of strip and auger coal was extracted. Blue Diamond Coal Co. and Virginia Lee Colliery were the chief producers. Petroleum was produced in Rose Hill field in the southwestern part of the county, the only oil-producing area in Virginia.

Limestone was mined for building and highway construction, railroad ballast, agstone, and riprap by Kentucky-Virginia Stone Co., Inc. (Gibson Station), and Woodway Stone Co. (Woodway). Over half of the total production in the county was consumed by various governmental subdivisions.

Loudoun.—Riprap and roadstone were produced from basalt quarries near Leesburg by Virginia Trap Rock, Inc., and Arlington Stone Co. Bull Run Stone Co. (Manassas) also mined basalt for roadstone. Virginia State Highway Department produced road material from the Palmer Limestone Quarry near Leesburg.

Louisa.—The exploration, dewatering, and development at the Arminius zinc-lead mine near Mineral, underway for several years, was recessed because of unfavorable market conditions. A quantity of sulfide mineral was collected as mineral specimens by one hobbyist.

Madison.—Several collectors reported gathering specimens of unakite and epidote in the Rose River area near Syria.

Mecklenburg.—Concrete aggregate, roadstone, railroad ballast, and riprap were produced by Marks-Wicker Co., Inc., at its Boydton granite quarry.

Montgomery.—Limestone was produced for concrete aggregate, roadstone, and agstone by Montgomery Limestone Corp. (Ellett) and Radford Limestone Co., Inc. (Radford). The latter company sold part of its output for railroad ballast and mason's sand. At Ironto, Velvet Sand Co. mined and crushed sandstone for concrete. This firm also produced a quantity of washed and screened sand near Radford for building construction and unwashed bank-run sand for fill. Miscellaneous clay (shale) was mined at Elliston, near Salem, by Old Virginia Brick Co., Inc., for making building brick.

Output of coal (semianthracite) in Montgomery County dropped more than 50 percent. All production came from two deep mines and was consumed mostly for domestic space heating.

Nansemond.—Roanoke-Webster Brick Co. mined miscellaneonus clay from an open pit near Suffolk for use in heavy clay products.

Nelson.—Consolidated Feldspar Department, International Minerals & Chemical Corp., mined and processed aplite. Riverton Lime & Stone Co. Division, Chadbourne Gotham, Inc., ground Amherst County aplite at its plant in Nelson County near Piney River. Uses comprised chiefly glass manufacture and roofing stone (granules). Ground material was consumed in Ohio, New York, New Jersey, Wisconsin, West Virginia, and other States. Buffalo Mines, Inc., a new firm, was engaged in mine and plant development, also at Piney

River. Construction commenced the latter part of October, with production scheduled to begin about May 1, 1959.

Alberene Stone Corp. of Virginia (Schuyler) continued to quarry and dress soapstone for use as dimension stone for laboratory and architectural applications and for flagging. Some of the soapstone was crushed or ground for roofing granules and for use as a filler.

Norfolk.—Lone Star Cement Corp. (South Norfolk) mined marl and clay for manufacturing portland cement in its three-kiln plant. Most of the Type I and II general-use portland cement was consumed within the State, but some was shipped to North Carolina and a small quantity exported. Part of the oystershell produced by J. H. Miles & Co., Inc. (Norfolk), was sold for road building and to Reliance Fertilizer & Lime Corp., which made hydrated agricultural lime from the shell. Approximately three-quarters of the product was returned to the bay for replanting the oysterbeds.

A quantity of sand and gravel for building and highway construction was produced.

Domestic and imported gypsum was calcined for use in gypsum plasters and other products by United States Gypsum Co. at Norfolk. A number of fertilizer plants in the Norfolk area sold imported, uncalcined gypsum for use chiefly as land plaster.

Nottoway.—Granite was crushed for use as roadstone and building stone by the Burkeville Stone Co., Inc. (Burkeville). Approximately half of the production was used by the Virginia Department of Highways.

Orange.—Roanoke-Webster Brick Co., Inc., produced miscellaneous clay from a new pit near Orange for consumption in making building brick.

Page.—Jasper, epidote, and "cave onyx" were reported as collected for gem or mineral specimen purposes at Ida and Luray.

Patrick.—A. C. Wilson Co. quarried limestone near Patrick Springs for concrete aggregate and roadstone.

Pittsylvania.—Marshall Sand Co. (Danville) and Kendall Sand Works (Danville) washed and screened sand for building construction and fill. Concrete aggregate and roadstone were produced at a granite quarry near Danville by Barnes Stone Co., Inc. The city of Danville also produced roadstone from a nearby granite quarry.

Southern Lightweight Aggregate Corp. manufactured lightweight aggregate at a two-kiln plant near Cascade from miscellaneous clay mined in North Carolina.

Powhatan.—Virginia Stone and Construction Co. produced road material from the Genito granite quarry near Powhatan.

Prince Edward.—Kyanite was mined on Baker Mountain near Farmville by the Kyanite Mining Corp. The product was beneficiated at grinding mills at Cullen and Pamplin and consumed in manufacturing high-temperature refractories and special ceramic bodies, including porcelain and insulators.

Mineral specimens were reported from Baker Mountain and Rice and included amazonite and amethyst crystals.

Prince George.—Hitch Gravel Corp. dredged sand and gravel from Powell's Creek about 18 miles from Hopewell for road material. Friend Sand & Gravel Co., Inc., and Bryan Rock & Sand Co. of Petersburg produced washed and bank-run sand and gravel, mainly

for building and highway construction. A small quantity was used as filter sand. Output was shipped to points of consumption by railroad, waterway, and motor truck.

Nitrogen Division, Allied Chemical Corp., Hopewell, manufactured ammonia, ammonium nitrate-limestone, solid and solution ammonium nitrate, urea solutions, and other nitrogen compounds for use in fertilizers.

Virginia Perlite Corp. expanded perlite from New Mexico at Hopewell for use in building plasters and concrete aggregate.

Princess Anne.—Six companies, two using dredges, produced sand and gravel. Building and highway construction each consumed about 38 percent of the total. The remainder of the output was used as filler in fertilizer, engine sand, molding sand, for grinding and polishing, and as a filter medium.

Prince William.—Miscellaneous clay for making heavy clay products was mined by Woodbridge Clay Products Co. near Woodbridge. This firm began developing and erecting a new mine and plant at Manassas; it was scheduled for production in 1959.

Gainesville Stone Quarry, Inc., produced roadstone and concrete aggregate at its basalt quarry near Gainesville.

Pulaski.—American Pigment Corp., Hiwassee, mined crude iron oxide pigments, including ocher, sienna, umber, and natural yellows. Mills of the American Pigment Corp. at Hiwassee and Pulaski prepared finished natural and manufactured iron oxide pigments. Materials sold included finished browns, siennas, and umbers, and manufactured yellows and reds.

The city of Radford produced limestone for road maintenance and repairs at a nearby quarry.

Roanoke.—Rockydale Quarries Corp. continued to produce crushed limestone for concrete aggregate, roadstone, and agricultural purposes at its quarry near Roanoke. Marl & Stone Corp. produced a small quantity of building sand near Salem.

Old Virginia Brick Co., Inc., operated an open-pit mine to obtain miscellaneous clay for use in making heavy clay products.

Rockbridge.—W. G. Matthews, Jr., Inc., continued to mine and grind quartzite at a quarry near Greenlee to produce raw material for ferrosilicon, railroad ballast, and mortar sand. Lone Jack Limestone Co. produced limestone for use as concrete aggregate, roadstone, and railroad ballast from its Glasgow quarry.

Locher Brick Co., Inc., mined surface (miscellaneous) clay for use in manufacturing building brick near Glasgow. This firm enlarged its brickmaking facilities by building a continuous drier kiln. Locher Silica Corp., near Goshen, washed and screened sand, mainly for glass. Small quantities were sold for use as building sand and engine sand. Unakite, as gem or mineral-specimen material, was obtained from near Vesuvius Station.

Rockingham.—Limestone was mined and crushed for concrete aggregate, roadstone, agstone, and stone sand by R. Y. Frazier and Fred K. Betts, III, at quarries near Harrisonburg. C. S. Mundy Quarries, Inc., 7 miles west of Broadway, also produced limestone for use as roadstone, agstone, concrete aggregate, and lime. Marble was crushed at a quarry near Harrisonburg by Jamison Black Marble Co., Inc., mainly for use as terrazzo.

Output of zinc at the Bowers-Campbell mine and mill of the Tri-State Zinc Co., near Timberville was suspended indefinitely on January 16, because of low prices realized for that metal. Underground development, however, continued. Zinc concentrate produced prior to the shutdown was shipped to the St. Joseph Lead Co., Josephtown, Pa., smelter.

Russell.—The output of bituminous coal declined slightly, and the number of mines dropped to 52 from 68 in 1957. Only 86 percent of the tonnage was produced from underground mines compared with 91 percent in 1957, indicating a substantial increase in strip and auger coal. Leading coal producers were Clinchfield Coal Co. (two underground mines), Smith Coal Co. (two underground mines), and Stallard Bros. Co. (strip and auger mines).

Limestone for building and highway construction was produced by Clinch River Quarries at St. Paul.

Scott.—Foote Mineral Co. (Duffield) produced limestone from an underground mine for use as a reagent in its lithium-refining plant. The lithium ore (spodumene) is mined and concentrated near Kings Mountain, N.C., and shipped to the Sunbright plant for extraction of the lithium as hydroxide. A large quantity of limestone was mined by Penn-Dixie Cement Corp. at its Speers Ferry mine for manufacturing cement at its plant near Kingsport, Tenn. Concrete aggregate, roadstone, agstone, filler, and filter medium were produced from limestone mined by Blountville Construction Co. from its Tri-State Lime quarry. Natural Tunnel Stone Co. (Clinchport) produced road material and concrete aggregate from its limestone mine.

Coal production dropped substantially, as output was reported from only two mines compared with six in 1957. The production of natural gas from the Early Grove field in the southeastern part of the county virtually ceased.

Shenandoah.—Shenandoah Valley Lime & Stone Corp. (Strasburg) mined and crushed limestone for blast-furnace and open-hearth furnace flux. Most of the production was shipped by rail. C. S. Mundy Quarries, Inc., near Timberville, and Toms Brook Lime & Stone Co., Inc., Toms Brook, produced limestone for concrete aggregate, roadstone, and agstone. Chemstone Corp., Strasburg Dominion Division (Strasburg), produced limestone for metallurgical flux and other uses and to supply the company Dominion and Strasburg Division lime-burning plants. Most lime produced was shipped to Ohio and Pennsylvania. During the year Chemstone Corp. consolidated all its limestone and lime-processing operations at its Dominion site. A larger and more efficient crusher was installed at this plant. The older Strasburg mine and mill were abandoned.

Smyth.—Olin-Mathieson Chemical Corp. (Saltville) continued to produce chlorine, soda ash, and other chemicals at its Saltville plant in northwest Smyth County from brines recovered from underground rock-salt deposits and limestone mined by the company. A small quantity of limestone was sold for concrete aggregate. Crushed limestone for building and highway construction was mined near Marion by Holston River Quarry, Inc.; R. Snyder & Sons and Sayers Sand Co., both of Marion, produced washed and screened sand for building.

Shales (miscellaneous clay) were mined at Groseclose, a few miles northeast of Marion, by Appalachian Shale Products Co. for use in making building brick.

Manganese ore of 35 percent or better manganese content was produced by Marion Manganese Ore Co., Sidney Manganese Corp., and O. E. Sayers, near Marion. The first two firms suspended operations indefinitely in July.

Spotsylvania.—Fredericksburg Stone Co. near Fredericksburg quarried, crushed, and screened granite for road material, concrete aggregate, railroad ballast, and riprap. Massaponax Sand & Gravel Corp., Fredericksburg, washed and screened sand and gravel in a stationary plant. Output was used for building and highway construction.

Stafford.—Diamond Construction Co. prepared sand and gravel for use as paving material.

Surry.—Friend Sand & Gravel Co., operating a mobile plant, produced sand and gravel for building construction and road material.

Tazewell.—Coal output dropped 31 percent in both quantity and value compared with 1957. The county was fourth in rank of Virginia coal-producing counties. Production was obtained from 41 mines, of which 32 were underground, 3 were strip, and 6 auger. Sixty-four mines were active in 1957. Some 94 percent of the county coal output came from underground mines. Leading producers were Pocahontas Fuel Co., Inc. (Amonate, Bishop, Boissevain, and Jenkinjones mines), Jewell Ridge Coal Corp. (No. 1 mine), and Alfredton Coal Co. (Alfredton mine).

Pounding Mill Quarry Corp. at its Pounding Mill Quarry produced a large quantity of limestone for construction, agricultural, and metallurgical purposes as well as for coal mine rock dust and use as stone sand. More than half of the output was shipped by motor truck, the balance by railroad. Two small producers quarried limestone for manufacture of lime largely for local consumption.

Miscellaneous clay was mined by General Shale Products Corp. from its Richland mine for use in making heavy clay products, chiefly building brick.

Warren.—Riverton Lime & Stone Co. Division, Chadbourn Gotham, Inc., manufactured masonry cement at its Riverton plant. The company also produced limestone at its No. 5 quarry for building and highway construction, agstone, and railroad ballast.

Washington.—Lambert Bros., Inc., Division of Vulcan Materials Co., Bristol, and Meadowview Lime Co., Meadowview, mined limestone for use as roadstone, concrete aggregate, and agstone.

A gypsum mine and plasterboard plant were operated by United States Gypsum Co. at Plasterco. The mine was the only gypsum producer in the State.

Wise.—Wise County ranked second among coal-producing counties. Output declined 2 percent in tonnage and 8 percent in value compared with 1957. The value dropped below $30 million. Some 294 mines contributed to the total output—261 deep mines, 24 strip, and 9 auger. More than 1 million tons was stripped or 16 percent of the county total, and 360,000 tons mined by auger, the largest quantities mined by these methods of any county in the State. Only 78 percent of the tonnage came from underground mines. Leading producers were Stonega Coke & Coal Co. (six underground mines, two strip

operations, and two auger mines), Stamack Mining Co. (one strip and one auger), Central Pennsylvania Quarry, Strip & Construction Co. (one strip and one auger). Coal Processing Corp. (one underground mine), and Wise Coal & Coke Co. (one underground mine). A small quantity of natural gas was obtained from wells by Clinchfield Coal Co.

Wythe.—Output of recoverable lead and zinc at Austinville was curtailed in July and reduced to half of the mill capacity. The Ivanhoe mine, on production status only since September 1957, was placed on a standby basis on July 1, owing to the lower market. Concentrate was shipped to smelters for metal recovery. A large tonnage of byproduct dolomite was marketed mostly as agstone, with smaller quantities for fertilizer filler or extender and road construction.

A small quantity of metallurgical manganese of 35-percent or better Mn content was produced by K. & L. Mining Co. near Marion.

Pendleton Construction Corp. (Wytheville) and H. D. Crowder (Poplar Camp) mined and crushed limestone for highway and building construction. The city of Wytheville produced limestone from the town quarry for use in building and maintaining streets. Silica Products Co., Wytheville, produced paving and road sand in a stationary plant at Wytheville.

York.—Whalebone and sharks' teeth were collected as mineral specimens from Indian Creek.

The Mineral Industry of Washington

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the State of Washington Division of Mines and Geology.

By Frank B. Fulkerson,[1] A. J. Kauffman, Jr.,[2] and Gary A. Kingston [1]

MINERALS produced in Washington increased in value slightly in 1958, despite depressed markets for several products. The $60.9 million total was $400,000 greater than in 1957. Larger quantities of sand and gravel, cement, uranium, gold, and silver offset lower output of lead, zinc, copper, magnesite, stone, and coal.

In northeastern Washington, uranium production continued to increase; nine mines produced compared with four in 1957. In contrast, copper output was almost nothing because of a mine closure, and lead-zinc mining was cut back, owing to low metal prices.

As in the preceding 4 years, industries using minerals to manufacture for regional markets led in new industrial construction in Washington. Capacity was increased in steel, petroleum-refining, stone and clay, and agricultural chemical industries.

Markets.—Most mineral and metal production in the State for eastern industrial markets declined because of low demand throughout the year. Output for local uses continued at a good rate because

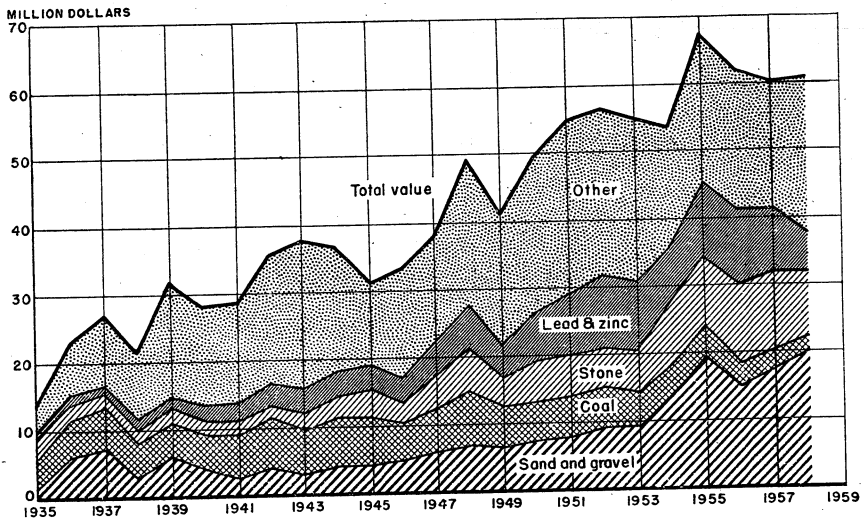

FIGURE 1.—Value of sand and gravel, stone, coal, lead and zinc, and total value of mineral production in Washington, 1935–58.

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of sustained activity in the construction industry in the State and because the business recession of 1957–58, severe in some localities, was felt less in the State than in the Nation—partly because of defense expenditures for aircraft manufacture.

TABLE 1.—Mineral production in Washington [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stone (grinding pebbles)	25	(2)	18	(2)
Chromium ore and concentrate—gross weight			17	$2
Clays—thousand short tons	298	$488	[3] 196	[3] 183
Coal—do	360	2,761	252	1,968
Copper (recoverable content of ores, etc)	1,700	1,023	52	27
Gypsum—thousand short tons	6	(4)	(4)	(4)
Iron ore (usable)—thousand long tons	4	(4)	4	(4)
Lead (recoverable content of ores, etc.)	12,734	3,642	9,020	2,111
Peat	39,364	153	34,642	116
Sand and gravel—thousand short tons	[5] 20,415	[5] 17,510	24,389	20,086
Stone—do	[5] 8,897	[5] 11,645	7,837	9,991
Talc and soapstone	4,065	25	4,000	21
Zinc (recoverable content of ores, etc.)	24,000	5,568	18,797	3,835
Value of items that cannot be disclosed: Barite, carbon dioxide, cement, diatomite, epsomite (1957), gem stones, gold, magnesite, mercury, olivine, petroleum, pumice, silver, strontium, tungsten (1957), uranium, and values indicated by footnote 4		19,025		24,204
Total Washington [6]		[5] 60,471		60,897

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Less than $500.
[3] Incomplete total, fire clay included with "Items that cannot be disclosed."
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Revised figure.
[6] Total has been adjusted to eliminate duplicating value of clays and stone.

In the mineral industries the gains in cement and sand and gravel production were bright spots. After a slow start, construction of buildings, highways, and dams increased; employment in contract construction in the last 3 months of the year was much greater than in the last quarter of 1957, but annual average employment was less than in the preceding year. Building permits increased 31 percent in value.

Coal mining continued its long-term loss of markets; revival of production depended upon obtaining foreign contracts and on the construction of coal-burning steam-electric plants.

The aluminum industry was one of the two most affected manufacturing industries in the State (the other was lumber). Aluminum production began to decline in the last quarter of 1957, continuing in 1958; output was 30 percent less than in 1957 and 36 percent less than in 1956. By the end of the year, there was slight improvement in this industry, which had to face temporarily lessened demand and competition from new plants in other states.

Employment.—The mineral industries (mining and mineral manufacturing) averaged 28,000 workers, and payrolls totaled $177 million. Employment at ready-mix concrete plants is included for the first time in 1958 data.

Smelting, refining, and casting (principally primary aluminum plants, steel works and foundries, and copper smelting) provided 38 percent of the employment; chemical industries (mainly the Hanford atomic works), 33 percent; stone, clay, and glass products, 18 percent; mining, 6 percent; and petroleum refining, 5 percent.

TABLE 2.—Average monthly employment and total wages in mining and mineral manufacturing, by industry [1]

Industry	1957		1958	
	Employment	Wages (thousands)	Employment	Wages (thousands)
Mining:				
Metal mining:				
Lead and zinc ore	347	$2,117	276	$1,435
Gold and silver ore	172	1,016	131	815
Other	285	1,526	178	965
Bituminous coal	371	1,842	298	1,258
Crude petroleum and natural gas	78	494	112	801
Nonmetallic mining and quarrying:				
Crushed and broken stone	332	1,817	348	1,922
Sand and gravel	334	1,836	348	1,939
Other	220	1,073	167	924
Total	2,139	11,721	1,858	10,059
Mineral manufacturing:				
Stone, clay, and glass products:				
Cement, hydraulic	630	3,306	650	3,608
Structural clay products	490	2,332	408	2,027
Concrete, gypsum, and plaster products [2]	1,475	7,235	3,180	17,820
Other	687	3,582	731	3,942
Total	3,282	16,455	4,969	27,398
Smelting, refining, and casting:				
Blast furnaces, steel works, rolling and finishing mills	2,472	13,774	1,889	11,347
Iron and steel foundries	1,030	5,229	819	4,480
Smelting, refining, and casting of nonferrous metals, except aluminum	1,269	6,461	1,018	5,451
Smelting, rolling, drawing, and casting of aluminum	9,367	56,033	6,722	43,836
Miscellaneous	100	623	51	273
Total	14,238	82,120	10,498	65,388
Industrial chemicals, and chemicals not elsewhere classified [3]	9,698	63,311	9,260	64,840
Petroleum refining and related industries	1,255	7,725	1,370	8,832
Grand total	30,612	181,332	27,955	176,517

[1] Washington State Employment Security Department bulletins. Comparability between 1957 and 1958 totals reduced because of revisions of the industrial classification system (see footnote 2). Industry groups may vary from those in the Bureau of Mines canvass. Figures may not add to total, owing to rounding.

[2] 1958 totals include ready mixed concrete.

[3] The Hanford atomic installation is the largest industry included.

In December, average employment in the aluminum industry was 6,700, compared with 7,600 in January and 10,000 in July 1957. The sharp decrease was due to plant closures and reduced operations. Other mineral industries that decreased employment from January to December included bituminous coal mining, crude petroleum production, iron and steel foundries, copper-smelting, and chemicals. There was an upward trend in monthly employment in producing crushed and broken stone, sand and gravel, cement, structural clay products, and petroleum refining.

Government Programs.—The new Office of Minerals Exploration (OME), U.S. Department of the Interior, succeeded the Defense

Minerals Exploration Administration (DMEA) on September 11; its similar type of program provided financial aid in exploring strategic mineral occurrences. Five DMEA contracts were active (2 each for copper and uranium and 1 for zinc) compared with 11 contracts in 1957.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Materials.—Manufacturers Mineral Co. produced grinding pebbles at a somewhat lower rate than in 1957 from a deposit near Chewelah, Stevens County.

TABLE 3.—Defense Minerals Exploration Administration contracts active during 1958

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
SNOHOMISH					
Robert T. Curtiss	Mint claims	Copper	Mar. 19, 1958	$11,620	50
Howe Sound Co	Calumet claims	do	July 22, 1957	23,560	50
SPOKANE					
Mudhole Exploration, Inc.	Hanson lease	Uranium	Nov. 14, 1957	9,520	75
STEVENS					
Grandview Mines, Inc. (assignee of Scandia Mining Group).	Scandia	Zinc	Aug. 1, 1957	44,922	50
Northwest Uranium Mines, Inc.	Peters and Boyd permits.	Uranium	June 15, 1956	49,352	75

Barite.—Small quantities of barite were produced at three operations in Stevens County. Output was chiefly for use at sugar refineries.

Sunshine Mining Co. concluded a contract with North Star Uranium, Inc., to develop a barite deposit on Queen of Sheba Mountain, 10 miles north of Colville, Stevens County. Work commitments, if implemented, were to give Sunshine controlling interest in the venture.

Cement.—Production of combined portland and masonry cement increased 22 percent compared with 1957; shipments were up 29 percent. The industry, comprised of six plants owned by four companies, operated at about 70 percent of annual capacity; year-end stocks were lowered considerably. About 90 percent of shipments terminated within the State; the remainder was sent to other Pacific Northwest States and Alaska.

Permanente Cement Co. (Oakland, Calif.) by stock purchase acquired the assets of The Olympic Portland Cement Co., Ltd., at Bellingham, Whatcom County. This was the third and largest purchase of Pacific Northwest cement plants by major national pro-

ducers in the 2-year period 1957–58. Permanente had shipped cement from the San Francisco Bay area into the Pacific Northwest for 12 years but had no plant in the Northwest since 1949. Ideal Cement Co. completed plans for constructing a cement storage and distribution center at Vancouver, Wash., to provide better service to northern Oregon and southern Washington. The company also announced purchase from the Port of Tacoma of acreage on the Port Industrial Waterway as a site for a cement distribution center and possibly a cement plant at a future date.

Combined production from nine cement plants operating in Washington and Oregon was 7,788,188 barrels of finished portland cement; the same plants shipped a total of 7,904,946 barrels during the year.

Clays.—Clays sold or used by producers in Washington dropped sharply in 1958 largely owing to reduced output of clay for heavy clay products; decreased production of fire clay used in making refractory products also contributed to the decline.

Fire clay used to manufacture firebrick and refractory products was produced in King and Spokane Counties. Miscellaneous clay used to make heavy clay products was produced at 10 pits in 6 counties; in addition clay used at cement plants was produced at three operations—1 each in King, Spokane, and Whatcom Counties.

A small quantity of clay was processed for flowerpots at plants in King County.

Diatomite.—Quantity and value of diatomite production decreased slightly from the 1957 total. Kenite Corp., Quincy, Grant County, mined and prepared diatomite for filtration, filler, insulation, and miscellaneous uses.

Gypsum.—Agro Minerals, Inc., the only producer in the State, obtained gypsite from a deposit at Poison Lake near Tonasket, Okanogan County. Output was marketed for agricultural use.

Crude gypsum mined in Baja California, Mexico, was processed to gypsum building products at the Seattle plant of Kaiser Gypsum Co., Inc. A quantity of gypsum mined in British Columbia, Canada, was sold for agricultural uses by a Spokane firm.

Magnesian Minerals.—Output of crude magnesite by Northwest Magnesite Co., Stevens County, declined 31 percent in tonnage and value. Slackened demand for refractory magnesia by eastern steel mills was the principal cause. The Stevens County operation continued to be the largest producer of crude magnesite in the Nation.

Northwest Olivine Co. mined olivine at the Twin Sisters quarry, Skagit County. The company doubled the capacity of the processing plant at Hamilton, and shipments of refined material were increased sharply over 1957. Sand for molding and blasting purposes was made from the raw material.

Agro Minerals, Inc., did not recover epsomite from its Poison Lake deposit during the year.

Pumice and Pumicite.—Continued high production of pumicite by Butte Pozzolan Co. resulted in a Statewide increase of 12 and 7 percent in quantity and value, respectively. This operation near Sunnyside, Yakima County, began production in 1957. Pumice for use in concrete building blocks was mined by Arne Sorlie in Chelan County.

Sand and Gravel.—Tonnage and value of sand and gravel output in 1958 increased 19 and 15 percent, respectively, compared with 1957. Demand at the various dams under construction and for the highway-building program remained strong.

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Building	4,823	$5,269	5,630	$5,626
Road material	3,676	3,736	4,403	4,185
Railroad ballast	(1)	(1)	154	71
Other [2]	1,599	1,453	1,514	984
Total	10,099	10,458	11,702	10,866
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Building	[3] 2,819	[3] 2,082	2,721	2,916
Road material	[3] 7,497	[3] 4,970	9,967	6,304
Total	[3] 10,316	[3] 7,052	12,688	9,220
ALL OPERATIONS				
Building	[3] 7,643	[3] 7,350	8,351	8,542
Road material	[3] 11,173	[3] 8,706	14,370	10,489
Railroad ballast	(1)	(1)	154	71
Other [2]	1,599	1,453	1,514	984
Grand total [4]	[3] 20,415	[3] 17,510	24,389	20,086

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Includes molding and engine sands, and sand and gravel for ballast and miscellaneous unspecified purposes.
[3] Revised figure.
[4] Owing to rounding, figures may not add to totals.

Production of sand and gravel was reported from 34 of the 39 counties in the State and the tonnage distributed for road building and maintenance was 59 percent; construction, 34 percent; and miscellaneous, 7 percent.

Stone.—Stone production totaled 7.8 million tons valued at $10 million, compared with 8.9 million tons ($11.6 million) in 1957. Lessened demand by the U. S. Army Corps of Engineers, Washington State Highway Department, and the U. S. Forest Service contributed to the decline.

Strontium Minerals.—Mineral Products Corp. processed a small quantity of strontium minerals from stockpiled material for use by the chemical industry for purification purposes.

Talc and Soapstone.—Production of soapstone declined moderately compared with 1957. Four mines in Skagit County furnished raw material to grinding plants operated by Northwest Talc & Magnesium Co., Clear Lake, and Manufacturers Mineral Co., Seattle. The ground product was used as a carrier in insecticides and for paint filler and fertilizer mix. A considerable quantity of the soapstone mined in Washington was sold to grinders in Oregon.

Vermiculite (Exfoliated).—Expansion of vermiculite by Vermiculite-Northwest, Inc. (Spokane), decreased about 13 percent compared with 1957. The raw material produced in Montana was expanded for insulation and for plaster and concrete aggregate.

TABLE 5.—Stone sold or used by producers, by uses

	1957		1958	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
Building (dimension stone)	(1)	(1)	(1)	(1)
Concrete and roadstone	5,852	$6,145	5,720	$6,665
Riprap	[2] 1,874	[2] 3,044	808	609
Railroad ballast	(1)	(1)	(1)	(1)
Other [3]	1,172	2,456	1,309	2,716
Total [4]	8,897	11,645	7,837	9,991

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Revised figure.
[3] Used at cement, paper, metallurgical, and chemical plants; sugar refineries; and for miscellaneous unspecified purposes.
[4] Owing to rounding, figures may not add to totals.

METALS

Aluminum.—Production of primary aluminum declined from 445,709 short tons valued at $227.4 million in 1957 to 311,417 short tons valued at $156.4 million in 1958. The decrease resulted from lower national demand at a time of increased capacity due to initial production from three new plants in other States. Power availability was adequate throughout the year; Washington aluminum plants consumed approximately 5.5 billion kw.-hr. of hydrogenerated electric energy from the Bonneville Power Administration in 1958.

Aluminum reduction works were operated at Vancouver and Wenatchee (Aluminum Company of America), Spokane and Tacoma (Kaiser Aluminum & Chemical Corp.), and Longview (Reynolds Metals Co.). On May 31, the Kaiser Tacoma works was closed for the year. There was no expansion of aluminum-production capacity in the State.

Pacific Northwest aluminum production received some marketing-cost relief by a reduction of freight charges on alumina moving west and aluminum pig, sheet, and plate moving east. A 50-cent-a-ton reduction was made on the $12.66-a-ton rate for alumina shipped from Gulf Coast ports. Pig aluminum, moving to points generally west of the Indiana-Illinois State line and the Mississippi River, received an 11-percent freight-rate reduction, lowering the $23.81 rate to $21.26 a net ton. Kaiser Aluminum & Chemical Corp., the only producer

TABLE 6.—Primary aluminum plant capacity and production data

Year	Annual rated capacity short tons	Production			Average U.S. ingot price per pound, cents
		Quantity		Value	
		Short tons	Percent of national total		
1949–53 (average)	319,000	292,577	34	$104,917	18.8
1954	415,000	432,534	30	175,338	21.8
1955	453,000	452,874	29	197,837	23.7
1956	481,000	486,204	29	233,632	26.0
1957	483,000	445,709	27	227,383	27.5
1958	483,000	311,417	20	156,376	26.9

of plate and sheet in the Pacific Northwest, benefited from a freight cut on these products of 5 cents per hundredweight on minimum 30,000-pound shipments and 10 cents per hundredweight on minimum 50,000-pound lots. The reductions were made to help Pacific Northwest aluminum producers meet the rapidly increasing competition developing from plants in the Ohio River Valley.

Chromium.—A small tonnage of chromite was shipped from a mine in Skagit County to the Government (General Services Administration) purchasing depot at Grants Pass, Oreg., under the Federal stockpiling program.

Copper.—Mine output was insignificant compared with other years, declining 97 percent below 1957. The sharp drop was due to closure of the Howe Sound Co. Holden mine, Chelan County. A report on the Holden mine was published.[3]

Employment at the American Smelting and Refining Co. smelter at Tacoma was decreased by 110 in February, owing to depressed markets and to the closure of several large copper mines, which formerly shipped to the plant.

Ferroalloys.—Three plants, one each in Douglas, Pierce, and Spokane Counties, produced ferroalloys. Curtailed production in the aluminum and steel industries brought about reductions in output; two plants were idled for several months.

Gold.—Gold output increased moderately over 1957. Two lode mines—the Knob Hill (includes the adjacent Gold Dollar mine worked from the Knob Hill mine workings), Ferry County, and the Gold King, Chelan County—produced most of the State total.

Iron Ore.—Iron ore in small lots was shipped from Stevens County to a cement plant near Spokane; it was the only ore marketed from State production.

Japanese industrialists were interested in the Buckhorn Mountain deposits, Okanogan County. According to a news report, two Canadian companies were contemplating concentrating and shipping the ore to Vancouver, British Columbia; bulk-loading facilities would handle and transship it to Japan. Magnetic Mines, Inc., owner of the Buckhorn claims, shipped 3 tons of magnetite fines to Japan for pilot-plant testing; test-lot analyses ran 58–67 percent iron, 0.007–0.020 percent phosphorus, and 0.03–1.27 percent sulfur.

Lead.—State output of lead, mostly from two mines in Pend Oreille County, declined 29 percent from 1957. This decline was due to reduced output from the Pend Oreille mine (Pend Oreille Mines & Metals Co.) because of low metal prices. The Grandview mine (American Zinc, Lead & Smelting Co.), operating at capacity during the year, produced 16,076 tons of combined zinc-lead concentrates; its output was 12 percent above the 14,367-ton 1957 total. Pend Oreille Mines & Metals Co. curtailed production for 9 months of the year; the mine was on a 4-day week and the concentrating plant, a 5-day week; this curtailment resulted in 20 percent less production at the Pend Oreille mine.

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[3] McWilliams, John R., Mining Methods and Costs at the Holden Mine, Chelan Division, Howe Sound Co., Chelan County, Wash: Bureau of Mines Inf. Circ. 7870, 1958. 44 pp.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1949–53 (average)	29	3	1,341	69,770	$2,442	339	$307
1954	24	6	1,552	66,740	2,336	314	284
1955	16	1	1,712	74,360	2,603	436	395
1956	34	1	1,697	70,669	2,473	448	406
1957	19	1	1,495	[3]	[3]	[3]	[3]
1958	14	3	975	[3]	[3]	[3]	[3]
1860–1958			[4]	[5]2,844,331	[5] 78,307	[5] 16,391	[5] 12,333

Year	Copper		Lead		Zinc		Total value (thousand)
	Short tons	Value (thousand)	Short tons	Value (thousand)	Short tons	Value (thousand)	
1949–53 (average)	4,504	$2,083	9,512	$2,853	19,325	$5,541	$13,226
1954	3,636	2,145	9,938	2,723	22,304	4,818	12,306
1955	3,958	2,953	10,340	3,081	29,536	7,266	16,297
1956	2,926	2,487	11,657	3,660	25,609	7,017	16,044
1957	1,700	1,023	12,734	3,642	24,000	5,568	13,766
1958	52	27	9,020	2,111	18,797	3,835	10,469
1860–1958	121,621	43,152	189,519	43,733	381,123	85,287	270,842

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, and ore shipped to smelters during calendar year indicated. Owing to rounding, figures may not add to totals.
[2] Does not include gravel washed.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] 1860–1903—Figure not available; 1904–58—28,311,000 tons produced.
[5] Excludes 1957–58.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1958, by classes of ore or other source material, in terms of recoverable metals

Source	Number of mines	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold and copper [1]	5	134,854	[2]	[2]	46,000		
Dry gold-silver and dry silver [1]	5	334	[2]	[2]	300	15,000	1,800
Lead	2	111		[2]		92,000	1,400
Lead-zinc	2	839,210		[2]	57,700	17,933,000	37,590,800
Total "lode" material	14	974,509	[2]	[2]	104,000	18,040,000	37,594,000
Gravel (placer operations)	3	[3]	[2]	[2]			
Total, all sources	17	974,509	[2]	[2]	104,000	18,040,000	37,594,000

[1] Combined to avoid disclosing individual company confidential data.
[2] Figures withheld to avoid disclosing individual company confidential data.
[3] 9,500 cubic yards.

In preparation for Federal hearings in 1959, studies were continued concerning the possible effect to the Metaline mining district of constructing two proposed dams on the Pend Oreille River.

Manganese.—Several shipments of oxide ore (averaging 43.6 percent Mn) were made from the Crescent mine, Clallam County, to the Government low-grade manganese ore stockpile at Butte, Mont.; the Federal program for stockpiling domestic low-grade manganese ore was completed during the year.

Mercury.—Washington Mining Corp. (Royal Reward and Cardinal Reward mines), King County, was the sole producer in the State.

Silver.—Output increased moderately over 1957. The following mines were the principal producers: the Knob Hill and Gold Dollar (gold ore), Ferry County; the Gold King (gold ore), Chelan County; and the Pend Oreille (lead-zinc ore), Pend Oreille County.

Steel.—Bethlehem Pacific Coast Steel Corp. progressed on its $25-million expansion program; a new 32-inch blooming mill was operating and a modern 12-inch merchant-bar mill was under construction.

Steel mills and foundries remained wholly dependent upon iron and steel scrap as a metal source.

Uranium.—Producing mines increased to nine compared with four in the preceding year. Dawn Mining Co. processed over 160,000 tons of uranium ore at a mill near Ford, Stevens County, and its Midnite mine in Stevens County was the principal producer of uranium ore in the State. Silver Buckle Mining Co. (Peters lease), Stevens County; Daybreak Uranium, Inc., (Dahl lease and Huffman operation), Spokane County; and Triple H. & J. Mining (Lost Creek property), Pend Oreille County, were other major producers shipping ore to the mill at Ford.

The minimum requirements for custom shippers to the uranium-processing plant at Ford were lowered from 500 to 350 tons. The change was made to enable more small producers to ship to the mill.

Zinc.—Production declined 22 percent below 1957. The Pend Oreille and Grandview lead-zinc mines (Pend Oreille County) were the chief producers. A reduced schedule at the Pend Oreille mine and mill, owing to lower metal prices, was the principal reason for the lower State output.

MINERAL FUELS

Carbon Dioxide.—Gas-Ice Corp. recovered about 19 percent less carbon dioxide from mineral waters in Klickitat County than in 1957; this gas was used to make dry ice at its Klickitat facility.

Coal.—Combined output from 11 active coal mines in the State totaled 252,000 tons, 108,000 tons less than in 1957. In 1948, 39 mines had contributed to a total of 1.2 million tons.

A firm of consulting engineers reported favorably on a Kittitas County (PUD No. 1) steam-electric generating plant proposed for construction in the Roslyn-Cle Elum coal-mining area. It was recommended that the Public Utility District negotiate with potential buyers and with Bonneville Power Administration for integration of anticipated output into the Pacific Northwest power pool.

Articles on the geology, beneficiation, and analysis of coal resources were published.[4]

Peat.—Production declined 12 percent from 1957. King County continued as the chief producing area; output also came from Pierce, Snohomish, Thurston, and Kitsap Counties. A comprehensive report, covering the peat resources of Washington, was published.[5]

Petroleum and Natural Gas.—According to the Sunshine Mining Co. annual report to shareholders, recovery of crude oil from the Medina No. 1 was 2,170 barrels. This quantity was a decline in production, which resulted in remedial work and a pumping-unit installation. The discovery well at Ocean City, Grays Harbor County, began producing in August 1957. No new drilling was done in 1958. Work continued for a while at the Minard No. 1, about 7 miles south of Ocean City; the well was abandoned later as nonproductive. The Sunshine Company planned to rehabilitate and deepen the Sampson John Unit No. 1 (formerly Hawksworth State No. 4) adjacent to the Medina No. 1. An attempt was to be made to locate the horizon from which the Medina production came.

Tidewater Oil & Gas Corp. announced plans for drilling a wildcat well on Long Island in Willapa Bay, Pacific County. Standard Oil Co. of California, terminated drilling in the Rattlesnake Hills, Benton County, at 8,418 feet after spending $625,000. Later Shell Oil Co., Humble Oil Co., Ohio Oil Co., and Richfield Oil Co. joined in the venture and continued drilling to a depth of 10,655 feet. Further drilling was recessed until the geological findings were evaluated.

Late in November The Texas Co. Puget Sound works shipped to Pacific Northwest markets. Shell Oil Co. began operating its new sulfuric acid alkylation unit at the Anacortes refinery.

TABLE 9.—Test holes drilled for oil and gas in 1958 [1]

Company	Well	Total depth	County
Sunshine Mining Co	Minard No. 1	5,038	Grays Harbor.
Standard Oil Co. of California	Rattlesnake Unit No. 1	Deepening, 8,418–10,655	Benton.
Pleasant Valley Gas & Oil Co.	Guenther No. 1	8,015	Lewis.
McCulloch Oil Exploration Company of California, Inc.	McCulloch-Krainick No. 1	5,069	King.
Standard Oil Co. of California	Silvana Community No. 12-1.	7,419	Snohomish.
Standard Oil Co. of California	Engstrom Community No. 1.	7,353	Island.

[1] Washington Division of Mines and Geology.

[4] Snavely, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., Geology and Coal Resources of the Centralia-Chehalis District, Wash.: Geol. Survey Bull. 1053, 1958, 159 pp.
Roberts, A. E., Geology and Coal Resources of the Toledo-Castle Rock District, Cowlitz and Lewis Counties, Wash.: Geol. Survey Bull. 1062, 1958, 71 pp.
Geer, M. R., and Yancey, H. F., Operating Results with the Feldspar Fine-Coal Jig: Bureau of Mines Rept. of Investigations 5412, 1958, 14 pp.
Daniels, Joseph, Yancey, H. F., Geer, M. R., Abernathy, R. F., Aresco, S. J., and Hartner, F. E., Analyses of Washington Coals: Supplement to Technical Papers 491 and 618, Bureau of Mines Bull. 572, 1958, 92 pp.

[5] Rigg, George B., Peat Resources of Washington: State of Washington Div. of Mines and Geol., Bull. 44, 1958, 272 pp.

Pacific Cooperatives began constructing a $15 million oil refinery in the Fruit Valley-Vancouver Lake district of Vancouver, planning first to build a tank farm and a pipeline system to docks on the Columbia River. Ultimately the refinery would process crude petroleum brought by tanker. U.S. Oil & Refining Co., Tacoma, are adding to their refinery a $750,000 asphalt plant, scheduled for completion in the spring of 1959.

A historical summary of oil and gas exploration in Washington from 1900 to 1957 was published.[6]

REVIEW BY COUNTIES

Chelan, Ferry, Pend Oreille, and Stevens Counties all in eastern Washington supplied most of the metals mined in the State. Gold was the chief product in Chelan and Ferry Counties; zinc, in Pend Oreille; and uranium, in Stevens. Except for Kittitas (coal), sand and gravel or cement was the leading mineral commodity in all other counties where production value exceeded $1 million in 1958. Sand and gravel was produced in 34 counties and was extracted in large part in industrial and metropolitan areas in King, Pierce, Snohomish, Spokane, and Yakima Counties and near sites of dam construction in Douglas, Grant, Skagit, and Walla Walla Counties. Cement was manufactured at four plants in the Puget Sound area (King, Skagit, and Whatcom Counties) and at two plants in eastern Washington (Pend Oreille and Spokane Counties).

Chelan.—Limestone quarried at Soda Springs near Leavenworth was shipped to the Grotto plant (King County) of Ideal Cement Co. Pumice for use as lightweight-concrete aggregate was mined near Lakeside.

Siliceous gold ore was shipped from the Gold King mine to the Tacoma copper smelter (American Smelting and Refining Co.), where it was valued for its fluxing qualities as well as its gold content; 28 men were employed at this mine.

The Aluminum Company of America Wenatchee aluminum-reduction works, installed capacity of 108,500 tons from four potlines, reduced production to 50 percent of capacity by closing a second potline in February. The cutback followed a reduction in aluminum prices and was due to high inventories and decreased demand.

Clark.—In February, Aluminum Company of America cut back a second of five potlines at the Vancouver plant, having a total capacity of 97,500 tons. Low demand and rising inventories supplied the reduction.

Cowlitz.—The Reynolds Metals Co. Longview aluminum-reduction works, with an annual capacity of 60,500 short tons, reduced production in May to adjust to market requirements.

Douglas.—For several months near midyear, slow market conditions idled 136 workers at Keokuk Electro-Metals Co., where silicon metal for alloying with aluminum and ferrosilicon for use in steelmaking were produced.

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[6] Livingston, Vaughan E., Jr., Oil and Gas Exploration in Washington 1900–1957: Washington Div. of Mines and Geol. Inf. Circ. 29, 1958, 61 pp.

TABLE 10.—Value of mineral production in Washington, by counties [1]

County	1957 (thousands)	1958 (thousands)	Minerals produced in 1958 in order of value
Adams	$595	$594	Sand and gravel, stone.
Asotin	160	42	Stone, sand and gravel.
Benton	117	344	Sand and gravel, stone.
Chelan	3,066	1,250	Gold, stone, sand and gravel, silver, pumice.
Clallam	522	516	Stone, sand and gravel.
Clark	241	382	Stone, sand and gravel, clays.
Columbia	----------	[2]	Stone.
Cowlitz	572	385	Stone, sand and gravel.
Douglas	674	1,030	Sand and gravel, stone.
Ferry	[2]	[2]	Gold, silver, stone, sand and gravel, copper.
Franklin	539	717	Sand and gravel, stone.
Garfield	[2]	62	Stone.
Grant	2,053	4,132	Sand and gravel, diatomite, stone.
Grays Harbor	187	256	Sand and gravel, stone, petroleum.
Island	193	114	Sand and gravel, stone.
Jefferson	[2]	259	Stone, sand and gravel.
King	8,173	8,864	Cement, sand and gravel, stone, coal, clays, peat, mercury.
Kitsap	270	176	Sand and gravel, stone, peat.
Kittitas	2,253	1,416	Coal, sand and gravel, stone, silver.
Klickitat	1,203	345	Sand and gravel, stone, carbon dioxide.
Lewis	858	475	Stone, sand and gravel, coal, clays.
Lincoln	275	603	Stone, sand and gravel.
Mason	102	[3]	Sand and gravel.
Okanogan	289	138	Sand and gravel, gypsum, stone, silver, gold, iron ore.
Pacific	545	315	Stone, sand and gravel.
Pend Oreille	[2]	[2]	Zinc, cement, lead, stone, sand and gravel, uranium, silver, copper, gold.
Pierce	2,596	3,043	Sand and gravel, stone, clays, peat.
Skagit	2,332	3,486	Cement, sand and gravel, stone, olivine, talc and soapstone, strontium, chromite.
Skamania	1,598	257	Stone, sand and gravel.
Snohomish	1,295	1,540	Sand and gravel, stone, peat, clays, copper, gold, silver.
Spokane	4,365	4,715	Cement, sand and gravel, stone, clays, uranium.
Stevens	4,538	3,357	Uranium, magnesite, stone, sand and gravel, barite, lead, iron ore, silver, zinc.
Thurston	214	204	Sand and gravel, coal, stone, peat, grinding pebbles.
Walla Walla	[2]	1,483	Sand and gravel, stone.
Whatcom	[2]	[2]	Cement, stone, sand and gravel, clays, gold, silver.
Whitman	285	398	Stone, sand and gravel.
Yakima	1,138	1,158	Sand and gravel, pumice, stone, clays.
Undistributed [3]	20,594	20,489	
Total [4]	[5] 60,471	60,897	

[1] San Juan and Wahkiakum Counties not listed because no production was reported.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Includes the value of sand and gravel, stone, and gem stones that cannot be assigned to specific counties and the value of minerals for counties indicated by footnote 2.
[4] Adjusted to eliminate duplicating value of clays and stone.
[5] Revised figure.

Ferry.—The Knob Hill Mines, Inc., working shaft at its Knob Hill gold mine near Republic was deepened 300 feet; surface plant facilities were improved. Output and grade of ore were good from the adjoining Gold Dollar mine, which was leased from Day Mines, Inc.

Grant.—Grant County went from ninth to fourth place in total value of nonmetal production and became the leading source of sand and gravel valued at $3.6 million. Projects of U. S. Army Corps of Engineers in the Walla Walla district and work at the Grant County PUD Priest Rapids Dam supplied most of the increase. Kenite Corp. mined diatomite at Quincy.

Jefferson.—Olympic Manganese Mining Co. reported development at the Tubal-Cain mine.

King.—King County led in nonmetal production; value of output was about $460,000 higher than in 1957. A substantial increase in the value of cement production more than offset losses for clay, peat, sand and gravel, and stone. Mine output of coal also advanced. The county was the leading source of cement and stone, and ranked second and third in producing coal and sand and gravel, respectively.

Ideal Cement Co. completed modifications designed to increase annual capacity of its Grotto facility.

Tonnage of coal at four mines in the county increased about 16 percent over 1957. The Franklin No. 12 and Danville mines of Palmer Coking Coal Co. were the main producers.

Locally mined clays were used by cement plants and manufacturers of firebrick and tile, heavy clay products, and flowerpots.

The county was the leading peat-producing area in the State.

Bethlehem Pacific Coast Steel Corp., the major rolled-steel producer in the Pacific Northwest, continued modernization and expansion of its Seattle plant.

Mine development, including completion of a 2-compartment shaft, was conducted, and a 25- to 40-ton multiple-hearth furnace was being constructed at the Cardinal Reward and Royal Reward mercury mines (Washington Mining Corp.) near Palmer.

Kittitas.—The county maintained its position as the leading source of coal in the State. Output dropped to 144,000 tons, compared with 261,000 tons in 1957. The Roslyn strip mine and the underground mine of Northern Pacific Railway Co. Coal Department and the No. 4 mine of Roslyn Cascade Coal Co. contributed to the total. The value of coal mined was about $850,000 less than in the preceding year. In total value output of nonmetals, the county dropped to eleventh place from seventh.

Okanogan.—Flaghill Mines, Inc., employed a four-man crew to rehabilitate the Spokane mine at Wannacut Lake. Gold, silver, lead, and copper ores previously were mined.

Pend Oreille.—The Metaline Falls plant of Lehigh Portland Cement Co. was the principal nonmetal mineral industry in the county. Value of cement and stone production was higher than in 1957 in contrast to a sharp drop in valuation of sand and gravel output.

Despite its lower production rate, Pend Oreille lead-zinc mine near Metaline Falls reduced costs from $3.88 to $3.28 per ton, according to the annual company report to shareholders. It scheduled excavation of a new inclined shaft and completion of a crusher plant. Development was enough to maintain the reduced production schedule.

A new inclined shaft to reach deeper lead-zinc ores at the Grandview mine near Metaline Falls was about one-third completed. The mine and mill employed approximately 65 men on a 5-day-week schedule in 1 production shift and 1 development shift daily.

The Lost Creek open pit (Triple H. & J. Mining Co.) was the third largest uranium producer in the State; output of high-grade ore came from the mine begun during the year.

Utahcan, Inc., was building a mill at a lead-zinc-silver property near Ione.

Pierce.—The county dropped from fourth to sixth in nonmetal output, but the value of production increased to $3 million compared with $2.6 million in 1957. Advances were noted in production of sand and gravel (second in State) and stone. The quantity of clay mined was less than in the preceding year.

The American Smelting and Refining Co. reduced its Tacoma copper smelter work force by 110 workers in February because of poor markets for copper and low ore receipts.

The Kaiser Aluminum & Chemical Corp. Tacoma aluminum plant shut down its large vertical-stud pots in February, reduced output by one-half potline in March, and closed its entire plant in May. Production of silicon metal and ferrosilicon was continued by Ohio Ferroalloys Corp. at its plant at Tacoma.

Skagit.—The value of cement, sand and gravel, and olivine substantially increased resulting in Skagit County ranking fifth as a source of nonmetal mineral commodities ($3.5 million). Sand and gravel was almost double in the 1957 total. Stone production continued to decline.

Skamania.—Completion of major heavy construction work at the Swift Hydroelectric Project for Pacific Power & Light Co. resulted in a sharp decrease in output of sand and gravel and stone.

Snohomish.—Federal, State, county, and municipal groups used sand and gravel and stone for road construction and maintenance. Granite was crushed for poultry grit and roofing granules, and limestone was processed for agricultural purposes. Building brick was made from clay mined locally.

Kromona Consolidated Mines, Inc., mined and shipped copper ore from the Kromona mine, near Sultan, to the Tacoma smelter; the company reported that the ore contained 0.1 to 3.0 percent molybdenite and processes for recovering the mineral were being investigated.

Spokane.—The county again was third in value of nonmetal mineral commodity output in the State, and the relative standing of cement (third) and clay (first) did not change. Output of stone almost tripled and the quantity of sand and gravel recovered was only slightly less than in 1957. The principal nonmetal industry, the Ideal Cement Co. plant at Irvin used limestone and iron ore from Stevens County and mined clay locally for manufacturing cement.

Gladding, McBean & Co. formally dedicated its superduty refractories plant at Mica, which facility was part of its $3-million expansion.

Kaiser Aluminum & Chemical Corp. made net capital additions of approximately $400,000 in the State and employed over 4,500 persons, principally at the Trentwood rolling mill and Mead reduction works. One potline was closed down the entire year at the Mead works; another potline was shut down in December 1957 and reactivated in October; and the two potlines closed in April were reopened in August.

Pacific Northwest Alloys, Inc., produced low-carbon ferrochrome on a curtailed basis, principally to supply the manufacturers of stainless steel. Lack of orders completely closed this operation for several months during the year.

Bear Creek Uranium Co. completed a 94-foot shaft and over 100 feet of drifting and crosscutting and signed a contract to deliver 300 tons of ore a month with the Dawn Mining Co. mill at Ford.

Clayloon Uranium Co. was sinking a shaft on the Huffman lease under a profit-sharing agreement with Daybreak Uranium, Inc.

Daybreak Uranium, Inc., began a new underground mine off the existing open pit at the Dahl lease. A 37-hole exploratory-drilling program was carried out by the company in the Mount Spokane district.

Mudhole Exploration Co. shipped ore that was mined with a bulldozer at the Hanson lease; exploration was carried out under a contract with the DMEA.

North Star Uranium, Inc., explored the Lehmbecker lease and shipped to the Ford mill.

Field offices of the Bureau of Mines, Geological Survey, and OME were in Spokane. Personnel from the first two agencies comprised the field teams through which property examinations and inspections were conducted in conjunction with the OME program of loans for mineral exploration.

Stevens.—Dawn Mining Co. (51-percent-owned subsidiary of Newmont Mining Co.) mined 1,400 tons of uranium ore daily from 3 open pits at the Midnite mine. Mining and haulage were contracted; Isbell Construction Co., Reno, Nev., held the mining contract. Drilling at the Midnite mine revealed primary uranium ore (uraninite and coffinite) below the secondary minerals (meta-autunite, uranophane, and sooty uraninite) being mined.

Silver Buckle Mining Co. purchased the Peters lease from Northwest Uranium Mines, Inc., and in August began to ship ore to the Ford plant under a contract for a minimum of 420 tons a week.

Iron ore was shipped from the Kulzer mine to a cement plant in the Spokane area.

A. G. Lotze produced lead ore at the Electric Point and Gladstone mines.

Whatcom.—The county ranked second in the State as a source of nonmetal mineral commodities, owing to the increased value of cement, stone, and clay. The Olympic Portland Cement Co., Ltd., operation was the principal mineral industry in the county.

Yakima.—This was the second year of activity at the pumicite operation of Butte Pozzolan Co. near the Priest Rapids Dam; output of pumicite pozzolan was used in construction of the dam. Clay mined near Granger was processed for building brick and heavy clay products. A small quantity of bentonite, used as a hydro-seal in irrigation canals, was produced near Naches.

The Mineral Industry of West Virginia

This chapter has been prepared under the cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the West Virginia Geologic and Economic Survey.

By James R. Kerr [1] and Jean Pendleton [2]

WEST VIRGINIA'S mineral production decreased sharply in 1958 owing to a loss of $240 million in value of coal production. The drop in U.S. steel output and decreased industrial activity affected not only coal but the lime, refractory clay and stone industries, all closely affiliated with steel, also were depressed. Minerals for the construction industry, clay for building brick, sand and gravel, and cement decreased only slightly, indicating continuance of firm construction activity.

Counties leading in value of mineral output were McDowell, Logan, Wyoming, Marion, Raleigh, Kanawha, and Monongalia.

TABLE 1.—Mineral production in West Virginia [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays	707,533	$2,691	509,806	$1,960
Coal	156,842,038	875,587	119,467,697	635,201
Gem stones			[2]	[3]
Natural gas ---million cubic feet--	202,440	48,181	204,581	50,734
Natural gas liquids:				
Natural gasoline ---thousand gallons--	30,435	2,185	27,917	5,643
LP-gases ---do---	235,881	6,543	235,524	12,806
Petroleum (crude) ---thousand 42-gallon barrels--	2,215	9,436	[4] 2,186	[4] 7,629
Salt (common)	648,139	2,642	626,709	2,784
Sand and gravel	5,353,527	9,893	5,252,586	11,729
Stone	6,989,043	11,934	[5] 5,598,623	[5] 9,990
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, cement, lime, and manganese ore (1957)	----------	14,938	----------	13,104
Total West Virginia [6]	----------	[7] 981,654	----------	749,784

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $1,000.
[4] Preliminary figure.
[5] Excludes certain stone, data for which are included with "Items that cannot be disclosed."
[6] Total adjusted to avoid duplicating value of clays and stone used in cement and lime.
[7] Revised figure.

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REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Bituminous coal production decreased 24 percent. All major markets were depressed. Lower steel output, a decline in the European coal market because of overbuying in 1957, and increasing competition from oil and gas were the underlying factors in the loss in these two markets. In the electric utility market coal continued to be displaced by oil, gas, and hydroelectric power.

Underground mining continued to predominate, comprising 91 percent of output, strip 7 percent, and auger 2 percent. There were 1,283 underground, 174 strip, and 78 auger mines active. Of the underground mined tonnage, 91 percent was loaded mechanically. Mobile loading was the most important method, comprising 77 percent of the mechanically loaded output. Of the 1,304 mobile loaders active, 956 loaded into shuttle cars, 207 onto conveyors, and 141 into mine cars. Continuous mining was on the upswing, as 189 machines (37 more than in 1957) were active, cutting and loading 19 percent of underground output. Hand loading onto face or room conveyors dropped to comprise only 4 percent of output; the number in use decreased by 148 to 478. Duckbills and self-loading conveyors also declined to comprise less than 1 percent of the total. Over 97 percent of the underground tonnage was cut by 2,406 machines. There were 2,929 handheld and post-mounted and 125 mobile drills for coal, plus 553 rotary and 479 percussion drills for roof bolting and rock drilling.

Active at strip mines were 366 power shovels, 16 draglines, 16 carryall scrapers, 328 bulldozers, and 108 horizontal and 79 vertical overburden drills.

Augering was done by 106 machines.

There were 192 cleaning plants, 2 less than in 1957, cleaning 69 percent of the total output. Of this, 37 percent was by jigs, 53 percent by wet washing other than jigs, and 10 percent by pneumatic methods. A 5-percent decrease in tons crushed (23 percent) was noted. Of the tonnage treated for dust-allaying and antifreezing purposes, most was treated with oil (82 percent) and the balance by calcium chloride and combinations of calcium chloride and oil. Of the total production, 95 percent was shipped by rail or water, 3 percent by truck, and 2 percent by all other methods.

According to preliminary data, employment at coal mines decreased 12 percent, as 8,365 fewer men were employed. The total average employment in underground mines was 60,198 men, in strip mines 2,429, and in auger mines 639. Comparative accident data were: In 1957—188 fatal and 6,170 nonfatal injuries were reported; in 1958 there were 149 fatal and 5,190 nonfatal injuries.

Experiments for advancing mining technology included the following: (1) Studies on the feasibility of remote-control units for continuous miner operation, (2) visual tension indicators to show initial and loading tensions on roof bolts, (3) infusion of roof with adhesives over solid coal in advance of mining, (4) techniques for auxiliary face ventilation for continuous miners (including inertial dust collectors and foam dust traps at face), and (5) continuous monitoring of methane at the face.

An indication of the trend in new major mine development was noted in the opening of the Loveridge mine of the Mountaineer Coal Co. Division, Consolidation Coal Co. near Fairmont, Marion County. One of the world's largest mines, with an ultimate annual capacity of 3 million tons, it will begin operation at 50 percent of capacity. After chemicals have been removed from the Loveridge output by proposed new chemical plants in the vicinity, the char residue, a fine cokelike substance will fire the boilers of the Ohio Power Co. 675,000-kw.-hr. Kammer station. The power will supply an aluminum-reduction plant on the Ohio River at Clarington owned by Ormet Corp. Hanna Coal Co., Division Consolidation Coal Co. opened a 3-million-ton-annual-capacity preparation plant near Moundsville, which is part of a large industrial complex that includes the Ireland mine. Coal is hauled from the mine to the preparation plant on a 60-inch-wide, mile-long conveyor belt. A portion of Ireland output also was destined to the Kammer powerplant.

TABLE 2.—Coal production by counties, in short tons

County	1957		1958	
	Production	Value	Production	Value
Barbour	3,808,997	$18,007,519	3,221,003	$14,542,104
Boone	7,344,010	36,885,160	5,456,235	26,379,072
Braxton	220,872	913,704	196,788	814,734
Brooke	110,114	5,023,504	748,411	3,577,772
Fayette	7,118,769	42,575,944	5,153,074	30,991,144
Gilmer	394,890	1,538,899	407,372	1,557,298
Grant	93,954	360,483	94,179	278,689
Greenbrier	1,340,265	7,254,308	1,084,539	5,147,430
Hancock	8,071	40,825		
Harrison	9,193,139	42,719,577	6,538,502	29,355,409
Kanawha	10,867,876	54,694,166	9,583,862	45,191,208
Lewis	1,059,510	3,957,803	790,197	2,668,994
Logan	22,518,288	119,672,148	16,449,686	79,212,992
McDowell	19,023,435	133,170,580	13,955,106	95,777,325
Marion	11,970,907	68,032,242	9,471,631	53,237,029
Mason	195,031	805,403	346,397	1,156,802
Mercer	1,442,327	9,442,954	888,508	5,295,652
Mineral	(1)	(1)	97,546	372,053
Mingo	7,667,629	40,344,862	5,905,108	29,606,338
Monongalia	10,160,807	51,906,028	6,945,673	34,982,616
Nicholas	5,893,328	32,846,621	4,726,596	23,935,660
Pocahontas	564,798	2,283,069	576,448	2,792,342
Preston	2,450,810	9,221,409	2,039,176	7,465,539
Putnam	158,657	669,061	67,493	232,518
Raleigh	11,566,776	75,716,808	7,777,600	48,219,343
Randolph	1,017,937	5,923,929	874,073	4,730,843
Summers			11,519	49,383
Taylor	514,119	1,946,369	174,648	588,399
Tucker	355,663	1,423,549	406,808	1,132,032
Upshur	1,429,636	6,620,733	1,085,414	4,770,190
Wayne	172,046	712,282	56,337	192,109
Webster	1,126,069	6,284,918	769,224	4,407,116
Wyoming	12,892,434	79,385,005	10,344,308	61,681,966
Undistributed	3,160,874	15,207,216	3,224,236	14,859,316
Total	156,842,038	875,587,078	119,467,697	635,201,417

[1] Included with "Undistributed" for 1957, which also includes data for Clay, Marshall, and Ohio Counties for 1957 and 1958.

TABLE 3.—Coal production in West Virginia, in thousands

Year	Short tons	Value	Year	Short tons	Value
1949–53 (average)	141,171	$738,595	1956	155,890	824,043
1954	115,996	541,370	1957	156,842	875,587
1955	139,168	653,388	1958	119,468	635,201

Coke and Coal Chemicals.—Five oven-coke plants (813 ovens) were active, producing 3,289,537 tons of coke (648,465 tons less than in 1957). The average value of the coke at the ovens was $16.11 per ton. Recovered products at the coke plant included 205,463 tons of coke breeze (a yield of 4.62 percent per ton of coal carbonized), 53,200,060 thousand cubic feet of coke-oven gas, 44,973 tons of ammonium sulfate equivalent, 50,087,091 gallons of coke-oven tar, and 14,189,685 gallons of crude light oil from which were derived 7.847,868 gallons of benzene, 2,447,947 gallons of toluene, 792,828 gallons of xylene, and 138,628 gallons of solvent naphtha (crude and refined).

Of the coal carbonized, about three-fourths was produced in Pennsylvania and shipped into West Virginia. Most of the remainder was produced in West Virginia, plus a small quantity mined in Virginia. Most of the coal carbonized (86 percent) was high-volatile bituminous. The major portion of coke produced was consumed in blast furnaces. The second-ranking consumer in the State was producer and water-gas plants. Both these markets dropped sharply, with lower steel output and discontinuance of the use of coke by Olin-Mathieson Chemical Corp. as a starting raw material in making synthetic ammonia at its Morgantown plant.

Petroleum and Natural Gas.—Output of petroleum decreased only slightly, but its value decreased 19 percent due to a sharp drop in price. Natural gas and natural gas liquids (both natural gasoline and LP-gases) also were produced.

The number of well completions increased by 76 to a total of 756. Of these, 114 were oil, 512 gas, 122 dry, and 8 service wells. Total footage drilled was 2,044,085, an average of 2,704 feet a well. Seven hundred and thirty-four were field wells and 22 wildcat. Of the 22 wildcat wells drilled, 13 were gas, and 9 were dry; 736 of the completions were by cable tool, and 20 were by rotary rigs. Producing crude oil wells (14,415) averaged 5,978 barrels per day, an average of 0.4 barrel daily.[3]

According to the American Petroleum Institute and the American Gas Association, reserves as of January 1, 1959, were 1,557,633 million cubic feet of natural gas, 52.1 million barrels of petroleum, and 63.3 million gallons of natural gas liquids (a significant change from the 22.9 million gallons on January 1, 1958).

NONMETALS

Cement.—Shipments of Portland cement dropped 8 percent, but the output of masonry cement remained virtually the same as in 1957. Production, which was at 76 percent of capacity, was mostly non-air-entrained Types I and II, general use and moderate heat, but small quantities of Type III, high-early strength, and waterproof portland also were produced. Shipments were mostly by rail in bulk and in paper containers to Maryland, Virginia, West Virginia, and the District of Columbia. Eleven kilns were reported active averaging 213 days worked per year. Two companies were active in Berkeley and Preston Counties.

[3] Oil and Gas Journal, Review-Forecast: Vol. 57, No. 4, Jan. 26, 1959.

Clays.—The output of fire clay was 34 percent less than 1957, due largely to decreased demand for refractory materials. Small consumption by fire brick and block manufacturers and by foundries and steelworks was the main cause. The output of miscellaneous clay used for building brick was only slightly less than 1957; however, output for cement manufacture was off 37 percent.

Ten clay pits (four underground and six opencut) and 10 plants were active in six counties. Hancock County led, followed by Berkeley and Kanawha Counties.

North American Coal Corp. and Strategic Materials Corp. formed the Strategic North American Corp. to develop a process for making alumina from clay occurring adjacent to coal seams. Plans were to mine clay at the Powhatan coal mines.

TABLE 4.—Clays sold or used by producers

Year	Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1949–53 (average)	515,993	$1,526,292	340,835	$299,085	856,828	$1,825,377
1954	290,256	1,171,495	296,864	279,044	587,120	1,450,539
1955	406,025	2,277,163	301,408	286,126	707,433	2,563,289
1956	428,033	2,171,942	341,485	277,266	769,518	2,449,208
1957	402,581	2,445,427	304,952	245,182	707,533	2,690,609
1958	264,107	1,732,634	245,699	227,340	509,806	1,959,974

Gem Stones.—Aragonite, stilbite, and marine fossils were collected by hobbyists in Hardy and Mineral Counties and other unspecified locations.

Lime.—Production of lime decreased 42 percent, chiefly because of the low operating rate of the steel industry. Demand for refractory material and for industrial uses was far below that of 1957. Output of agricultural lime increased and building lime remained virtually unchanged. Of the lime output, 59 percent was for refractory uses, 33 percent for industrial uses, 5 percent for agricultural uses, and the balance was for building. Ninety-five percent of the output was quicklime. Two companies operated four plants employing 15 kilns (five rotary kilns burning coal and 10 pot kilns burning coke). Output at 36 percent of capacity was reported from Jefferson and Berkeley Counties.

Natural Salines.—Bromine, bromine compounds, calcium-mangnesium chloride, and soda ash were prepared from well brines produced near South Charleston.

Salt.—Salt production showed an overall decrease although output rose in two of the three producing counties. As in past years, most of the salt output was consumed in brine form in manufacturing chemicals (mostly chlorine). Evaporated salt was produced by the open-pan method and sold in Mason County.

Sand and Gravel.—Although production of sand and gravel decreased slightly, the value increased significantly, owing to increased prices of the more valuable types of sand (glass sand and ground sand). The strong market of 1957 for grinding and polishing sands was depressed in 1958 as the output dropped considerably. An indication of increased road-building activity was reflected in the paving sand and gravel uses that increased 13 and 81 percent, respectively,

offsetting partly decreased demand for structural material. Of the total sand and gravel output, 36 percent was for structural purposes, 34 percent was for paving purposes, and a considerable quantity used in glass sand manufacture. Output was reported from 16 counties. Leading tonnagewise were Hancock and Morgan Counties, followed by Wood and Wetzel Counties. Morgan County, with its valuable glass-sand deposits led in value of production.

TABLE 5.—Sand and gravel sold or used by producers, by uses

Use	1957		1958	
	Short tons	Value	Short tons	Value
Sand:				
Building	973,526	$1,228,895	936,348	$1,216,678
Paving	909,529	1,130,924	1,028,377	1,184,291
Grinding and polishing	(1)	(1)	59	186
Fire or furnace	54,295	86,607	43,095	63,457
Engine	(1)	(1)	111,385	288,347
Gravel:				
Building	1,392,791	1,445,064	957,112	1,218,645
Paving	424,061	729,378	769,286	951,741
Railroad ballast	14,899	17,134	(1)	(1)
Other	109,752	209,271	(1)	(1)
Undistributed [2]	1,474,674	5,045,450	1,406,924	6,805,822
Total	5,353,527	9,892,723	5,252,586	11,729,167

[1] Figure withheld to avoid disclosing confidential data of individual companies; included with "Undistributed."
[2] Includes grinding and polishing sand (1957), engine sand (1957), glass, molding, and other sands, and railroad ballast gravel (1958), and other gravel (1958).

Stone.—The stone industry, limited almost entirely to crushed-limestone production, was depressed in 1958. All major markets consumed less crushed limestone, with the greatest decreases in the consumption as flux, for railroad ballast, and for lime manufacture. Berkeley County replaced Jefferson as the leading limestone-producing county. Output was reported from 11 counties.

A significant output of crushed sandstone for concrete aggregate and roadstone was reported from Monongalia County, and a small quantity of dimension sandstone was quarried in Greenbrier County. Calcareous marl was produced for soil conditioning.

TABLE 6.—Stone sold or used by producers, by uses

Use	1957		1958	
	Short tons	Value	Short tons	Value
Crushed and broken stone:				
Flux	2,879,829	$5,145,448	2,403,790	$4,346,862
Concrete and roadstone	1,719,360	2,939,972	1,717,434	3,053,291
Agricultural (limestone)	51,694	125,143	(1)	(1)
Other [2]	380,383	840,335	210,274	487,845
Undistributed [3]	1,957,777	2,883,489	1,266,645	2,089,927
Dimension stone: Rough architectural (sandstone)	(1)	(1)	480	12,000
Total	6,989,043	11,934,387	5,598,623	9,989,925

[1] Figure withheld to avoid disclosing confidential data of individual companies; included with "Undistributed."
[2] Includes limestone for miscellaneous uses (asphalt filler, coal dust, stone sand, chemical, and rock dust) and calcareous marl.
[3] Includes limestone for cement and lime, riprap, railroad ballast, agricultural limestone (1958), and dimension sandstone (1957).

Sulfur, Recovered Elemental.—Sulfur was recovered as a byproduct in the liquid purification of gas in Kanawha and Monongalia Counties. The plant in Monongalia County was closed during the year.

METALS

Aluminum.—Fully integrated production of aluminum began in the Ohio Valley after 4 years of construction and an expenditure of more than $200 million with the starting of the hot-rolling line at the Ravenswood plant of Kaiser Aluminum & Chemical Corp.[4] Plant employment was nearly 2,000; and, when all scheduled equipment is installed by 1960, employment will total over 4,000. Two of four potlines at the reduction plant were in operation. The plant has its own carbon plant to provide 83,000 tons of anode and cathode paste annually for the electrolytic cells in the potline.

Ferroalloys.—Fourteen types of ferroalloy material were produced in West Virginia. The largest production was ferrochromium, ferrosilicon, and ferromanganese.

Iron and Steel.—Weirton Steel Co. Division National Steel Corp., and Wheeling Steel Corp. with four and one blast furnaces, respectively, had an annual operating capacity of 2,646,000 tons—an increase of 100,000 tons over 1957. Weirton Steel Co. also operated a basic open-hearth plant with 14 furnaces and a capacity of 3.3 million tons. Also at the Weirton plant were two Bessemer converters for melting the feed to open-hearth furnaces. Connors Steel Co., Division of H. K. Porter Co., Inc., at Huntington had an electric-furnace capacity of 110,000 tons a year. Weirton Steel Co. placed in operation a 6,000-ton-a-day iron-ore sintering plant during the year.

Nickel.—The International Nickel Co., Inc., at its Huntington plant produced rolled nickel, Monel, Inconel, Inconel X, K, Duranickel, nickel-chromium, nickel-manganese, and nickel-copper alloy in rods, bars, strip, sheets, plates, tubes, gas welding rods, angles, channels, forgings, and special shapes.

Zinc.—The Meadowbrook Corp. continued operating its vertical-retort zinc smelter at Spelter in Harrison County.

Zirconium.—Carborundum Metals Co. operated its first full year at its Washington, Woods County, zirconium plant. The plant produced zirconium sponge metal from Florida zircon for the Atomic Energy Commission.

REVIEW BY COUNTIES

Barbour.—Although production of bituminous coal decreased 2 percent, the total number of mines increased from 50 to 59. Underground (41 mines) comprised 74 percent of the total tonnage, strip (16 mines) 25 percent, and auger (2 mines) 1 percent. Eleven companies reported mechanical loading, an increase of 1 over 1957, with mobile loading into shuttle cars the chief method. Clinchfield Coal Co. discontinued use of two continuous miners. Of the total underground production, 83 percent was mechanically loaded, and 40 per-

[4] Mining Congress Journal, vol. 44, No. 7, July 1958, Modern Metals, Ravenswood Works: Vol. 14, No. 6, July 1958, pp. 68–73.

TABLE 7.—Value of mineral production in West Virginia, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value [2]
Barbour	$18,007,519	$14,542,104	Coal.
Berkeley	12,329,764	11,219,824	Cement, stone, lime, clays.
Boone	36,885,160	26,379,072	Coal.
Braxton	913,704	814,734	Do.
Brooke	5,092,611	(3)	Coal, sand and gravel.
Cabel	(3)	(3)	Sand and gravel, clays.
Clay	(3)	(3)	Coal.
Fayette	42,575,944	30,991,144	Do.
Gilmer	1,538,899	1,557,298	Do.
Grant	(3)	(3)	Coal, stone.
Greenbrier	(3)	(3)	Do.
Hancock	(3)	(3)	Sand and gravel, clays.
Hardy	(3)	145,600	Stone.
Harrison	42,719,577	29,355,409	Coal.
Jackson	875		
Jefferson	(3)	(3)	Stone, lime.
Kanawha	56,634,965	46,891,164	Coal, salt, bromine, clays, calcium chloride, sand and gravel.
Lewis	3,960,803	2,679,494	Coal, clays.
Lincoln	23,641	9,575	Sand and gravel.
Logan	119,672,148	79,212,992	Coal.
Marion	68,032,242	53,237,029	Do.
Marshall	(3)	(3)	Coal, salt.
Mason	(3)	(3)	Coal, salt, sand and gravel.
Mercer	9,512,954	5,303,902	Coal, clays.
McDowell	133,170,580	95,777,325	Coal.
Mineral	(3)	(3)	Coal, stone.
Mingo	40,349,214	29,606,338	Coal.
Monongalia	(3)	(3)	Coal, stone, sand and gravel.
Monroe	(3)		
Morgan	(3)	(3)	Sand and gravel.
Nicholas	32,866,701	23,947,648	Coal, sand and gravel.
Ohio	(3)	(3)	Do.
Pendleton	11,672	14,421	Stone.
Pocahontas	2,283,069	2,792,342	Coal.
Preston	(3)	(3)	Coal, cement, stone.
Putnam	669,061	232,518	Coal.
Raleigh	75,751,347	(3)	Coal, sand and gravel.
Randolph	(3)	5,018,843	Coal, stone.
Summers		49,383	Coal.
Taylor	1,946,369	588,399	Do.
Tucker	1,427,694	1,275,393	Coal, stone.
Upshur	6,620,733	4,770,190	Coal.
Wayne	733,929	(3)	Coal, sand and gravel.
Webster	6,284,918	4,407,116	Coal.
Wetzel	975,999	(3)	Sand and gravel.
Wood	(3)	941,750	Do.
Wyoming	79,402,505	(3)	Coal, sand and gravel.
Undistributed	[2] 181,272,971	278,022,331	
Total	[4] 981,654,000	749,784,000	

[1] The following counties were not listed because no tonnage was reported: Calhoun, Doddridge, Hampshire, Pleasants, Ritchie, Roane, Tyler, and Wirt.
[2] Natural gas, natural-gas liquids, and petroleum, not listed by counties; also includes a small amount of sand and gravel and gem stones not specified by county; included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Revised figure.

cent of total output was cleaned. Of this, wet washing cleaned 80 percent, the balance by pneumatic methods. Simpson Creek Collieries abandoned its Galloway mine during the year. Most mining was in the Pittsburgh seam, which averaged 80 inches in thickness, and the Redstone seam, which averaged 68 inches in thickness.

Berkeley.—The Standard Lime & Cement Co. continued to produce portland and masonry cement at its Martinsburg plant. The output was mostly for general and moderate heat uses, although high-early-strength types were also produced. Limestone, cement rock, and shale were mined at company-owned pits and quarries for use in cement manufacture. Five rotary kilns ranging from 9 to 12 feet in diameter and 175 to 450 feet in length were in operation. New

finish grinding mills and accessories were completed September 20. Portland-cement shipments went mostly to Maryland, Virginia, District of Columbia, and Pennsylvania. Masonry shipments were consigned to Maryland, North Carolina, and Virginia.

In addition to the production of limestone for cement manufacture, output was reported for metallurgy, concrete aggregate, and roadstone. Producers were: W. F. Frey, J. E. Baker, Standard Lime & Cement Co., and Jones & Laughlin Steel Corp. (Blair Limestone Division). The latter company also sold limestone for railroad ballast and for use as raw material in producing captive lime. Standard Lime & Cement Co. produced lime for metallurgy, masonry and mortar, and miscellaneous uses.

Miscellaneous clay for building brick was mined at two opencuts, one operated by the United Clay Products Co. (North Mountain) and one by Continental Clay Products Co. (Martinsburg).

Boone.—Coal production in Boone County (ranked 10th in coal output) decreased 26 percent as the number of active mines decreased from 55 to 46. Underground mining comprised 88 percent of the total output, auger mining 7 percent, and strip mining 5 percent. Almost all of the underground production was loaded mechanically by 67 mobile loaders and 4 continuous miners. Westmoreland Coal Co. began continuous mining. Nine cleaning plants cleaned 90 percent of the output, mostly by wet-washing methods. Most production was in the Cedar Grove seam, which averaged 36 inches in thickness.

Braxton.—Underground mining, which comprised 97 percent of the total output, decreased 14 percent, and the number of underground mines decreased 2 to 7. The R. & H. Coal Co., the only strip producer, began operating. Of the total underground production, almost 80 percent was loaded mechanically. Cedar Creek Coal Co. cleaned its output by calcium chloride air-box methods. Mining was mostly in the Pittsburgh seam, averaging 54 inches in thickness.

Brooke.—Although the number of mines in operation (12) remained the same as in 1957, production decreased 33 percent. Underground mining comprised 78 percent of the total, strip 20 percent, and auger 2 percent. Of the total underground production, 93 percent was mechanically loaded. Ninety-five percent of total production was mechanically cleaned, employing Jeffrey jigs, Chance cones, and R. & S. hydro methods. The entire production was in the Pittsburgh No. 8 seam, which averaged 53 inches in thickness.

The Brilliant Sand Co. produced fire or furnace sand from a stationary plant near Follansbee. Duquesne Sand Co. dredged paving sand and gravel from the Ohio River near Wellsburg.

Cabell.—The Ohio River Dredging Co. and the Union Sand & Gravel Co. operated dredges on the Ohio River, producing chiefly structural and paving material. Miscellaneous clay (red shale) for building brick was mined from an opencut near Barboursville.

Clay.—Coal production decreased 13 percent as the number of mines decreased from 9 to 7. Strip mining ceased in 1958. Underground mining comprised 99 percent of the total output; the balance was produced by auger mining. Loading at two of the five underground mines was by mechanical methods, accounting for 96 percent of output. Virtually all the output was cut by machine, and 100 percent was drilled. Ninety-two percent of the total county production was

cleaned by Baum jigs and by dense-medium washing. The Elk River Coal & Lumber Co., the leading producer, sold out to Clinchfield Coal Co. in November. Mining was mostly in the Kittanning seams, which varied from 36 to 84 inches in thickness.

Fayette.—Although the number of mines decreased by only two, coal production decreased 28 percent. Underground mining, which comprised 95 percent of the total, decreased 25 percent, strip mining 53 percent, and auger mining 64 percent. Forty-four percent of the total underground tonnage was loaded mechanically. Thirty percent was cleaned, using jigs and other wet washing (chloride, Chance cone, and hydroseparators). The Maryland New River Coal Co. reported cleaning for the first time, using calcium chloride. Royalty Smokeless Coal Co. took over the Medo Fuel Co. on January 1 and installed a continuous miner. The Powellton No. 9 mine of the Eastern Gas & Fuel Associates closed on February 1, and the New River Co. suspended operations at the Summerlee mine in May. According to the setup of the Coal Act districts, Fayette County is divided into District 7 and District 8. In District 7 mining was mostly in the Sewell seam, which averaged 36 inches in thickness. In District 8 mining was mostly in the Eagle and Powellton seams, which averaged 45 inches in thickness.

Gilmer.—Gilmer was one of the five counties in the State to show increased coal production. Underground production (seven mines) made up 48 percent of the county total, strip mining (two mines) 44 percent, and auger mining (one mine) 8 percent. Mechanical loading increased, as over half of the county production was mechanically loaded, owing chiefly to the output of the Kessler Coal Co., which opened in April, and loaded mechanically, with a mobile loading machine and two shuttle cars. The Rochester & Pittsburgh Coal Co. cleaned its entire output at its recently constructed cleaning plant, which employed an R. & S. air cleaner. All mining in the county was in the Pittsburgh seam, which averaged 72 inches in thickness. Twenty-five feet was the average depth of overburden stripped.

Grant.—A slight increase in coal production was noted, even though the number of mines decreased from 9 to 7. Underground production decreased 71 percent, but was countered by a 71-percent increase in strip mining. Augering was reported; none the previous year. Strip mining comprised 76 percent, underground mining 16 percent, and auger mining 8 percent of the total tonnage. There was no mechanical loading or cleaning in the county. Underground mining was in the Bakerstown seam, which averaged 28 inches in thickness. The seams strip-mined were the Bakerstown (26 inches) and the Harlem (16 inches). The average depth of overburden was 32 feet. Buffalo Coal Co. mined in Grant County for a few months and then moved to Garrett County, Md.

A small tonnage of crushed limestone (for agricultural purposes) was produced.

Greenbrier.—Coal production decreased 19 percent. Underground mining comprised 73 percent of total production and strip mining the balance. Less than one-fourth of the underground output was loaded mechanically by hand loading onto face or room conveyors. Only two companies reported mechanical cleaning. They were

Lafayette Springs Coal Co. and Leckie Smokeless Coal Co., using calcium chloride and Kanawha heavy medium, respectively. Raine Lumber & Coal Co. was abandoned in June. The seams stripped were the Sewell and Fire Creek. The average depth of overburden was 40 feet.

The Acme Limestone Co. and the H. Frazier Co., Inc., both of Fort Springs, operated limestone quarries and produced crushed stone. The Acme Limestone Co. output was chiefly for concrete and roadstone and H. Frazier Co., Inc., for railroad ballast. Greenbrier Quarries produced dimension sandstone (rough blocks) for architectural purposes.

Hancock.—The county ranked first in clay production, with the Globe Brick Co. (Newell) and Crescent Brick Co. (New Cumberland) operating underground mines to produce plastic fire clay for manufacturing fire brick and block. West Virginia Fire Clay Manufacturing Co. mined plastic fire clay from an opencut near New Cumberland for foundries and steelworks.

The Dravo Corp., Keystone Division, continued to operate its Nos. 8 and 9 dredges on the Ohio River near Moscow to produce building and paving sand and gravel. The county continued to rank first in sand and gravel output.

Mines reporting coal production in 1957 (The A. A. A. L. W. underground mine and the M. E. Coal Co. strip mine) did not produce in 1958.

Hardy.—Feather Construction Co. and Potomac Valley Soil Construction Co. produced crushed limestone for concrete and roadstone and for agricultural purposes, respectively. West Virginia Soil Conservation did not operate its quarry.

The gem materials aragonite and stilbite were collected near Wardensville.

Harrison.—Although 16 fewer mines were reported active and total coal production decreased 29 percent, the county rose from 10th to 8th rank in coal production. Underground mining comprised 74 percent of the total, strip mining 20 percent, and auger mining only 6 percent. Of the underground production, 91 percent was mechanically loaded by 13 mobile loaders into mine cars, 58 mobile loaders into shuttle cars, and 4 continuous miners. Of the output, 57 percent was cleaned by five companies. Most production was in the Pittsburgh seam, which averaged 82 inches in thickness. In addition, a small tonnage of the Redstone seam was stripped. The depth of overburden ranged from 15 to 85 feet and averaged 43 feet.

The Meadowbrook Corp. operated its vertical-retort zinc smelter at Spelter during the year.

Jefferson.—Michigan Limestone Division, United States Steel Corp., Blair Limestone Division, Jones & Laughlin Steel Corp., and Standard Lime & Cement Co. were the active producers. The captive tonnage of the steel companies was used mostly for flux and some for concrete aggregate and roadstone. Production by the Standard Lime & Cement Co. (Millville) was for manufacturing dead-burned dolomite. This company abandoned the Bakerton quarry and lime plant.

Jones & Laughlin Steel Corp. and Standard Lime & Cement Co. burned a portion of their dolomitic limestone output to produce dead-burned dolomite.

West Virginia Lime Co. mined calcareous marl from an open pit near Charles Town for agricultural purposes. The product was sold in raw, sun-dried condition.

Kanawha.—This county ranked fourth in coal production compared with sixth in 1957. Although the total number of mines increased by 6 to 99, total production decreased 12 percent. Underground mining comprised 91 percent of the total, auger mining 7 percent, and strip mining 2 percent. Of the underground tonnage, 86 percent was loaded mechanically. There was an increase of five in the number of continuous miners. Imperial Colliery Co., Warner Collieries Co., and Wyatt-Seanor Coal Co. all added one and Cannelton Coal & Coke Co. added two. Sixty-nine percent of the total production was cleaned mechanically—over half by jigs. The Carbon Fuel Co. added a hydrotator and hydroseparator to its Nos. 9 and 12 cleaning plants. Mines abandoned during the year included the No. 7 mine of Carbon Fuel Co., the No. 2 mine of Fields Creek Coal Co., and the Nos. 10 and 14 mines of Riverton Coal Co. A wide variety of seams was mined in the county, but most of the tonnage was from the No. 2 Gas seam.

Westvaco Chlor-Alkali Division of Food Machinery & Chemical Corp. increased production of brine from wells near South Charleston for manufacturing chlorine. The company also purchased rock salt from Louisiana and Michigan. In addition, natural salines, bromine, bromine compounds, calcium-magnesium chloride, and sodium carbonate, were produced from well brines at South Charleston.

West Virginia Brick Co. and Charleston Clay Products Co. both operated underground mines near Charleston to produce flint and plastic fire clay, respectively, for manufacturing building brick.

Saint Albans Sand Co. (Saint Albans) and Charleston Sand Corp. (Big Chimney) produced engine and paving sand, respectively.

E. I. duPont de Nemours & Co. continued to recover brimstone at its Belle Plant, using the Thylox process.

Lewis.—Coal production was down 25 percent. Strip production, as reported by five companies, dropped 54 percent. Two fewer auger mines were active, but production was up 66 percent. Auger mining yielded 51 percent of the total output and strip mining 47 percent; the balance came from underground. The depth of overburden to the Pittsburgh and Redstone seams averaged 45 feet. The auger mines of Swaney Contracting Co. and the Good Hope mine of Bitner Fuel Co. did not operate. The Yochym Bros. McWhorter No. 2 mine was taken over by the B. H. Swaney, Inc. Twenty-nine percent of the total county output was cleaned mechanically.

Weston-Jane Lew Brick & Tile Co. operated two opencut mines near Jane Lew to produce miscellaneous clay for building brick and other heavy clay products.

Lincoln.—Davis & Adkins Sand Co. and Dean Coal & Sand Co. dredged engine sand from the Guyan River near Ferrellsburg. Guyan River Co. did not operate.

Logan.—The county remained in first place in coal production despite a 27-percent drop in output. Virtually the entire output was mined underground; only one strip and three auger mines were active. Significant mine closings included: No. 27 mine of Island Creek Coal Co., Hutchinson No. 8 mine of Jewell Eagle Coal Co.,

the mines of Mallery Eagle Coal Co., Superior Eagle Coal Co., Inc., the Winisle Coal Corp., and the auger mines of Amherst Coal Co., Baily Production Corp., and Omar Mining Co. Mechanical loading was similar to that of the preceding year. Almost nine-tenths of total output was cleaned mechanically, mostly by jigs and heavy medium processes. Additions to cleaning plants included Diester tables to Amherst No. 1 and Omar Central Plant to clean the ¼ by 0-inch fractions. The Island Creek, Chilton, and Cedar Grove seams were mined most in the county. Massey Coal Co. took over operation of Merrill Coal Co. during the year.

Marion.—Total production decreased 21 percent, as the number of underground mines decreased from 14 to 11. Most of the mines were large, averaging more than 850,000 tons. Five mines produced over 1 million tons. Only one strip mine was active. Almost 100 percent of the underground production was loaded mechanically. There were 31 continuous miners active; only 19 in 1957. Companies adding continuous miners to their mechanical loading force included: Consolidation Coal Co., which added seven continuous miners to three mines, Rochester & Pittsburgh Coal Co. added three, and Joanne Coal Co. cut back the number of mobile loading units and added two continuous miners. Nine plants reported mechanically cleaning 60 percent of the total output, with jigs and Deister tables the chief methods of mechanical cleaning. The Loveridge plant of Mountaineer Coal Co. began operating using a Jeffrey jig and Deister tables. Virginia & Pittsburgh Coal & Coke Co. was idle but reported that other companies were using its tipple. The seam mined most in the county was the Pittsburgh, which averaged over 80 inches in thickness. Considerable tonnages of captive coal were mined, mainly by Bethlehem Cuba Iron Mines and the Joanne Coal Co.

Marshall.—Coal production increased 36 percent, chiefly because of increased operation of the Ireland mine of the Hanna Coal Co. Division, Consolidation Coal Co., which put four more continuous miners into operation. The Valley Camp Coal Co. switched from mobile loading into mine cars to shuttle cars. Mechanical cleaning was practiced at two plants. Mining was in the Pittsburgh No. 8 seam, which averaged 65 inches in thickness. There was no stripping or augering.

The county continued to lead in salt production. Salt in brine form was produced by Columbia-Southern Chemical Corp. (New Martinsville) and the Solvay Process Division, Allied Chemical & Dye Corp. (Moundsville). Output was consumed as brine, mainly for manufacturing chlorine. Columbia-Southern reported adding one brine well whose development is in process.

Mason.—Coal production increased 50 percent as the number of mines increased from 5 to 9. The larger output of the Williams Coal Co. which took over operation of Moles Coal Co. contributed most to the increased county output. Almost 100 percent of the underground production was loaded mechanically. The chief mechanical loading method was mobile loading into mine cars and into shuttle cars and onto conveyors. None of the county production was cleaned mechanically. Most mining was in the Pittsburgh No. 8 seam, which averaged 60 inches in thickness. Coal was shipped

by truck and by barge on the Ohio River. One strip and one auger mine mined the Pittsburgh seam, removing 15 feet of overburden.

The Liverpool Salt Co. (Hartford) produced evaporated salt in open pans or grainers. Output was mainly for feed dealers and mixers, but small amounts were used for water softening and for meat packing. Shipments were equally distributed to West Virginia, Kentucky, and Ohio.

The Letart Sand & Gravel, Inc., dredged building and paving sand and gravel near Letart.

McDowell.—Underground production decreased 25 percent, although the number of mines increased by 21. There were no significant mine shutdowns; decreased production by larger producers was not offset by an increase in small truck mines. Although more mines were active in McDowell than in any other county, it ranked second in total output. There were eight fewer strip mines, and production decreased 44 percent, dropping the county to fourth place in strip output. Significant strip-mine shutdowns were: The General Mining & Construction Co. and Groves Landin & Cox, Inc. The average depth of overburden ranged from 20 to 58 feet but averaged 36 feet. Auger production was down 42 percent. Significant auger mine closings were the Cole Bros. and the Pocahontas Fuel Co. (Rolfe mine).

Almost 90 percent of the underground production was loaded mechanically. Mobile loading into shuttle cars was the most popular method. There were 46 continuous miners active—7 more than in 1957. Eastern Gas & Fuel Associates added two continuous miners, at its Keystone mine; the Nassau Coal Co. added one; the New River & Pocahontas Coal Co. began continuous mining at the Berwind No. 11 mine; the Olga Coal Co. added six continuous miners at the Olga mine; and Pocahontas Fuel Co. added one. United States Steel Co. No. 2 mine, where 17 continuous miners were employed in 1957, cut back to 4 in 1958. Eighty percent of the coal output was mechanically cleaned. Considerable tonnage was air cleaned, mostly the ⅜ by 0-inch fractions. Additions to cleaning plants included the Island Creek Coal Co. adding R. & S. air flow and Deister tables to the No. 1 and No. 6 mines, respectively, the United Pocahontas Co. adding a hydrotator and United States Steel Co. adding a Deister table to clean the fines. Nassau Coal Co. began cleaning using R. & S. air flow to clean the ⅜- x 0-inch sizes. W. B. Swope did not operate a cleaning plant.

The United States Steel Corp. No. 14 mine at Gary, which operated 693,817 man-hours without a disabling injury, won the Sentinels of Safety trophy for underground bituminous coal mines for 1958.

Mercer.—Coal production decreased 38 percent, although the number of mines decreased only by 2 to 25. Underground production decreased 42 percent—from over 1,000,000 tons to 670,000. Significant underground closings were the Piedmont colliery of Pocahontas Fuel Co. and the Louisville mine of Winding Gulf Coals, Inc. Strip tonnage decreased 20 percent, although one more mine (seven) was active. Production by augers was 60 percent less than in 1957; the Crane Creek auger of Pocahontas Fuel Co. did not operate. Seams mined most in the county were the Pocahontas Nos. 3 and 6.

The Virginian Brick & Tile Co. mined miscellaneous clay from an opencut near Princeton for building brick, drain tile, and building tile.

Bluefield Limestone Co., Inc., reported being out of business in 1958.

Mineral.—Total coal production more than doubled, as nine mines were active compared with only three in 1957. Strip mining was most important, comprising 79 percent of the county output. The depth of the contour-stripped overburden averaged 35 feet. Only one auger mine was active. The Bakerstown seam was mined most by underground methods, and the Bakerstown, Pittsburgh, and Daugherty seams were stripped.

The Spencer Lime Co. operated a limestone quarry near Kaiser to produce concrete aggregate and roadstone. Feather Construction Co. did not operate.

Marine fossils were collected from near Keyser by gem-stone hobbyists.

Mingo.—Coal production dropped 23 percent as the number of mines decreased by 20 to 37. Fourteen fewer underground mines were active, and production was 18 percent less. There was no stripping reported compared with 1957 when 4 mines produced over 350,000 tons. Significant strip mines closing were: The Ames Coal Co., The Gay Mining Co., The Liberty Mining Co., and The Mining Enterprises, Inc. Significant underground mines closed were: The B. & E. Coal Co., Lando Corp., The Ames Coal Co. No. 1 mine, and the No. 3 mine of Crystal Block Coal & Coke. The Alma, The Lower Thacker, and the Cedar Grove seams were the seams mined most. Virtually all the underground production was loaded mechanically. Island Creek Coal Co. began continuous mining at the Nos. 17 and 20 mines, but most of the county output was mobile-loaded into shuttle cars. Ninety-one percent of the total output was cleaned mechanically, mostly by jigs and heavy-medium processes, plus hydrotators for cleaning the fines.

The Guyan Valley Sand Co. did not operate.

Monongalia.—The county ranked seventh in bituminous coal production even though output dropped 32 percent. Only 3 strip and 1 auger mines were active. Virtually all the output was mined underground. A significant mine closing was by Lockview Coal Corp. which abandoned its No. 1 mine in August but less production was explained largely by smaller output from the major companies. The Pittsburgh seam yielded most of the county output, although a significant tonnage was also mined from the Sewickley and Redstone seams. A major portion of the tonnage was shipped on the Monongahela River. Almost 70 percent of the output was cleaned, chiefly by Chance sand flotation, with tabling in conjunction, and by jigs. Changes in mechanical loading in the county included Christopher Coal Co. adding a continuous miner to its Booth No. 6 mine and the Rosedale Coal Co. adding a continuous miner to its operation. Trotter Coal Co. used only one continuous miner compared with three in 1957. Valley Camp Coal Co. in its Maiden No. 2 mine did away with mobile loading into mine cars and loaded the entire production by continuous miners.

Keeley Construction Co. produced crushed sandstone for use as concrete aggregate and roadstone.

Lambert Bros., Inc., continued operating a limestone quarry near Morgantown (leased from Greer Limestone Co.) to produce crushed material for constructing the Sutton Dam.

Deckers Creek Sand Co., Morgantown, operated a stationary plant and produced glass and engine sands.

Olin Mathieson Chemical Corp. produced byproduct sulfur in liquid purification of gas at a plant near Morgantown. The plant ceased operation in June.

Monroe.—Output of manganese did not continue.

Morgan.—Pennsylvania Glass Sand Corp. ground a large quantity of sand at a stationary plant near Berkeley Springs. The major portion of output was used for glass sand, but considerable quantities also were used for pottery, abrasives, engine sand, molding sand, and enamels.

Nicholas.—Twenty percent less coal was produced than in 1957, as seven fewer mines were active. Strip production was up slightly, but one less auger mine reported production and output was only a fraction (one-sixth) of the preceding year's output. Augers not operating included those operated by Excavators, Inc., the Gauley Nos. 2 and 5 mines. Nicholas County is split into Coal Act Districts 3 and 8. In District 3 the Sewell seam was mined most, and in District 8 the Sewell and the Eagle seams were mined. Significant underground closings included abandonment of the Imperial Smokeless Coal Co. Quinwood No. 3 mine in October and the Peters Creek Coal Co. Nos. 6 and 7 mines in August.

A little more than half of the coal output was cleaned by mechanical methods. The J. F. Coal Co. reported cleaning for the first time using magnetite heavy-medium methods. Piper Corp. used hydroseparators and cleaned the minus-¼-inch material by air. The Johnstown Coal & Coke Co. added R. & S. air tables to clean the minus-⅜-inch fines. Eighty percent of the coal mined underground was loaded by mechanical means. The J. F. Coal Corp. added a continuous miner at the Jerry Fork mine.

Nettie Sand Co. (Nettie) produced building sand.

Ohio.—Coal production decreased 10 percent, although stripping was reported by two mines (none the preceding year). Most underground production was loaded mechanically and cleaned, using jigs and tables. Mining was mostly in the Pittsburgh No. 8 seam.

H. L. Seabright Co. dredged building sand and gravel from the Ohio River near Wheeling.

Pendleton.—North Fork Lime Producers Cooperative, Inc., continued to operate a limestone quarry at Riverton to produce crushed agricultural limestone (50 percent through 60-mesh).

Pocahontas.—Coal production increased slightly (2 percent). Six more underground mines were reported active in the year, but they were small truck mines. Augering was reported for the first time. Underground production was mostly mobile-loaded onto conveyors and into mine cars and also hand-loaded onto face or room conveyors. The Maust Coal & Coke Co. closed the Donegan No. 11 mine in April. There was no mechanical cleaning in the county. All output was from the Sewell seam, which averaged 38 inches in thickness.

Preston.—Total coal production dropped 16 percent, although 2 more underground mines (65) were active than in 1957. Strip production

dropped 7 percent, but augering was practiced while none had been done the preceding year. Only about one-third of the underground production was mechanically loaded; most was hand-loaded onto conveyors. There was no mechanical cleaning in the county. Production was from the Upper Freeport and Bakerstown seams, averaging 50 and 40 inches in thickness, respectively. The average depth of overburden stripped (mostly by diesel shovels with buckets less than 3 cubic yards capacity) was 42 feet.

Alpha Portland Cement Co. continued to operate its cement plant and limestone quarry at Manheim. Cement output was entirely Types I and II, general use, and moderate heat. The company generated most of its power requirements. Portland output was consumed mostly within the State, but significant quantities were shipped to Maryland, the District of Columbia, and Virginia. Masonry cement was also produced. Terra Alta Limestone Co. produced crushed limestone for concrete aggregate and roadstone from a quarry near Terra Alta.

Putnam.—Underground coal mining increased 56 percent, as the number of mines increased by 6 to total 13, but strip mining (which yielded over half the total output in 1957) was not practiced in 1958 because the Whit Coal Co. and the Yonker Coal Co., Inc., did not operate. Underground mining was entirely from hand-loading mines producing less than 10,000 tons. Only one small auger mine was active, producing only one-fifth of the previous year's auger total. There was no mechanical loading or cleaning in the county. The entire output was from the Pittsburgh No. 8 seam.

Raleigh.—The county dropped to sixth place in coal production, as output fell 33 percent below 1957. Underground mining at 120 mines comprised 93 percent of the total output. Only 12 strip and 7 auger mines, with 58 and 12 percent, respectively, less production than in the preceding year, were active. Significant changes in mechanical loading included addition of two continuous miners to the New River Co. Stanaford No. 2 mine, one to the C. H. Meade Coal Co. No. 3 mine, and one to Eastern Gas & Fuel Associates Eccles No. 5 mine. A prevailing mining practice was mobile loading onto conveyors and into shuttle cars. Sixty percent of the total county output was cleaned mechanically. Heavy mediums and jigs cleaned the larger sizes, and air tables the major portion of the fines.

Raleigh County is split into Coal Act Districts 7 and 8. In District 7 the seams mined most were the Beckley, Fire Creek, and Pocahontas. In District 8 the seams mined most were the Dorothy and the Eagle.

Table Rock Sand Plant and Beaver Block Co. operated stationary plants near Beaver and produced building sand.

Randolph.—Coal production dropped 14 percent. Underground mining comprised 83 percent of the total. Strip mining increased 11 percent, even though one less producer was active during the year. Auger-mining activity ceased. Loading in the county was mostly by hand loading onto conveyors. L. E. Cleghorn and Peerless Coals, Inc., operated continuous miners. There was no mechanical cleaning in the county. The Peerless, Kittanning, and Sewell seams were mined. In the strip-mining operations an average of 20 feet of overburden was stripped to reach the Kittanning seams.

Elkins Limestone Co. operated a quarry near Elkins to produce crushed limestone for use in highway construction.

Taylor.—Coal production decreased 66 percent. Auger mining was the only mining method showing increased production, even though only one mine was active, compared with two the preceding year. Strip tonnage was only one-third that of 1957, and underground only slightly more than one-fourth that in 1957. There was no mechanical loading or cleaning in the county. The entire output was from the Pittsburgh seam.

Tucker.—Coal production increased slightly. One underground mine and two strip mines were active. The underground production was about the same as in the preceding year, and strip output by three fewer mines increased 15 percent. The Upper Freeport seam was mined most. In stripping 30 feet of overburden was removed to reach the Upper Freeport seam. There was no mechanical loading or cleaning in the county.

Anderson, Inc., operated the Valley Furnace Quarry near Phillipi and produced crushed limestone for concrete aggregate and roadstone.

Upshur.—Coal production dropped 24 percent, as the number of mines decreased from 34 to 29. No auger mining was reported. Most of the loss in production was from underground mining. Strip production was only slightly less than in 1957. Eighty-two percent of the underground production was loaded mechanically, mostly mobile loaded into shuttle cars, plus two continuous miners. Almost half of the county output was cleaned. The Christopher Mining, Inc., opened a new mine (No. 9) and operated a cleaning plant, using the R. & S. wet and dry combined methods. Almost the entire county output was from the Redstone coal seam, which averaged 55 inches in thickness.

The Buckhannon Brick Co. did not operate its clay mine.

Wayne.—Coal production was only about one-third that in 1957, as the number of mines dropped from five to two. There was no mechanical loading or mechanical cleaning. Production was in the No. 5 block coal seam, which averaged 52 inches in thickness.

Laval Sand Co., Inc., dredged near Fort Gay and produced engine sand.

Webster.—Coal production decreased 38 percent, even though strip output was 2½ times greater than in 1957. One auger mine was active; none had been in 1957. The Big Creek Coal Co. and the S. & K. Coal Co. were out of business in 1958. Over 97 percent of the underground output was loaded mechanically. Pardee & Curtin Lumber Co. switched from mobile loading into shuttle cars to mobile loading onto conveyors. Almost three-fourths of the county output was cleaned mechanically, most production was in the Sewell seam, which averaged 46 inches in thickness.

Wetzel.—The output of building and paving sand and gravel, plus fill and other gravel, was reported by the Ohio River Sand & Gravel Corp., New Martinsville. The Ohio Valley Sand Co. operated a dredge near New Martinsville and produced building and paving sand and gravel and railroad ballast gravel.

Wood.—Sand and gravel was produced by the Kanawha Sand Co. by dredge near Parkersburg; Ohio River Sand & Gravel Corp. at a stationary plant also at Parkersburg; and Pfaff & Smith Builders

Supply Co. from a dredge on the Kanawha River near Charleston. Output was almost entirely for building and paving purposes.

Wyoming.—Although total coal production dropped 20 percent, the county remained in third place. Underground mining was the most important method with 56 mines reported active. Seven strip mines and three auger mines were operating. Ninety-four percent of the total underground production was loaded mechanically. There were many changes in mechanical loading activity during the year, among which were Pocahontas Fuel Co., adding two continuous miners to its Itmann Colliery and Premier Pocahontas Co. adding one to its Tierney mine. Bolt Mining Co. opened a new mine, and put a continuous miner into operation. Significant additions to existing cleaning plants included: Premier Pocahontas Co. adding R. & S. air tables to its Wemco heavy-medium plant, the Slab Fork Coal Co. adding Deister tables to its Gastone No. 2 mine, and the United Pocahontas Coal Co. adding a hydrotator, all to assist in cleaning the ¼- x 0-inch fractions. The Bolt Mining Co. operated a plant with heavy-medium and Deister tables working in combination. Lamar colliery abandoned its Herndon underground and strip mine in January.

Engine sand was dredged from the Guyandot River near Baileysville by Casto & Lackey Sand Co.

The Mineral Industry of Wisconsin

This chapter has been prepared under a cooperative agreement for collection of mineral data, between the Bureau of Mines, Department of the Interior, and the Geological Survey of Wisconsin.

By Lenox H. Rand [1]

WISCONSIN'S mineral production rose in 1958 to a new high of $71.3 million—an increase of nearly $2.7 million over that of 1957. This gain reflected a continued expansion of Government-and-contractor operations, mainly for road construction, the major increases being confined to roadbuilding and construction materials, sand and gravel, crushed stone, cement, and roofing granules. There was drastic curtailment in the mine production of iron, lead, and zinc ores.

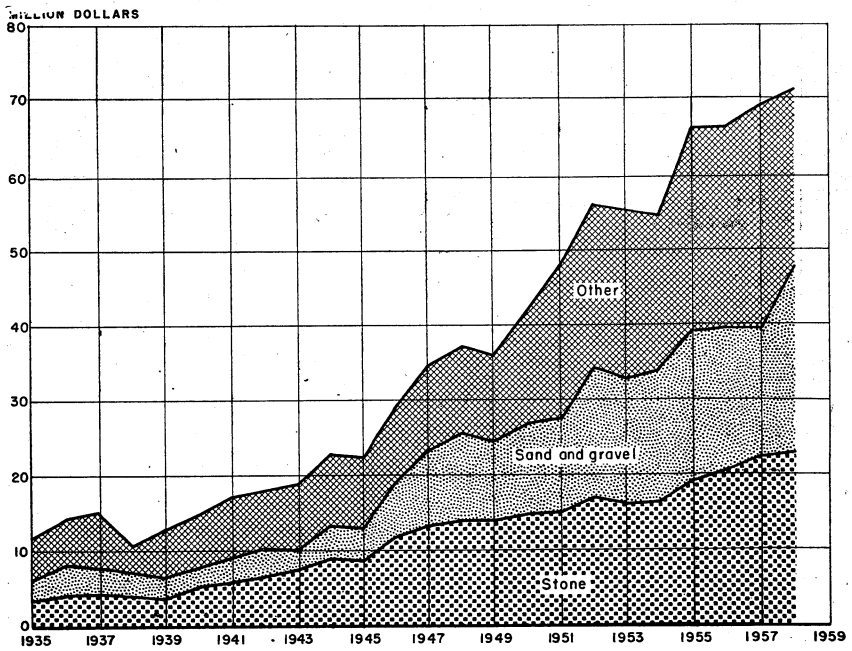

FIGURE 1.—Value of sand and gravel, stone, and total value of all minerals produced in Wisconsin, 1935–58.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.

TABLE 1.—Mineral production in Wisconsin [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Abrasive stones: Pebbles (grinding) and tube-mill liners	1,790	43	858	26
Clays thousand short tons	131	136	154	167
Iron ore (usable) thousand long tons, gross weight	1,576	(2)	867	(2)
Lead (recoverable content of ores, etc.)	1,900	543	800	187
Lime thousand short tons	(2)	(2)	141	2,193
Peat	400	(2)	(2)	(2)
Sand and gravel thousand short tons	29,394	18,694	39,383	25,845
Stone do	12,434	22,455	13,722	23,334
Zinc (recoverable content of ores, etc.)	21,575	5,006	12,140	2,477
Value of items that cannot be disclosed: Cement, gem stones, and values indicated by footnote 2		22,590		18,083
Total Wisconsin [3]		68,644		71,334

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Total adjusted to eliminate duplicating value of clays and stone.

TABLE 2.—Summary of employment and injuries for selected mineral industries in Wisconsin [1]

Year	Commodity	Average number of men working	Total man-hours	Total number of lost-time injuries		Total number of days lost or charged	Injury frequency rate	Injury severity rate
				Fatal	Nonfatal			
1957	Clay [2]	26	25,583					
	Granite	174	336,907		43	(3)	127.63	(3)
	Limekiln [4]	142	334,556		20	(3)	59.78	(3)
	Limestone [5]	1,375	2,017,073		171	(3)	84.78	(3)
	Sand and gravel	240	432,071	1	11	6,266	27.77	14,502
	Sandstone	114	200,490		6	(3)	29.93	(3)
1958	Clay [2]	30	21,564					
	Granite	149	321,586		14	(3)	43.53	(3)
	Limekiln [4]	118	314,992		7	(3)	22.22	(3)
	Limestone [5]	804	1,217,119		68	(3)	55.87	(3)
	Sand and gravel	728	1,225,708	1	23	6,668	19.58	5,440
	Sandstone	88	145,249		7	(3)	48.19	(3)

[1] Office workers excluded; data are final for 1957 and preliminary for 1958.
[2] Excludes pits producing clay used exclusively in manufacturing cement.
[3] Figure not available.
[4] Includes limestone quarries producing raw material used in manufacturing lime.
[5] Excludes quarries producing limestone used exclusively in manufacturing lime.

Consumption, Trade, and Markets.—Falling industrial demand and lower prices seriously affected the zinc-lead mining district in southwestern Wisconsin. Many mines remained idle throughout the year. Low consumption of iron ores adversely affected the iron-ore producers. Even with greatly reduced shipments, there was little change in the large stocks of iron ore on hand at the furnace yards and lower Lake ports at year end. The base prices for iron ores remained at the level posted in January 1957.

There was a substantial increase in the manufacture of cement, due primarily to full year's operation of the new plant of the Marquette Cement Manufacturing Co. in Milwaukee.

The bulk of mineral production in Wisconsin was sand and gravel and crushed stone. Competition in these industries was severe; prices remained quite steady. Many portable plants were installed at pits and quarries along projected highway routes. As transportation cost was a vital factor in the marketing of these low-priced commodities, several producers made concerted studies of means to revive rail transport.

Trends and Developments.—To augment the capacity of existing blast furnaces and to postpone the capital cost of new installations, steelmakers' specifications called for higher grade, sized iron-ore feed. These trends held serious implications for producers of direct-shipping-grade iron ores, which, in competition with higher grade foreign ores and manufactured-iron-ore pellets, no longer had a position of preference. Rising costs of operation, especially at underground mines, precluded much added expense for further beneficiation of this type of ore. Thus economical operation of these properties became a subject of grave concern.

A new quarry for railway ballast was opened by Foley Bros. of St. Paul, Minn., as contractors for the Chicago & North Western Railway Co.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Grinding pebbles and tube-mill liners were produced by Baraboo Quartzite Co. from a deposit of hard quartzite in Sauk County. The combined tonnage and value of these abrasive stones fell materially as a result of lower industrial activity.

Cement.—Portland cement was manufactured at two plants in Wisconsin—the Manitowoc Portland Cement Co., a subsidiary of Medusa Portland Cement Co., in Manitowoc and a unit of Marquette Cement Manufacturing Co. of Chicago at its new Milwaukee plant. There was no increase in the capacity of these plants; the gain in production was due to a full year's operation at the Marquette installation. Cement clinker, made in Michigan by Huron Portland Cement Co. and in Indiana by Universal Atlas Cement Co., was ground at Milwaukee and Green Bay, respectively. Production of this cement is credited to the originating States. All cement produced in Wisconsin was types I and II, general use and moderate heat. A small portion of the portland cement made at Milwaukee was converted to masonry cement. The high level of activity in road building accounted for the increased cement shipments. The average mill value per 376-pound barrel of portland cement rose from $3.20 in 1957 to $3.30 in 1958.

Clays.—Miscellaneous clay was used as an ingredient of cement and in the fabrication of heavy clay products. Although the output of bricks was down, gains in the manufacture of cement and drain tile resulted in an 18-percent increase in the production of clay. An abnormally wet season in 1957 and Federal financial assistance combined to stimulate the installation of drain tile in farming areas. Production was reported by 10 companies from pits in 8 counties.

Lime.—Total shipments and value of quick and hydrated lime increased slightly. Production was reported from Brown, Dodge, Douglas, Fond du Lac, and Manitowoc Counties by five companies operating seven plants. Over 77 percent of the total output was used for chemical and industrial purposes, such as insecticides, metallurgy, water purification, sewage treatment, paper manufacture, and polishing compounds; 21 percent was used in construction as mason's lime; and the remainder was used in agriculture. The average value per ton of lime sold in Wisconsin was $15.52 as compared with $14.50 in 1957. The total capacity of the 3 rotary and 25 shaft kilns installed in the plants was reported as 226,495 tons a year. About one-third of the total quicklime produced was hydrated before shipment.

Perlite.—Crude perlite from Colorado was expanded at plants in Milwaukee and Outagamie Counties. This product was used chiefly in lightweight plaster and concrete.

Sand and Gravel.—Production of sand and gravel in Wisconsin soared to nearly 40 million tons, a gain of 34 percent over 1957. The value of this record output exceeded $25.8 million—a 38-percent increase above the earlier year. Production was reported from 58 of the 71 counties. The proportion of production by commercial producers, as compared with Government-and-contractor operators' output, dropped sharply to 47 percent from 55 percent in 1957. Over 91 percent of the total output of sand and gravel was used in building and paving. Of this, 14 percent was for building and 86 percent for paving. Virtually all Government-and-contractor and over 67 percent of the commercial production of sand and gravel was used in connection with road building, emphasizing the influence of the highway construction programs on the economy of the State.

Commercial production of sand for industrial purposes declined sharply even from the low output of 1957.

Competition for contracts to supply sand and gravel for prime contractors was severe; as a result, unit prices for sand and gravel remained steady. More stringent specifications on size and quality of materials for concrete aggregates led to installation of more crushing, washing, and screening equipment in many areas. As transportation from stationary plants became an increasingly larger factor in delivered cost, large numbers of portable plants were installed at pits adjacent to projected highway routes. There was a slight reversal in the recent trend of the proportion of sand and gravel transported by truck and rail—90 percent in favor of trucks in 1958 as compared with 95 percent in 1957.

The 10 leading commercial operators reporting production in 1958, in alphabetical order, were: Consumers Co., Division of Vulcan Material Co., Chicago; Jaeger Sand & Gravel Co., Inc., Milwaukee; Janesville Sand & Gravel Co., and Wm. J. Kennedy & Son, Janesville; Koepke Sand & Gravel Co., Appleton; Edward Kraemer & Sons, Inc., Plain; C. C. Linck, Inc., Beaver Dam; Olsen Construction Co., Sturgeon Bay; Reiske Sand & Gravel Co., and State Sand & Gravel Co., Milwaukee.

Stone.—Stone output in Wisconsin included limestone, granite, sandstone, quartzite, basalt, and marl. The total production and value of

TABLE 3.—Sand and gravel sold or used by producers, by classes of operations and uses

	1957		1958	
	Short tons (thousand)	Value (thousand)	Short tons (thousand)	Value (thousand)
COMMERCIAL OPERATIONS				
Sand:[1]				
Molding	240	$468	63	$127
Building	2,484	2,102	2,432	2,005
Paving	1,747	1,389	1,740	1,382
Railroad ballast	(2)	(2)	20	7
Fill	1,045	545	1,285	769
Other	77	29	30	59
Undistributed[3]	183	216	61	133
Total	5,776	4,749	5,631	4,481
Gravel:				
Building	2,862	2,456	2,685	2,498
Paving	5,197	3,886	8,163	6,015
Railroad ballast	948	508	391	271
Fill	826	315	1,315	625
Other	550	359	253	153
Total	10,383	7,524	12,807	9,563
Total sand and gravel	16,160	12,273	18,437	14,044
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	3	1	58	22
Paving	6,680	2,884	11,766	5,721
Total	6,683	2,885	11,824	5,743
Gravel:				
Building	11	3		
Paving	6,540	3,532	9,122	6,058
Total	6,551	3,535	9,122	6,058
Total sand and gravel	13,234	6,420	20,945	11,801
ALL OPERATIONS				
Sand	12,459	7,634	17,454	10,224
Gravel	16,934	11,059	21,928	15,621
Grand total	29,394	18,693	39,383	25,845

[1] Includes friable sandstone.
[2] Figure withheld to avoid disclosing individual company confidential data, included with "Undistributed."
[3] Includes engine, blast, filter, and filler sand (1957–58).

stone were 13.7 million tons and $23.3 million—increases of approximately 10 percent and 4 percent, respectively, over 1957. Crushed limestone for use in road construction comprised the bulk of the total output, except for some special products; only in this class of material was there any sizable gain over 1957. The use of pulverized limestone to control soil acidity, encouraged by Federal aid, showed a small increase.

In eastern Wisconsin an extensive deposit of thinly bedded limestone yielded dimension stone of exceptionally good quality. Scattered and smaller but somewhat similar deposits were quarried in other areas of the State. Output of this type of limestone, used chiefly for building construction and house veneer, was reported by 29 producers in 9 counties. The volume and value of dimension stone produced declined about 10 percent from 1957.

Crushed or broken limestone was produced from quarries in 32 counties. The major use of this material was for concrete aggregate and roadstone; smaller quantities went for agricultural, industrial, and chemical purposes. Competition in the industry was severe, and price was a governing factor in distribution and sale. To help reduce costs, many operators used or experimented with the use of various grades of ammonium nitrates as a blasting agent.

The 10 leading commercial producers reporting production of crushed and broken limestone are listed alphabetically: Becker & Tuckwood, Lancaster; Consumers Co. (Division of Vulcan Materials Co.), Chicago; Franklin Stone Products, Inc., Hales Corners; Edward Kraemer & Sons, Inc., Plain; Landwehr & Hackl, Seymour; Arthur Overgaard, Inc., Elroy; Quality Limestone Products, Inc., Sussex; P. W. Ryan Sons, Janesville; Waukesha Lime & Stone Co., Inc., Waukesha; and George Wendtlandt, Mineral Point.

Granite, cut and dressed or polished for use chiefly for building and monumental purposes, was quarried in Marathon, Marquette, and Waushara Counties. Crushed granite for concrete aggregate and road surfacing was produced in Marathon and Wood Counties. In Marathon County near Mosinee substantial quantities of soft, decomposed granite were dug from a weathered outcropping by power shovels and used locally for road surfacing. The value of this material was relatively low compared with that of the hard, unaltered granite usually produced in Wisconsin.

A small output of dimension sandstone was used for flagging, rubble, rough construction, and dressed stone. A much greater production of crushed sandstone and quartzite was used as concrete aggregate and railroad ballast and for special purposes, such as abrasives, filters, glass, refractories, and roofing granules. Production of sandstone and quartzite, reported by six companies from Clark, Columbia, Marathon, and Portage Counties, totaled 1,623,158 short tons valued at $7,072,365.

After a thorough study of many deposits convenient to its railway lines, the Chicago and Northwestern Railway Company chose a deposit of quartzite near Rock Springs in Portage County as the site of a new plant for producing railroad ballast. A modern processing plant equipped to produce 350 tons an hour was erected. About 22 men were employed in operating the plant and quarry. Special studies were made to determine the best materials for drilling, crushing, and screening this hard, extremely abrasive rock. Safety precautions against the fine silica dust were rigidly maintained. More than 50 million tons of quartzite was estimated to be available above track grade, enough to supply the plant for many years. Use of the hard and sharp fines, screened from the coarser ballast material as asphalt filler and for sand blasting, was explored.

Crushed basalt was produced in Marinette and Polk Counties for roofing granules, concrete aggregate, railroad ballast, and filter rock.

Production of marl was somewhat lower, but the total value gained slightly owing to the increased average price per ton—75 cents as compared with 49 in 1957. Output of about 8,000 tons was reported by seven producers in Portage, Waupaca, and Waushara Counties. The marl was used entirely for agricultural purposes.

TABLE 4.—Limestone sold or used by producers, by uses [1]

Use	1957		1958	
	Quantity	Value	Quantity	Value
Dimension:				
Rough construction short tons	2, 458	$15, 741	5, 277	$19, 624
Rubble do	10, 676	32, 386	22, 302	87, 652
Rough architectural cubic feet	33, 146	24, 437	13, 058	14, 102
Dressed (cut and sawed) do	726, 244	1, 250, 427	476, 407	1, 066, 149
Flagging do	111, 989	159, 185	108, 776	94, 041
Total, equivalent short tons [2]	82, 844	1, 482, 176	75, 438	1, 281, 568
Crushed and broken:				
Riprap short tons	116, 007	138, 670	99, 752	77, 636
Flux do	26, 965	37, 981	(3)	(3)
Concrete aggregate and roadstone do	8, 319, 137	8, 251, 175	9, 706, 798	9, 981, 024
Railroad ballast do	589, 309	692, 181	(3)	(3)
Agriculture do	1, 167, 538	1, 587, 462	1, 240, 677	1, 687, 095
Other [4] do	213, 190	294, 176	348, 691	468, 600
Total do	10, 432, 146	11, 001, 645	11, 395, 918	12, 214, 355
Grand total do	10, 514, 990	12, 483, 821	11, 471, 356	13, 495, 923

[1] Includes both commercial and Government-and-contractor production.
[2] Average weight of 160 pounds per cubic foot used to convert cubic feet to short tons.
[3] Included with "Other" to avoid disclosing individual company confidential data.
[4] Includes limestone for stone sand (1957), paper mills, magnesia plants, asphalt, fertilizer, filter beds, lime, and other uses (1957–58).

METALS

Iron Ore.—Shipments of iron ore from Wisconsin reached a 20-year low, decreasing 45 percent from 1957. This decline was due primarily to lack of demand for iron ore, as production of steel fell from 84.5 percent of average rated ingot capacity in 1957 to 60.6 percent in 1958. The situation was aggravated further by large stocks of ore on hand at the beginning of the year and a relatively smaller reduction in the imports of ore. An increase of about 10 percent in transportation costs for iron ore from the mines to the lower Lake ports in February was partly offset by repeal of the 3-percent Federal tax on freight shipments on June 30; even so, the producing companies had to absorb the net added cost.

The entire output of iron ore in Wisconsin came from two underground mines, the Montreal and the Cary, operated by Oglebay, Norton & Co. and Pickands Mather & Co., respectively. Because of the small demand for iron ore, each company curtailed its operations most of the year. Both properties are on the Gogebic range in Iron County. The Montreal mine, developed to a depth of 4,500 feet, was one of the deepest iron mines in the world. Its total production through 1958 exceeded 42 million tons, with an average annual output over the past 33 years exceeding 900,000 tons.

The Meress open-pit mine, on the Menominee range in Florence County, was inactive. The higher grade of the ore shipped was due in part to the absence of any of the somewhat lower grade ore from this property.

Production of iron ore exceeded shipments by 285,207 long tons. Year-end stocks at the mines increased to 490,004 tons. All ore produced was of direct-shipping grade. It was moved by rail from the mines to ore docks at Ashland, Wis., and then by boat to lower

Lake ports. Shipments from the port of Ashland began May 18 and ceased November 20.

There was no change of the base prices per long ton for iron ores posted January 30, 1957, as follows: High Phosphorus, $11.45; Mesabi Non-Bessemer, $11.45; Mesabi Bessemer and Old Range Non-Bessemer, $11.70 and Old Range Bessemer, $11.85. Prices for iron ore include all shipping costs from the mines to lower Lake ports; these costs do not appear in the total value of iron-ore output of Wisconsin. The base prices are for ores grading 51.50 percent iron (natural) and for Bessemer ores less than 0.045 percent phosphorus (dry). Ores higher than 0.18 percent phosphorus (dry) are classed as High Phosphorus. Variations in grade from this base, as well as diversities in physical structure from established norms, call for premiums or penalties.

No further development was done during the year at the property of the Ashland Mining Corp., near Butternut, Ashland County where a substantial quantity of low-grade magnetic iron ores, amenable to concentration and open-pit operation, was indicated by drilling in 1957. However, studies and activities pointing toward exploitation of this property continued. Other companies showed active interest in similar low-grade iron formations in Ashland and Iron Counties, and several thousand acres of land was acquired by purchase or lease.

TABLE 5.—Iron-ore production and shipments

Year	Number of mines	Production (thousand long tons)	Shipments (thousand long tons)	Iron content of shipments natural (percent)
1954	2	1,491	1,429	52.81
1955	3	1,589	1,886	52.03
1956	3	1,551	1,488	52.49
1957	3	1,618	1,576	52.32
1958	2	1,152	867	53.72

TABLE 6.—Mine production of lead and zinc, in terms of recoverable metals

	Mines producing		Material treated		Lead		Zinc		Total value
	Lode	Tailings	Ore (short tons)	Tailings (short tons)	Short tons	Value	Short tons	Value	
1949–53 (average)	26	4	411,446	28,726	1,375	$417,673	12,838	$3,875,756	$4,293,429
1954	7	11	523,755	39,799	1,261	345,514	15,534	3,355,344	3,700,858
1955	10	5	583,731	31,831	1,948	580,504	18,326	4,508,196	5,088,700
1956	14	5	828,579	139,346	2,582	810,748	23,890	6,545,860	7,356,608
1957	16	3	710,776	17,066	1,900	543,400	21,575	5,005,400	5,548,800
1958	2	------	468,822	----------	800	187,200	12,140	2,476,500	2,663,760

Lead and Zinc.—Sharp declines in the prices for lead and zinc that began in 1957 continued in 1958, causing further reductions in the output of the ores of these metals from Wisconsin mines.

Production of 800 tons of lead and 12,140 tons of zinc represented a decrease of 58 and 44 percent in tonnage and 66 and 51 percent in value, respectively, from 1957. The average weighted yearly prices

TABLE 7.—Mine production of lead and zinc in 1958, by months, in terms of recoverable metals, in short tons

Month	Lead	Zinc	Month	Lead	Zinc
January	95	1,120	August	55	1,040
February	60	1,100	September	70	885
March	50	1,030	October	70	900
April	75	1,380	November	60	700
May	70	1,050	December	65	750
June	45	1,075			
July	85	1,110	Total	800	12,140

per pound were 11.7 cents for lead and 10.2 for zinc, compared with 14.3 and 11.6 cents, respectively, in 1957. Lead price quotations fell to a low of 10.75 cents per pound in August, and zinc was at a low of 10 cents per pound for the first 9 months of the year. At the end of 1958 quotations were 13 cents per pound for lead and 11.5 cents per pound for zinc.

REVIEW BY COUNTIES

Mineral production was reported from 66 of 71 counties. Output of sand and gravel or crushed stone for use in construction and roadbuilding was common to all productive counties. Some larger sand and gravel producers, operating many portable and temporary plants, did not break down output by counties, but reported total production from various counties. It is thus possible that all counties contributed materials for the roadbuilding programs. In all, 162 operators showed commercial output of sand and gravel and 102 producers crushed limestone. Noncommercial or Government-and-contractor operators included State and county highway departments, cities, towns, and full-time contractors for Federal or State projects.

Production of minerals not directly connected with roadbuilding was reported from only 17 counties. These minerals included dimension stone, quartzite, marl, peat, and lime among the nonmetallics group and lead, zinc, and iron among the metals.

Adams.—Arthur Overgaard Co., Elroy, and A. T. Reese, Wisconsin Dells, produced sand and gravel for road construction.

Ashland.—The low-grade magnetic-iron-ore formations near Butternut continued to attract the attention of several large companies. In addition to the Ashland Mining Co. property, on which a substantial quantity of such material had been disclosed by drilling in 1957, other companies acquired several thousand acres of land in the same vicinity by purchase or lease in 1958.

Barron.—Sand and gravel production was reported by Clyde Lilly, Poskin; Ostermann Sand & Gravel Co., Turtle Lake; and Pioneer Sand & Gravel Co., Rice Lake. The Barron County Highway Department, Barron, was active in preparing road material.

Brown.—Production of sand and gravel and crushed limestone for roadwork was reported by 13 operators. Larger producers reporting included: Daanen & Jenssen, DePere; Schuster Construction Co.; Leo Scray, DePere; W. B. Sheedy Construction Co., Frank Van Nelson, Inc., Green Bay; and Wm. Winkler Sons Construction Co., Green Leaf. Scray Quarries, DePere, quarried dimension limestone for building construction.

TABLE 8.—Value of mineral production in Wisconsin, by counties [1]

County	1957	1958	Minerals produced in 1958 in order of value
Adams		(2)	Sand and gravel.
Barron	$69, 923	$257, 096	Do.
Brown	1, 234, 328	1, 111, 564	Sand and gravel, lime, stone, clays.
Buffalo	238, 013	(2)	Stone.
Burnett	87, 377	90, 599	Sand and gravel, stone.
Calumet	133, 021	143, 420	Do.
Chippewa	12, 336	23, 500	Sand and gravel.
Clark	127, 999	109, 969	Sand and gravel, stone, gem stones.
Columbia	(2)	(2)	Stone, sand and gravel.
Crawford	(2)	129, 477	Do.
Dane	1, 381, 703	1, 238, 947	Sand and gravel, stone.
Dodge	605, 453	1, 045, 801	Sand and gravel, lime, stone.
Door	(2)	(2)	Sand and gravel, stone.
Douglas	(2)	(2)	Lime, sand and gravel.
Dunn	(2)	(2)	Stone, sand and gravel, clays.
Eau Claire	625, 792	(2)	Sand and gravel.
Florence	(2)		
Fond du Lac	1, 040, 729	1, 109, 699	Stone, sand and gravel, lime, clays.
Forest	84, 133	71, 884	Sand and gravel.
Grant	1, 708, 932	644, 714	Stone, sand and gravel.
Green	402, 927	(2)	Do.
Green Lake	501, 066	189, 923	Sand and gravel.
Iowa	735, 979	360, 292	Stone, sand and gravel.
Iron	(2)	(2)	Iron, sand and gravel.
Jackson	(2)	(2)	Sand and gravel, stone.
Jefferson	(2)	167, 045	Do.
Juneau	57, 801	(2)	Stone, sand and gravel.
Kenosha	222, 098	390, 654	Sand and gravel.
La Crosse	161, 956	218, 864	Stone, sand and gravel, clays.
Lafayette	4, 321, 712	2, 727, 554	Zinc, lead, stone.
Langlade	140, 960	225, 955	Sand and gravel.
Lincoln	92, 387	(2)	Do.
Manitowoc	7, 041, 990	(2)	Cement, sand and gravel, lime, stone, clays.
Marathon	6, 808, 717	7, 010, 127	Stone, sand and gravel, clays.
Marinette	(2)	(2)	Stone, sand and gravel.
Marquette	(2)	370, 727	Do.
Milwaukee	3, 352, 596	5, 023, 207	Cement, stone, sand and gravel.
Monroe	127, 589	81, 446	Stone.
Oconto	266, 634	282, 605	Sand and gravel, stone.
Oneida	169, 077	219, 731	Do.
Outagamie	652, 400	459, 000	Stone, sand and gravel.
Ozaukee	232, 674	225, 491	Sand and gravel, stone.
Pepin	25, 401	(2)	Stone.
Pierce	392, 941	385, 822	Sand and gravel, stone.
Polk	489, 534	(2)	Stone, sand and gravel.
Portage	(2)	214, 655	Sand and gravel, stone.
Price	(2)	7, 549	Sand and gravel.
Racine	1, 272, 641	1, 347, 339	Stone, sand and gravel, clays.
Richland	(2)	(2)	Stone.
Rock	1, 218, 194	1, 341, 082	Sand and gravel, stone.
Rusk	73, 608	71, 680	Sand and gravel.
St. Croix	426, 242	399, 776	Sand and gravel, stone.
Sauk	1, 408, 087	1, 662, 162	Stone, sand and gravel, abrasives.
Sawyer	64, 654	94, 926	Sand and gravel.
Shawano	276, 780	263, 072	Do.
Sheboygan	393, 612	394, 160	Sand and gravel, stone.
Taylor	(2)	323, 258	Sand and gravel.
Trempealeau	214, 628	251, 588	Stone.
Vernon	(2)	(2)	Stone, sand and gravel.
Vilas	27, 492	41, 697	Sand and gravel.
Walworth	180, 356	305, 592	Do.
Washington	543, 357	604, 925	Sand and gravel, stone.
Waukesha	4, 487, 473	5, 465, 484	Sand and gravel, stone, peat.
Waupaca	(2)	(2)	Sand and gravel, stone, clays.
Waushara	(2)	(2)	Stone.
Winnebago	1, 455, 719	1, 551, 459	Sand and gravel, stone.
Wood	(2)	(2)	Stone.
Undistributed [3]	23, 877, 189	33, 655, 493	
Total [4]	68, 644, 000	71, 334, 298	

[1] Ashland, Bayfield, Kewaunee, and Washburn Counties are not listed because no production was reported.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Includes sand and gravel and stone that cannot be assigned to specific counties and values indicated by footnote 2.

[4] Total adjusted to eliminate duplicating value of clays and stone.

Duck Creek Brick Co. and Hockers Brothers Brick and Tile Co., Green Bay, mined miscellaneous clay for manufacturing brick and other heavy clay products.

The Western Lime & Cement Co., Milwaukee, made quick and hydrated lime at its plant in Green Bay, using five shaft kilns and a batch-type hydrator. Sales were for industrial and chemical use.

Buffalo.—Neuheisel Lime Works, Eau Claire, and Herbert Tiffany, Jr., Nelson, crushed substantial quantities of limestone for roads and agricultural purposes. The Buffalo County Highway Department, Alma, produced roadstone.

Calumet.—Sand and gravel was mined by Arnold M. Ortlepp, Chilton; Quality Sand & Gravel Co., Wrightstown; and Sells Brothers, Appleton. Noncommercial sand and gravel and limestone were produced by the Calumet County Highway Commission, Chilton.

Clark.—Charles Marek, Sr. (Merrillan), Paul Brothers (Owen), and Plautz Brothers Sand & Gravel Co. (Willard) produced sand and gravel for roads and buildings. Clark County Highway Department (Neillsville) provided material for road maintenance.

The sandstone quarry of Ellis Quarries, Inc., Stevens Point, was active.

Columbia.—Portage-Manley Sand Co., Rockton, Ill., produced high-quality glass and foundry sand from its quartzite quarry near Portage. The demand for glass sand held up quite well, but there was considerable reduction in the sale of foundry sand. Francis James, Doylestown, shipped untreated foundry sand from a nearby deposit.

Noncommercial sand and gravel was produced by the Columbia County Highway Department, Portage. Dann & Wendt, Rio, and Edward Kraemer & Sons, Inc., crushed limestone for road material.

Crawford.—Output of both sand and gravel and crushed limestone was reported. Leading producers were: Prairie Sand and Gravel Co. and Loren J. Slaght, Prairie du Chien, and Edward Kraemer & Sons., Inc., Plain.

Dane.—The large output of Dane County consisted almost entirely of sand and gravel and crushed limestone used in connection with roadbuilding and construction. The larger producers reporting were: Boehnen, Inc. (Cross Plains), Capitol Sand & Gravel Co. (Madison), Hartland-Verona Gravel Co. (Verona), Madison Sand & Gravel Co. (Madison), Dane County Highway Department (Madison) and Hammersley Stone Co., Inc. (Madison).

Dodge.—Mayville White Lime Works, Mayville, and The Western Lime & Cement Co., Milwaukee, produced limestone for lime, metallurgical use, and roadstone. The former made quicklime at its plant near Mayville, and the latter manufactured both quick and hydrated lime at its Knowles plant where five shaft kilns were in use.

C. C. Linck, Inc., Beaver Dam, produced sand and gravel and Edward Kraemer & Sons, Inc., Plain, and Alvin E. Voigt Construction Co., Fox Lake, crushed limestone for roadwork.

Door.—Materials for construction and roads were produced by Olson Construction Co. and Door County Highway Department, Sturgeon Bay, and Hubert Charles, Luxemburg.

Douglas.—Cutler-LaLiberte-McDougall Corp., Duluth, produced quicklime in its plant at Superior for chemical and industrial uses.

The plant is equipped with two rotary kilns. There was also production of sand and gravel by Otto Wiesner, Inc., city engineer, and Douglas County Highway Department, all of Superior.

Dunn.—The Menomonie Brick Co., Menomonie, operated its brick plant and mined its own clay. Limestone for agricultural purposes was quarried and ground by the Barron County agricultural agent.

Eau Claire.—Special sands for blast, engine, filter, and foundry uses were prepared at the modern plant of Eau Claire Sand & Gravel Co. This company and the Wissota Sand & Gravel Co. also produced materials for construction and highways.

Fond du Lac.—The larger producers of construction and roadbuilding materials were: Braun Construction Co. and Lake View Sand & Gravel Co., Fond du Lac; Fox Valley Sand & Gravel Co. and Nellis Limestone Quarry, Inc., Ripon; M. A. Leiberg, Oakfield; Schroeder Brothers Sand & Gravel Co., Kiel; C. C. Linck, Beaver Dam; and the Fond du Lac County Highway Department.

Dimension limestone for building construction and house veneer was quarried by Fond du Lac Stone Co., Inc., and Hamilton Stone Co., Fond du Lac, and Oakfield Stone Quarry, Allenton.

The Oakfield Shale Brick and Tile Co., Oakfield, mined clay for its manufacture of heavy clay products, and Western Lime & Cement Co., Milwaukee, quarried limestone to make both quick and hydrated lime at its Eden plant. Five shaft kilns were used.

Grant.—Zinc and lead mines were idle throughout the year. The Pickett mine and mill, the county's chief producer of zinc and lead in 1957, was unproductive except for the sale of jig tailings for road use but was maintained in standby condition.

Green.—Virtually the entire output was crushed limestone for roads. Becker & Tuckwood (Lancaster), George Wendtlandt (Mineral Point), and P. W. Ryan & Sons (Janesville) were among the larger producers.

The Green County Highway Commission reported sand and gravel and crushed limestone production for use on highways. Green County Sand & Gravel Co., Inc., Monroe, had commercial production of sand and gravel.

Green Lake.—Molding sand was produced by C. A. Chier Sand Co. and Chier St. Marie Sand Co., Berlin. However, the low demand by steel operators tended to retard the sale of this special sand. Kopplin & Kinas Co., Inc., Green Lake, and Paul Polenska & Son, Manchester, produced sand and gravel for building and road construction.

Iowa.—Davis and Richardson, Spring Green, produced sand and gravel and crushed limestone. Other operators producing crushed limestone were: Ivey Construction Co. and George Wendtlandt, Mineral Point; Wonn & Martin, Cobb; and the Iowa County Highway Department, Dodgeville.

Iron.—The Montreal and Carey underground mines on the Gogebic range were operated by Oglebay Norton & Co. and Pickands Mather & Co., respectively. Low demand for direct-shipping ore resulted in a curtailment of normal operating schedules during most of the year.

Kenosha.—Sand and gravel was produced at the new Munster plant of Consumers Co., Division of Vulcan Materials, Chicago, and by the Kenosha County Highway Department, Silver Lake.

La Crosse.—Clay was mined by the Meir Brick Co., La Crosse, for making heavy clay products. Sand and gravel was produced by Kammel-Smith Sand & Gravel Co. and La Crosse Sand & Gravel Co., Inc., La Crosse. Limestone was quarried and crushed by Arthur Overgaard, Inc., Elroy.

Lafayette.—Eagle Picher Company operated the Shullsburg mine and mill throughout the year and the Birkett-Andrews-Bastian mine most of the year. Ore from the latter mine was hauled by truck to the company's Graham mill near Galena, Ill. At both mines diesel powered haulage equipment was used underground. Mining was by room and pillar method. The Shullsburg mine was worked through a shaft, and ore was hoisted to the surface by skips. An inclined tunnel was driven to the mining level at the Birkett-Andrews-Bastian property, and all ore was hauled by truck to the surface and thence to the mill without transfer. Vinegar Hill Division, American Zinc, Lead & Smelting Co., did development at the Blackstone mine in the first part of the year, but the Hancock and Temperly-Thomson mines were idle. Pumping at these mines to keep them dewatered was stopped April 19.

Langlade.—Output of sand and gravel for construction and road work was reported by Duffek Sand & Gravel, Inc., and Langlade County Highway Department, Antigo.

Manitowoc.—This county led in the output of cement. The Manitowoc Portland Cement Co. manufactured portland cement at Manitowoc. The plant had four rotary kilns ranging in length from 160 to 350 feet and 10 feet in diameter. The company also mined its own clay.

Quick and hydrated lime for building, chemical, and industrial uses was made by the Rockwell Lime Co., Chicago, Ill., at its plant near Francis Creek. A rotary kiln and a batch-type hydrator were used. Valders Lime & Stone Co., Valders, produced quicklime for agricultural purposes and also quarried dimension limestone for architectural uses. Both companies produce their own crude limestone.

Substantial quantities of sand and gravel were produced by R. & J. Fricke Co., Kasper Construction Company, Manitowoc County Highway Department, and Fred Radandt Sons, all of Manitowoc, and Schroeder Bros. Sand & Gravel Co., Kiel.

Marathon.—Argillaceous sandstone for roofing granules and quartzite for abrasives were produced at the Greystone and Rib Mountain quarries near Wausau. The crude material, mined and crushed by Foley Bros., Inc., under contract with Minnesota Mining and Manufacturing Co., St. Paul, Minn., was shipped to finishing plants for final processing. The quantity and value of roofing granules produced increased over 1957.

Dimension granite for building and monuments was produced by Anderson Bros. & Johnson Co., Lake Wausau Granite Co., Prehn Granite Quarries, Inc., and Red Wausau Granite Co., Wausau; Wausau Granite Industries, Inc., Schofield; and Cold Spring Granite Co., Cold Spring, Minn.

A soft, disintegrated granite, dug by power shovels from extensive outcroppings near Mosinee by M. M. Granite Co. and Tony Schilling, was used locally for road surfacing.

Ellis Quarries, Inc., Stevens Point, quarried and dressed sandstone for buildings, and clay was produced by Marshfield Brick & Tile Co., Marshfield, to make heavy clay products. Substantial quantities of sand and gravel were also produced in the county.

Marinette.—Basalt was quarried and crushed near Pembine by Central Commercial Co. of Chicago, Ill., to produce both natural and artificially colored roofing granules.

Marquette.—Granite for monuments was quarried and polished by Montello Granite Co., Montello. Sand and gravel and crushed limestone, respectively, were produced by Marquette County Highway Department and Edward Kraemer & Sons, Inc., Plain.

Milwaukee.—The new plant of the Marquette Cement Mfg. Co., Chicago, Ill., in Milwaukee had its first full year of operation. The ACL (Allis-Chalmers-Lellep) process, used for the first time in the United States, featured a traveling grate to preheat pelletized raw materials before entry into the 175 foot rotary kiln. Full production at this plant materially increased the output of cement in Wisconsin.

Major quantities of sand and gravel and crushed limestone were produced in the county. The larger operators were: Consumers Company, Division of Vulcan Materials Co., Chicago, Ill.; Reiske Sand & Gravel Corp. and Wauwatosa Stone Co., Milwaukee; and Moritz Sand & Gravel Co., Franklin Stone Products, Inc., and Ray Anderson Sand & Gravel Co., Hales Corners.

Outagamie.—Road building and construction materials were produced by Landwehr & Hackl, M. R. K. Construction Co., Inc., Seymour, and Black Creek Limestone Co., Black Creek.

Pierce.—Molding sand was produced by Bay City Sand Co., Inc., Bay City, and other special purpose industrial sands were prepared by Maiden Rock Silica Sand Co., Maiden Rock.

Sand and gravel and crushed limestone were produced by Riverfalls Sand and Gravel Co., River Falls; Rush River Sand & Gravel Co., Ellsworth; Sanders Stone & Lime Co., Mount Horeb; Edward Kraemer & Sons, Inc., Plain; and the Pierce County Highway Department, Ellsworth.

Polk.—Output of crushed basalt for concrete aggregate and some industrial purposes was continued by the Dresser Trap Rock Co., Dresser. The Polk County Highway Department produced road construction and maintenance materials, and the Polk County agricultural agent, Balsam Lake, ground limestone for soil conditioning.

Portage.—Sand and gravel production was reported by F. F. Mengel Co., Wisconsin Rapids; and Wimme Trucking and the Portage County Highway Department, Stevens Point.

Clifford W. Caldwell, Waupaca, and Bert Somers, Stevens Point, excavated and sold small tonnages of marl.

Racine.—Consumers Company, Division of Vulcan Materials, Chicago, Ill., had a major output of limestone from its quarry near Racine. Hillside Sand Co., Racine, and J. W. Peters & Sons, Burlington, reported sand and gravel production.

Union Grove Drain & Tile Co., Union Grove, produced miscellaneous clay for manufacturing heavy clay products.

Rock.—This county was one of the large producers of sand and gravel and crushed limestone for building and road construction. The larger

operators were: Atlas Sand & Gravel Co., Janesville Sand & Gravel Co., P. W. Ryan Sons, and Little Limestone Co., Janesville; Edgerton Sand & Gravel Co., Edgerton; and Chicago, Milwaukee, St. Paul & Pacific R.R. Co., Chicago, Ill.

St. Croix.—Output of dimension limestone for building and house veneer was reported by St. Croix Valley Stone Co., Inc., Stillwater, Minn. Other producers of construction and road materials were: Casey Gravel Works, New Richmond; Ed. J. Leary Construction Co., River Falls; Wilson Rock & Limestone Co., Wilson; and St. Croix County Highway Department, Hammond.

Sauk.—A large, new quartzite quarry for producing railroad ballast was opened by Foley Bros., Inc., near Rock Springs. Quartzite for refractory and abrasive uses was produced by General Refractories Co., Harbison-Walker Refractories Co., and Baraboo Quartzite Co.

Large output of sand and gravel and crushed limestone was reported by Edward Kraemer & Sons, Inc., Plain; W. R. Dubois & Son, Inc., Baraboo; and Craig Seaman, Reedsburg.

Waukesha.—Many prominently bedded limestone occurrences in this county are structurally favorable for dimension stone. Nineteen operators produced dimension stone for construction, architectural use, and building veneer. The large producers included: Halquist Lannon Stone Co. and Quality Limestone Products, Inc., Sussex; Sussex Lannon Stone Corp., Pewaukee; and Weather Rock Lannon Stone Quarry, Milwaukee Lannon Stone Co., and Midwest Lannon Stone Co., Lannon.

This county also had the largest output of sand and gravel and crushed limestone in Wisconsin. Major producers were: Jaeger Sand & Gravel Co., Edward Lutz Sand & Gravel Co., Walter Emil Merget, Northwest Sand & Gravel Co., and K. & N. Trucking Co., Milwaukee; Bodus Bros., Valley Sand & Gravel Co., Waukesha Lime & Stone Co., Inc., Kahlen Bros. Sand & Gravel Co., and James Brothers, Inc., Waukesha; Frank Clark & Sons, West Allis; Hartland Sand & Gravel Co., Hartland; and Consumers Company, Division of Vulcan Materials Co., Chicago, Ill.

Peat was produced by Demilco, Inc., Milwaukee.

Wood.—Ellis Quarries, Inc., Stevens Point, produced dimension sandstone for building and house-veneer use. Wood County Highway Commission quarried granite for road construction.

Other Counties.—Some counties not listed had substantial outputs of sand and gravel and crushed limestone for building and highway construction. In addition to the county highway departments and the county agricultural agents, the larger commercial operators were as follows: Edw. J. Murphy Sand & Gravel, Adolph Riemer, and M. J. Zimmermann Construction Co. in *Shawano County;* Cascade Sand & Gravel Co., Crystal Lake Crushed Stone Co., and Elkhart Moraine Sand & Gravel Co. in *Sheboygan County;* Edward Kraemer & Sons, Inc., and Clarence Weiss in *Trempealeau County;* B. R. Amon & Sons, Lake Geneva Sand & Gravel Co., Mann Bros. Sand & Gravel Co., R. W. Miller, and J. F. Thorpe in *Walworth County;* Ozaukee Sand & Gravel Co., Schmidt Service, Inc., West Bend Sand & Stone Co., and John B. Jacklin in *Washington County;* and Badger Highways Co., Inc., Courtney & Plummer, Inc., Schultz Sand & Gravel Inc., Wilson & Shipler, and Consumers Company, Division of Vulcan Materials Co., Chicago, Ill., in *Winnebago County.*

The Mineral Industry of Wyoming

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Wyoming.

By Frank J. Kelly,[1] William H. Kerns,[1] and D. H. Mullen [1]

THE VALUE of minerals produced in Wyoming in 1958 advanced from $352.5 million in 1957 to $369.9 million. The major reasons for the gain were the greatly expanded output of uranium ore (an increase of nearly 2½ times) and a rise in petroleum production.

The mineral-fuels group continued to supply the bulk of income to the mineral industry of Wyoming. Output in 1958 was valued at $323.4 million compared with $314.9 in 1957 and supplied 87 percent of the value in 1958, compared with 89 percent in 1957.

The contribution of metals to the total value of mineral production (up 2 percentage points in 1958) was enhanced by increased activity in uranium, which became the second most important mineral product in the State in 1958 after ranking eighth in 1957.

Although output of certain nonmetals decreased, particularly the 15-percent decline in bentonite, the value of production for the group as a whole gained 6 percent over 1957, principally because of the greater production of sand and gravel used in constructing highways.

Major mineral industry developments centered around uranium. The Lucky Mc uranium mill was completed in March, the Riverton mill of Fremont Minerals began operating in November, and Western Nuclear Corp. mill at Jeffrey City completed its first full year of production. Construction of two new mills was authorized by the Atomic Energy Commission (AEC) in 1958—one by the Globe Mining Co. (492 tons per day) and the other by Federal Uranium Co. (522 tons per day). In addition, commitments for expanding the three existing mills were made. The reserve of uranium ore was increased 25 percent over 1957.

A new bentonite mill was built by Archer-Daniels-Midland Co. near Colony and Intermountain Chemical Co. began a plant expansion program at its Westvaco soda-ash facility. A new 20-ton-a-day desulfurization plant was built by Pan American Petroleum Corp. and placed in operation in May for processing sour natural gas from the Cottonwood area northwest of Worland.

The United States Steel Corp. continued development related to its large low-grade iron-ore deposit near Atlantic City.

[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

TABLE 1.—Mineral production in Wyoming [1]

Mineral	1957		1958	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate---gross weight	5	$3	17	$9
Clays [2]---thousand short tons	1,069	11,973	1,075	9,968
Coal---do	2,117	7,777	1,629	5,820
Copper (recoverable content of ores, etc.)	4	2	(3)	(3)
Gem stones	(4)	55	(4)	52
Gold (recoverable content of ores, etc.)---troy ounces	573	20	117	4
Gypsum---thousand short tons	(3)	(3)	6	19
Iron ore (usable)---thousand long tons, gross weight	736	(3)	557	(3)
Natural gas---million cubic feet	117,256	10,201	121,682	10,221
Natural-gas liquids:				
Natural gasoline---thousand gallons	47,709	2,866	49,451	3,052
LP-gases---do	57,805	2,566	54,496	2,614
Petroleum (crude)---thousand 42-gallon barrels	109,584	291,493	[5] 115,572	[5] 301,643
Phosphate rock---thousand long tons	18	121	124	937
Pumice---thousand short tons	49	41	45	40
Rare-earth metals ore and concentrate	2	5		
Sand and gravel---thousand short tons	2,425	1,905	5,333	4,760
Stone---do	1,291	2,266	1,099	1,472
Uranium ore	274,699	4,669	651,790	13,286
Value of items that cannot be disclosed: Cement, feldspar, fire clay, silver, sodium carbonate, sodium sulfate, vanadium, and values indicated by footnote [3]		17,527		16,760
Total Wyoming [6]		[7] 352,532		369,938

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay; value included with "Undistributed."
[3] Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."
[4] Weight not recorded.
[5] Preliminary figure.
[6] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement.
[7] Revised figure.

Employment and Injuries.—According to the Employment Security Commission of Wyoming, the average employment in mining was 8,700, 2 percent more than in 1957. The number of men employed monthly varied from the low of 7,300 in March to the high of 8,800 in December. The spread of average weekly earnings was from $98.04 in March to the high of $105.01 in April.

The State mine inspector reported [2] that there were no fatalities in the mineral industry. Eight nonfatal accidents occurred in coal mines and 58 in other mining operations.

Government Programs.—Six Defense Minerals Exploration Administration (DMEA) contracts were executed. All were for uranium and amounted to $211,800, and the Government provided 75 percent of the funds for five contracts and 50 percent for one project. DMEA expired June 30, 1958, and was superseded later in the year by the Office of Minerals Exploration (OME) under the Department of the Interior.

[2] Fearn, Lyman, Annual Report of the State Inspector of Mines of Wyoming, Year Ending Dec. 31, 1958: 73 pp.

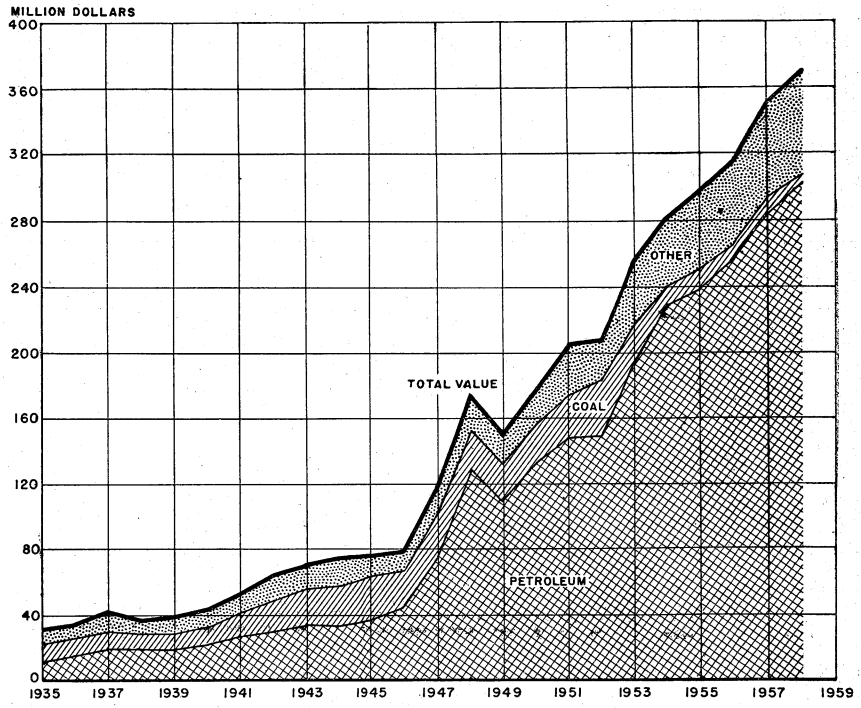

FIGURE 1.—Value of petroleum, coal, and other minerals, and total value of all minerals produced in Wyoming, 1935–58.

Table 2.—Mining employment in Wyoming,[1] in thousands

[Bureau of Labor Statistics, U.S. Department of Labor and Employment Security Commission of Wyoming]

	1954	1955	1956	1957	1958
Mining	9.4	8.9	8.7	8.5	8.7
Bituminous and other soft coal	1.2	.9	.7	.7	.5
Crude petroleum and natural gas	7.0	6.7	6.5	6.2	6.4
Other	1.2	1.3	1.5	1.6	1.8

[1] Excludes administrative and nonworking supervisory personnel, domestic servants, and personnel of the Armed Forces.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The mineral fuels (coal, natural gas, natural-gas liquids, and crude petroleum) produced were valued at $323.4 million, an increase of 3 percent over 1957, and represented 87 percent of the value of all mineral production. Petroleum, the most important mineral fur-

nished 82 percent of the total value of all minerals produced. Wyoming remained the leading producer of petroleum in the Rocky Mountain States.

Coal.—Coal production declined 23 percent below that of 1957. Eighteen active mines (10 underground and 8 strip) produced in excess of 1,000 tons each in 8 counties compared with 19 in 1957. The Dave Johnston strip mine was opened by Pacific Power & Light Co. in Converse County to provide fuel for the Dave Johnston powerplant at Glenrock.

Data collected by the Federal Bureau of Mines show 603 employees worked 84,583 man-days in 1958 and 1,022 employees worked 128,698 man-days in 1957. Productivity rates in 1958 were 7.9 tons per man-day at underground mines, 33.5 tons at strip mines, and an average of 19.3 tons for all mines. In 1957 the rates were 8.4 tons at underground mines, 28.5 tons at strip mines, and an average of 16.4 tons for all mines. There were 14 lost-time injuries compared with 2 fatal injuries and 26 lost-time injuries in 1957.

TABLE 3.—Production of coal by counties

(Exclusive of mines producing less than 1,000 tons annually)

County	1957		1958	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Campbell	365,859	$1.27	375,947	$1.28
Carbon	119,744	3.17	97,214	6.61
Converse	6,250	3.35	35,040	3.34
Fremont	1,220	5.67	1,477	5.73
Hot Springs	16,439	6.23	10,683	9.04
Lincoln	647,284	2.86	442,214	2.87
Sheridan	408,748	3.40	369,341	3.39
Sweetwater	551,722	6.46	297,514	6.57
Total	2,117,266	3.67	1,629,430	3.64

[1] 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 as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

Natural Gas.—Dry natural gas, principally from fields in Sweetwater, Sublette, and Uinta Counties in the Green River basin, and residue gas recovered at natural-gasoline plants from petroleum gas was marketed through pipelines to consumers in Rocky Mountain and Pacific Coast States. The quantity sold was 2 percent above that of 1957. There were 15 gas discoveries, of which 11 were in the Green River basin (8 in the southeastern part). Six of the discoveries were new fields, and five were new producing horizons in older fields. The Mesaverde formation, the most productive, furnished 8 of the 11 discoveries; 3 were completed in the Frontier formation. Development drilling resulted in 48 new producers—in the Green River (46), Wind River (1), and Hanna (1) basins. The completion of major pipeline construction had provided the necessary outlets and generated exploratory and development programs in the area. Pacific Northwest Pipeline Corp. began a major expansion program in the Green River

basin to provide additional outlets for gas in the Big Piney, Tip Top, and Hogsback fields in Lincoln and Sublette Counties. The project involved constructing a 51-mile 30-inch line to connect the fields with the corporation's mainline system to Northwestern States at an estimated cost of $5.5 million. The new line will parallel an existing 16-inch line.

Natural-Gas Liquids.—Natural gas was processed at 11 plants in 10 counties for recovering natural gasoline, butane, propane, and sulfur. Some plants recovered only natural gasoline; others recovered natural gasoline, butane, and propane. Plants in Park and Washakie Counties also recovered sulfur from the sour gases of the Elk basin, Silver Tip, and Worland fields, in addition to the natural-gas liquids. Two new plants were under construction, one at Glenrock in Converse County and one at Opal in Lincoln County. Announcement also was made of plans to construct a plant at the Beaver Creek field in Fremont County. The quantity of natural-gas liquids recovered was 1 percent below that of 1957; the quantity of natural gasoline recovered increased 4 percent, whereas the quantity of the liquid-petroleum gases (butane, propane) declined 6 percent. The value of natural gasoline, liquid-petroleum gases, and total natural-gas liquids increased 6, 2, and 4 percent, respectively, over 1957.

Petroleum.—Production of petroleum from 21 counties reached 115.6 million barrels, an increase of 5 percent over 1957.

Exploratory and development drilling was below that of 1957. There were 14 oil discoveries compared with 33 in 1957. Of 533 development wells completed, 329 were oil wells compared with 553 completions and 328 oil wells in 1957. Seven of the 14 discoveries were in the Powder River basin in Campbell (1), Crook (5), and Weston (1) Counties. There were four discoveries in the Wind River basin in Fremont (three) and Natrona (one) Counties—and one each in the Big Horn, Powder River, and Hanna basins.

TABLE 4.—Production of crude petroleum, by counties, in thousand barrels

County	1957	1958 (preliminary)	County	1957	1958 (preliminary)
Albany	421	397	Natrona	9,891	11,909
Big Horn	12,209	12,142	Niobrara	587	1,553
Campbell	114	877	Park	23,898	26,749
Carbon	3,447	3,441	Sheridan	1,107	995
Converse	5,579	5,146	Sublette	461	632
Crook	737	1,342	Sweetwater	3,994	4,089
Fremont	14,457	14,769	Uinta	81	45
Goshen	62	47	Washakie	5,676	5,869
Hot Springs	16,787	14,845	Weston	3,037	3,129
Johnson	6,555	7,046			
Laramie	398	461	Total	109,584	115,572
Lincoln	86	89			

Development drilling was largely confined to the Powder River and Big Horn basins. In the Powder River basin extensive development was done in 12 fields. In the Brooks Ranch field, a 1957 discovery, 43 producers were completed, and at the Dead Horse Creek field, there were 22 new producers. Substantial development at the Donkey Creek and Donkey Creek-S fields resulted in 11 successful wells in the Donkey Creek field and 5 in Donkey Creek-S. Drilling

at the Teapot-E field furnished 12 producers. Other fields with significant development drilling included the Skull Creek 12 successful completions, Osage (10), Mush Creek (8), Big Muddy (6), South Glenrock (5), Lightning Creek (4), and Salt Creek-E (3).

In the Big Horn basin the most extensive development was at the Greybull field where 29 producers were completed and the Cottonwood Creek field with 21 new producers. Other successful development wells were completed at the Hamilton Dome field (10), Little Buffalo (9), and Fourbear (5). In the Wind River basin two new producers were added to the Winkleman Dome field and a gas well was added to the Riverton Dome field.

The State's nine refineries, three at Casper and one each at Cheyenne, Cody, Lusk, Newcastle, Sinclair, and Thermopolis, processed 34.2 million barrels of crude oil in 1958, a decline of 2 percent from 1957 when 10 refineries were operating. Daily capacity of the nine refineries was 109,675 barrels. Husky Oil Co. announced plans to increase the capacity of its 7,000-barrel-a-day plant at Cody by possibly 100 percent. The project also included gathering facilities in the Cody area and a products line to connect with the Yellowstone pipeline at Billings, Mont.

Major pipeline-construction projects were not in progress. Continental Oil Co. expanded its Lance Creek-Denver system by adding new pump stations and improving delivery facilities at Cheyenne. Service Pipeline Co. began replacing a 12-inch line from Casper to Fort Laramie with a 20-inch line and was authorized to build a new 12-inch line from the North Fork field to Midwest. Interstate Pipeline Co. modernized pumping stations along its line from fields in the Big Horn basin to Billings, Mont. The crude-oil pipeline from the Grieve field to Casper was completed and went into operation.

The Federal Bureau of Mines Laramie Petroleum Research Center at Laramie continued its engineering studies of oilfields in the Rocky Mountain States, including production and secondary recovery. Research was done on the physical properties and composition of petroleum reservoir fluids and on the physical properties, capillary behavior, and clay-mineral content of reservoir rocks. Research on oil shale and shale oil included investigation of the composition, analyses and resources of oil shale, the characteristics and analysis of shale oil, and conversion of oil shale to shale oil.

NONMETALS

Cement.—Shipments of types I, II, III, V, oil-well, and waterproof-portland cement continued to advance, and total shipments were 4 percent greater than 1957. One rotary kiln was operated by Monolith Portland Midwest Co. at its Laramie plant for 349 days. The company continued to mine its own cement rock and purchase other raw-material requirements. Aside from the consumption of cement in Wyoming, shipments were made to consumers in Colorado, Nebraska, and New Mexico.

Clays.—Total production of clays remained at relatively the same as in 1957, but output of individual types of clay varied widely. Total bentonite sold or used in 1958 was 120,000 tons less than in 1957. A

74,000-ton reduction in the demand for bentonite as a constituent in rotary-drilling mud furnished the bulk of the decline. The use of bentonite in manufacturing cement, chemicals, insecticides, and fungicides gained, and demand by foundries, steelworks, other miscellaneous consumers, and for export dropped considerably.

Conversely, output of miscellaneous clay increased 126,000 tons, which offset the decline in bentonite shipments. The principal reason for the gain in production was the demand for shale in manufacturing cement and lightweight aggregate. The operation of an expanded-shale plant by Great Western Aggregates, Inc., and a cement plant by Monolith Portland Midwest Co., both near Laramie, created the demand for the miscellaneous clay. Miscellaneous clay or shale also was mined by Lovell Clay Products Co. and Sheridan Press Brick & Tile Co. for use at company brick plants at Lovell and Sheridan, respectively. Lovell Clay Products Co. also mined a small quantity of fire clay to manufacture brick and other heavy clay products.

The construction of a new plant to supply Minnesota taconite processing plants with bentonite was the highlight of the clay industry. Archer-Daniels-Midland Co. completed constructing of a processing plant at Colony, consisting of a 15,000-square-foot steel structure and two concrete storage silos with a combined capacity of 1,000 tons of pulverized bentonite.

Feldspar.—The Catherine No. 1 claim (Casper Mountain mine) of International Minerals & Chemical Corp. in Natrona County continued to be the only source of feldspar. The mine was operated for only a short period and shipments made to the company grinding plant at Denver and to an Eastern dental supply house.

Gem Stones.—A decline in the quantity of agate, jasper, petrified wood, and jade collected resulted in the value of gem and ornamental stones and mineral specimens dropping to $52,000—5 percent less than in 1957. Fremont County collectors recorded the largest value in material collected and once again jade headed the list of the most important stones. Agate and petrified wood were also important in value.

Gypsum.—Wyoming Construction Co. continued to be the only producer of gypsum. An open-pit mine was operated near Laramie and all output was trucked to the Monolth Portland Midwest Co. cement plant at Laramie.

Phosphate Rock.—Production of phosphate rock from the Leefe mine of San Francisco Chemical Co. rose to 124,000 tons compared with 18,000 tons in 1957. The reason for the increase was the operation of the company 1,000-ton-a-day flotation plant at Leefe. Work began on the construction of a fluosolids reactor addition to the mill. This new addition, scheduled for completion early in 1959, will enable the company to treat low-grade phosphate ore heretofore discarded.

Pumice.—A decrease in the demand for scoria used as railroad ballast resulted in an 8-percent drop in output. The Tongue River Stone Co. continued to be the only producer in the State, and the crude material was mined from a deposit near Sheridan.

Sand and Gravel.—A twofold increase in sand and gravel production was chiefly the result of activity by the Wyoming Highway Department. Output by Government-and-contractor producers in 13 coun-

ties and Yellowstone National Park was recorded at 3.7 million tons valued at $3.5 million, whereas commercial production quarried in 14 counties was 1.6 million tons valued at $1.3 million. Ninety-one percent of the commercial and 88 percent of the Government-and-contractor output was washed, crushed, screened, or otherwise prepared. Wyoming ranked seventh in the Nation in mileage (141.9 miles) of all construction underway on the Federal interstate system.[3] In all mileage completed, Wyoming ranked 20th (73.7 miles).

The major commercial operators were Gilpatrick Construction Co., Inc.; Wyoming Paving, Inc.; W. F. Gettel, Inc.; and Union Pacific Railroad Co. In the Government-and-contractor group Taggart Construction Co., Woodward Construction Co., and Dean R. Rounds were leading producers.

Sodium Carbonate and Sulfate.—The production of soda ash from trona by Intermountain Chemical Co. at Westvaco was an important mineral-industry activity; output was 2 percent greater than in 1957. The company was awarded leases on 4,973 acres of Federally-owned sodium deposits near Green River on a bid of $5.05 per acre. One 2,556-acre tract is 13 miles west of Green River and the remaining 2,417 acres are 15 miles west of the city. Intermountain Chemical Co. also began an expansion program which will increase output of soda ash by 20 percent; completion is expected early in 1959.

TABLE 5.—Production of sand and gravel in 1958, by counties, in thousands

County	Short tons	Value	County	Short tons	Value
Albany	187	$108	Platte	(1)	(1)
Big Horn	(1)	(1)	Sheridan	34	$58
Converse	7	4	Sweetwater	(1)	(1)
Crook	(1)	(1)	Teton	12	15
Fremont	544	435	Washakie	(1)	(1)
Goshen	(1)	(1)	Weston	14	20
Hot Springs	39	61	Yellowstone National Park	43	44
Laramie	49	76	Undistributed	4,056	3,602
Lincoln	45	58	Total	5,333	4,760
Natrona	166	178			
Park	137	101			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Stone.—Because of a 28-percent decrease in tonnage of crushed limestone quarried, output of stone declined 15 percent compared with 1957. Production of limestone was 788,200 tons valued at $1.2 million, whereas output in 1957 was 1.1 million tons valued at $2.1 million. Crushed-granite production totaling 265,300 tons compared with 135,600 tons in 1957 partially offset the decline. Dimension limestone and crushed sandstone and miscellaneous stone were also quarried.

Crushed limestone for commercial use was produced by Monolith Portland Midwest Co., Great Western Sugar Co., Guernsey Stone Co., and Utah-Idaho Sugar Co. Morrison-Knudsen Co., Inc., was the principal commercial producer of crushed granite; dimension limestone was quarried by Husman Bros., Inc. Contractors for the Fed-

[3] Bureau of Public Roads, Status of Federal-Aid Highway Programs, Dec. 31, 1958: BPR 59-2.

eral Bureau of Public Roads and Bureau of Reclamation and the State highway department produced crushed limestone, granite, sandstone, and miscellaneous stone.

Sulfur.—Because of a lower industrial demand for sulfur, shipments of this commodity dropped to 102,000 tons—6 percent below 1957. Recovery of sulfur from sour natural gas declined to 118,000 tons compared with 127,000 tons in 1957. Texas Gulf Sulphur Co. reported a smaller production total, as did Jefferson Lake Sulphur Co., Pan American Petroleum Corp., Texaco Seaboard, Inc., and Signal Oil & Gas Co. The only operator that increased sulphur shipments was Jefferson Lake Sulphur Co.

TABLE 6.—Production of stone in 1958, by counties

County	Short tons	Value	County	Short tons	Value
Albany	(1)	(1)	Platte	291,700	$323,400
Fremont	4,100	$1,000	Teton	20,600	20,500
Goshen	3,400	5,900	Washakie	200	200
Hot Springs	92	4,600	Yellowstone National Park	19,800	52,800
Laramie	(1)	(1)	Undistributed	737,100	1,046,700
Lincoln	300	400			
Natrona	10,400	10,400	Total	1,099,192	1,471,700
Park	11,500	5,800			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

In June the assets of Seaboard Oil Co. which operated the Silvertip plant were acquired by Texaco Seaboard, Inc., a wholly owned subsidiary of The Texas Co. The Elk Basin plant of Stanolind Oil & Gas Co. was acquired by Pan American Oil Corp. Pan American constructed a 20-ton-a-day sulfur-recovery unit at the Cottonwood Creek field, which produced a small quantity of sulfur; no shipments were made. The Neiber Dome plant of Signal Oil & Gas Co. was abandoned because of a flooding of the wells, which supplied the sour natural gas.

Vermiculite.—Golden Earth, Inc., of Encampment sold 10 tons of crude vermiculite from stockpiled material mined in 1953 for use as potting material for plants.

METALS

Beryllium.—Five beryl claims or prospects were worked; 17 tons valued at $9,000 was produced—Principally at the Sleeper Nos. 1 and 2 of Thermopolis Mining & Exploration Co. All beryl mined was shipped to the Government stockpile at Custer, S. Dak.

Gold, Silver, and Copper.—Production of gold, silver, and copper was valued at $4,300, a substantial drop from the $22,600 recorded in 1957. Output came from one lode mine each in Carbon and Fremont Counties and one placer mine in Teton County. Uraninite Corp. shipped a few tons of copper ore from the Porter mine (Carbon County), and Atlantic City Mining and Milling Co. milled a small tonnage of gold ore produced from the St. Louis mine (Fremont County). Also included in the total gold, silver, and copper production was gold and silver recovered from ore from the Duncan mine (Fremont County) by Atlantic Western Mining Co., mined and milled in 1957 and mar-

keted in 1958. Frank J. Allen recovered gold from the Sterling mine (Teton County) by placer-mining methods.

TABLE 7.—Mine production of gold, silver, copper, and lead, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)		Copper		Total value
	Lode	Placer		Troy ounces	Value	Troy ounces	Value	Short tons	Value	
1949–53 (average)	1	1	362	80	$2,800	7	$6	(3)	$115	$2,921
1954	2	-------	1,445	407	14,245	74	67	1	590	14,902
1955	1	-------	206	52	1,820	20	18	-------	-------	1,838
1956	3	-------	3,202	762	26,670	154	139	3	2,550	29,359
1957	4	-------	2,069	573	20,055	126	114	4	2,408	22,577
1958	2	1	3,086	117	4,095	30	27	(3)	210	4,332
1867–1958	-------	-------	(4)	81,953	1,976,683	75,236	52,289	16,335	5,690,704	[5] 7,721,162

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, and ore shipped directly to smelters during calendar year indicated.
[2] Does not include gravel washed.
[3] Less than 1 ton.
[4] Data not available.
[5] Includes 14 short tons lead valued at $1,486 produced before 1949.

Iron Ore.—One of the principal developments in metal mining was the continued work by Columbia-Geneva Steel Division of the United States Steel Corp. on its large low-grade iron-ore deposit near Atlantic City in Fremont County. The division paid more than $100,000 for claims in the area in 1958, optioned a 200-foot railroad right-of-way across the Sweetwater River, won approval for diverting 3,500 acre-feet of water a year out of the Popo Agie River from the Yellowstone into the Sweetwater drainage, paid an estimated $60,000 for 2,433 acres of recreation land in Medicine Bow Forest to replace 2,316 acres of forest land to be used in the project, and signed an 80,000-foot drilling contract to determine the damsite on Rock Creek. Requirements for getting the project underway and the estimated costs follow: a 60-mile rail spur costing $3.5 million to haul ore from South Pass to Winton, a highway relocation costing $1.5 million to $2 million, and a beneficiation plant costing $16 million. Three carloads of ore from the deposit was shipped to Duluth, Minn., for metallurgical tests at the company laboratory.

Southwestern Engineering Co. shipped a small quantity of titaniferous iron ore from the Shanton mine (Iron Mountain deposit) near Bosler in Albany County to the Combined Metals Reduction Co. mill (pilot plant) at Caselton, near Pioche, Nev., for test, using the Krupp-Renn process.

The recorded iron-ore production, which constituted ore shipped and marketed, came from two mines, one each in Albany and Platte Counties. Production was down 24 percent from 1957. The Colorado Fuel and Iron Corp. was again by far the principal producer. The company shipped crude ore (hematite) from the Sunrise mine in Platte County to its steel plant at Pueblo, Colo. Magnetite Products Corp. shipped iron ore (magnetite) from the Cobar No. 1 in Albany County to its plant in Texas for use as aggregate in concrete for coating underwater pipelines and transmission lines.

Rare-Earth Metals.—Ralph Platt operated the Uranium King mine, producing 1,000 pounds of euxenite. No shipments were made.

Uranium.—Uranium ore was second to petroleum in value of production. Output more than doubled, and the value was nearly 3 times that of 1957. Production was from 145 operations in 9 counties with the major producing areas in Fremont and Converse Counties. Fremont County mines produced nearly 600,000 tons, representing 91 percent of the output.

Preliminary data collected by the Federal Bureau of Mines from 14 major operations show that 489 employees worked 126,648 man-days and sustained 1 permanent partial and 38 lost-time injuries in 1958.

The reserve of uranium ore in Wyoming on December 31, 1958, as estimated by AEC, was 11.5 million tons averaging 0.31 percent (6.2 pounds) uranium oxide, compared with a similar December 31, 1957, estimate of 9.2 million tons, averaging 0.26 percent (5.2 pounds) uranium oxide. The latest reserve estimate represented 14 percent of the total reserve in the Nation.

TABLE 8.—Mine production of uranium ore, by counties [1]

County	1957				1958			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]
Big Horn	5	(3)	(3)	(3)	6	6,313	39,459	$169,117
Campbell	29	6,103	34,442	$143,443	32	4,449	24,572	100,452
Carbon	6	(3)	(3)	(3)	3	(3)	(3)	(3)
Converse	23	(3)	(3)	(3)	23	33,746	163,606	673,968
Crook	12	10,704	40,894	151,637	9	9,899	42,514	163,411
Fremont	28	192,226	800,226	3,128,959	57	594,150	3,000,208	12,134,229
Johnson	5	961	4,402	18,018	6	339	1,445	5,754
Laramie	1	(3)	(3)	(3)				
Natrona	11	11,192	32,921	100,222	5	1,783	5,260	15,841
Niobrara	2	(3)	(3)	(3)	4	(3)	(3)	(3)
Undistributed		53,513	277,062	1,126,402		1,111	5,634	22,862
Total	122	274,699	1,189,947	4,668,681	145	651,790	3,282,698	13,285,634

[1] Based on data supplied to the Bureau of Mines by the Atomic Energy Commission.
[2] F.o.b. mine value, base price, grade premiums, and exploration allowance.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Six contracts for Government assistance in the exploration of uranium deposits were approved by DMEA. Total amount of the contracts was $211,800 with Government assistance limited to $154,200.

A full year's operation of the Western Nuclear Corp. mill at Jeffrey City (Split Rock), completion of the Lucky Mc Uranium Corp. mill in the Gas Hills in March, and completion of the Fremont Minerals, Inc., mill at Riverton in November provided increased facilities for marketing the production.

Following an announcement in October by AEC that limited the number of purchase contracts that would be considered before 1962, AEC began a study [4] to determine the adequacy of existing mills. Results of the study indicated that milling facilities in central and north-

[4] Atomic Energy Commission, A Report on the Domestic Mining and Milling Problems Resulting From Limitation on Additional Milling Capacity by the Division of Raw Materials: Mar. 31, 1958, 20 pp.

ern Wyoming were insufficient to process the indicated and inferred reserve at a rate that would allow many companies to mine their ores economically, and it was recommended that an additional daily milling capacity of 1,700 tons be authorized. By the end of the year AEC had allotted an additional 1,702 tons of daily milling capacity to Wyoming. No contracts had been signed but tentative commitments had been made to increase the daily capacities of the Western Nuclear Corp. mill at Jeffrey City (Split Rock) from 400 to 845 tons, Lucky Mc Uranium Corp. mill in the Gas Hills from 750 to 1,002 tons, and Fremont Minerals, Inc., mill under construction at Riverton from 500 to 724 tons. Two new milling facilities also were tentatively authorized: Globe Mining Co. for a plant of 492 tons daily capacity in the eastern Gas Hills in Natrona County and Federal Uranium Co. for a plant with a capacity of 522 tons daily east of Riverton. Upon completion of the proposed mills and the added capacity of the existing mills, the total capacity would be 3,585 tons a day.

AEC had announced May 24, 1956, that it would guarantee the purchase of uranium oxide in concentrates from domestic ores produced and delivered during the period April 1, 1962, and December 31, 1966, at the previously established price of $8.00 a pound of uranium oxide in acceptable concentrate. On November 24, 1958, the program was modified to the extent that the previously announced guarantee would be limited to concentrate recovered from ores developed before November 24, 1958. The Commission could, however, make contracts to purchase concentrate recovered from ores developed after November 24, 1958, to the extent that requirements dictate, and on such terms, conditions, and prices that the Commission determines to be equitable to both the producer and the Government. The purpose of the revision was to prevent overproduction and to assure an adequate supply of uranium for military and domestic uses.

Vanadium.—Some uranium ores in Campbell County contained sufficient vanadium to warrant the cost of recovery. Vanadium oxide was recovered from ores of this type that were processed at southwestern Colorado mills and credited to Wyoming mineral production. The quantity of recoverable vanadium credited to Wyoming production was 34 percent more than in 1957.

REVIEW BY COUNTIES

Albany.—Portland cement from the Laramie plant of Monolith Portland Midwest Co. continued to comprise most of the mineral production. Cement rock and gypsum used in the cement were mined in the county.

Shipments of iron-bearing material nearly doubled. A total of 58,000 tons of magnetite and titaniferous iron ore was shipped by Magnetite Products Corp. and Southwestern Engineering Co. from the Cobar No. 1 and Shanton mines.

Petroleum production at five fields, principally the Quealy field, was 6 percent below that of 1957. Ohio Oil Co. operated its natural-gasoline plant at Rock River for recovering natural gasoline, propane, and butane; the residual gas was marketed through pipelines to consumers.

Big Horn.—Big Horn County ranked fourth in producing petroleum and uranium ore as well as in total value of mineral production. Of the 15 active oilfields, Bonanza, Garland, and Byron were the principal producers; total output was slightly below that in 1957. Mobil Producing Co. operated its natural-gasoline plant at Manderson to recover natural gasoline, propane, and butane. Residual gas was further processed by Jefferson Lake Sulphur Co. for recovering elemental sulfur. Uranium ore from five mines was shipped to the stockpile at Riverton. Major producers were Lisbon Uranium Corp. at the Mike group and Modern Mines Development Co. at the Jet No. 8. A contract for exploration of the Cave Line group of claims for uranium by Kanter-Levy Co. was approved by DMEA. Total amount of the contract was $41,200 with 75-percent Government assistance.

TABLE 9.—Value of mineral production in Wyoming, by counties

County	1957	1958 [1]	Minerals produced in 1958 in order of value
Albany [2]	[3] $6,110,739	$6,143,658	Cement, petroleum, stone, iron ore, clays, sand and gravel, gypsum, gem stones.
Big Horn [4]	[3] 35,948,489	34,693,607	Petroleum, clays, uranium ore, sand and gravel, gem stones.
Campbell	[3] [5] 909,845	2,871,099	Petroleum, coal, uranium ore.
Carbon [6]	[3] 9,826,912	9,667,780	Petroleum, coal, uranium ore, sodium sulfate, gem stones, copper, silver.
Converse	[3] 15,603,846	14,225,889	Petroleum, uranium ore, coal, sand and gravel, gem stones.
Crook	[3] 7,907,319	8,711,500	Clays, petroleum, uranium ore, sand and gravel.
Fremont [7]	[3] 42,007,249	51,165,548	Petroleum, uranium ore, sand and gravel, gem stones, coal, beryllium concentrate, gold, stone, silver.
Goshen	[3] 208,620	133,698	Petroleum, stone, sand and gravel, beryllium concentrate, gem stones.
Hot Springs [6]	[3] 44,777,169	38,907,931	Petroleum, coal, sand and gravel, stone.
Johnson [6]	[3] [5] 17,454,318	([8])	Petroleum, clays, uranium ore.
Laramie	([8])	([8])	Petroleum, stone, sand and gravel, gem stones.
Lincoln	[3] 2,211,102	2,496,580	Coal, phosphate rock, petroleum, sand and gravel, stone, gem stones.
Natrona [7]	[3] 26,837,888	31,507,581	Petroleum, clays, sand and gravel, sodium sulfate, uranium ore, stone, feldspar, gem stones.
Niobrara [7]	([8])	([8])	Petroleum, uranium ore.
Park [4]	([8])	69,922,070	Petroleum, sand and gravel, stone.
Platte	([8])	4,089,596	Iron ore, stone, sand and gravel, gem stones.
Sheridan	[3] 4,464,253	3,950,401	Petroleum, coal, sand and gravel, pumice, clays.
Sublette [6]	[3] 1,302,260	1,649,520	Petroleum.
Sweetwater [7]	[3] 23,033,855	21,634,367	Petroleum, sodium carbonate, coal, sand and gravel, gem stones.
Teton	121,300	35,435	Stone, sand and gravel, gold.
Uinta [9]	[3] 215,510	117,450	Petroleum.
Washakie [4]	([8])	([8])	Petroleum, sand and gravel, stone.
Weston [9]	[3] 10,829,954	9,728,255	Petroleum, clays, sand and gravel.
Yellowstone National Park	90,600	96,700	Stone, sand and gravel.
Undistributed [10]	[3] 103,629,000	58,908,000	
Total [11]	[3] 352,532,000	369,938,000	

[1] Petroleum is preliminary.
[2] Excludes natural-gas liquids and sulfur.
[3] Revised figure.
[4] Excludes natural gas, natural-gas liquids, and sulfur.
[5] Excludes vanadium.
[6] Excludes natural gas.
[7] Excludes natural gas and natural-gas liquids.
[8] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[9] Excludes natural-gas liquids.
[10] Includes all natural gas, natural-gas liquids, and vanadium and some sand and gravel, stone (1958), gem stones, and beryllium concentrate (1958), and values indicated by footnote 8.
[11] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement.

Big Horn County ranked second in bentonite output with mines and mills operated by Magnet Cove Barium Corp. and Wyo-Ben Products Co. Lovell Clay Products Co. continued to mine shale for use at its Lovell brick plant.

Campbell.—Campbell County ranked second in producing bituminous coal. Output from the Wyodak mine operated by Wyodak Resources Development Corp., a subsidiary of Black Hills Power & Light Co., was 3 percent above that of 1957. Petroleum from four fields was nearly eight times that of 1957; major production was from the Dead Horse Creek field. Discovery of the Barber Creek field 5 miles northwest of the Dead Horse Creek field in Mesaverde formation was probably the most outstanding success in 1958. Initial production was 456 barrels of oil a day. Development of the Dead Horse Creek field was extensive with 22 new producers completed.

Uranium ore produced at 32 operations was shipped to mills in Colorado, Wyoming, and South Dakota, but output was 27 percent below that of 1957. The major producer was Herldon H. Bowen at five mines. Some of the ore shipped was carefully selected and contained as much as 8 percent uranium oxide. Part of the ore contained an appreciable amount of vanadium oxide, which was recovered from the material shipped to Colorado mills.

Carbon.—Coal output (from one underground and two strip mines) declined 19 percent below that of 1957. Monolith Portland Midwest Co. operated the Hanna No. 2 strip mine and was the principal producer. The entire production of the mine was used at the company plant at Laramie as fuel in manufacturing cement.

Petroleum production from 13 fields was slightly below that of 1957. Principal producing fields were the Wertz and Rock River. One new field, O'Brien Springs, was discovered. The well produced 3.6 million cubic feet of gas a day from the Nugget formation and 1,176 barrels of oil (a day) from the Tensleep formation and was one of the more important discoveries in 1958. Development drilling resulted in five oil wells and one gas well. Sinclair Refining Co. operated its 25,000-barrel-a-day refinery at Sinclair.

Uranium ore was produced at three mines and shipped to mills in Colorado and Utah. Shawano Development Corp. at the Poison Basin mine was the principal producer. Considerable interest was generated by discoveries in the Shirley basin in the northeast part of the county. Exploration indicated the possibility of extensive deposits of a grade higher than other Wyoming uranium areas. Because of limitation in milling capacity for processing ores developed after November 1, 1957, and November 24, 1958, the material cannot be milled until after March 31, 1962.

Sweetwater Chemical Co. continued to produce sodium sulfate from semidry lakebeds near Rawlins. A small quantity of euxenite was mined by Ralph Platt, but no shipments were made.

Converse.—Of particular significance to Converse County was completion of the 100,000 kw, Dave Johnston powerplant at Glenrock by Pacific Power & Light Co. The plant, under construction for 30 months, was dedicated on December 20. Coal for the plant was developed 15 miles north of Glenrock, the reserve being sufficient to operate three such plants for 50 years. The Dave Johnston mine,

an open pit, produced 1,500 tons of coal a day, which was transported to the powerplant over a specially constructed highway by 70-ton coal haulers. The plant was designed to use natural gas, oil, or residual "pitch" as alternate fuels.

Petroleum production from nine fields was 8 percent below that of 1957. Glenrock and Big Muddy were the principal producing fields. Thirty successful development wells were completed. Cabot Carbon Co. was building a natural-gasoline plant at Glenrock. The plant was designed to process 8 million cubic feet of natural gas daily.

The county was second in producing uranium ore. Ore was from 23 operations and was shipped to mills in Wyoming and South Dakota for processing. Principal producers were Loma Uranium Corp., Marlock Mining Corp., and B & H Mines. Contracts for the exploration of uranium deposits by Douglas Corp. and Jenkins & Hand were approved by DMEA. Total amount of the contracts was $86,800 with 75-percent Government participation.

Crook.—The value of bentonite produced dropped to $5 million compared with $5.8 million in 1957, but the county led in the output of this commodity. Archer-Daniels-Midland Co. took over the operation of Federal Foundry Supply Co., and lower production was reported by American Colloid Co., Black Hills Bentonite Co., International Minerals & Chemical Corp., and National Lead Co.

The county led the State in exploratory drilling. Twenty-five wells were completed, of which Butler Ranch, Cabin Creek, Coyote Creek, Robinson Ranch, and Wind Creek, were discoveries. Twenty-three successful development wells also were completed. Petroleum production in the Donkey Creek, Moorcroft, and Wakeman Flats fields gained 82 percent over 1957.

The county ranked third in producing uranium ore, which decreased 8 percent in quantity but gained 8 percent in value over 1957 because higher grade ore was mined. Principal producers were Homestake Mining Co. (New Haven mine) and Quad Uranium Co. (Ackerman and Busfield leases). A contract for exploration of Laymon properties by Balboa Mining & Development Co. was approved by DMEA. The amount of the contract was $18,700 with 50-percent Government participation.

Fremont.—Fremont County supplied 91 percent of the uranium ore mined in Wyoming. Production increased threefold and was reported from 57 operations compared with 28 in the preceding year. Five major producers (Lucky Mc Uranium Corp., Vitro Minerals Corp., Western Nuclear Corp., Globe Mining Co., and Dale B. Levi) furnished 89 percent of the total production, all of which was shipped to mills and stockpiles in the county and to Salt Lake City, Utah. Western Nuclear Corp. operated its 400-ton-a-day mill at Jeffrey City (Split Rock) the entire year. Throughput at a rate of 1,000 tons a day was achieved by a new operating technique but was later reduced to capacity of 440 tons authorized by the AEC. Construction of an acid-leach 750-ton-a-day mill in the Gas Hills district east of Riverton by Lucky Mc Uranium Corp. was completed and began operating in March. The mill recovered the uranium in a column-ion exchange system, the first to use the system in uranium milling; operation was

highly successful. Construction of a 550-ton-a-day mill at Riverton by Fremont Minerals, Inc., was begun in February, and operations began November 28. The milling process employed two leaching circuits and uranium was recovered by solvent extraction. One leaching circuit used sulfuric acid for processing ores containing less than 6 percent lime and one used sodium carbonate for ores containing more than 6 percent lime, thus enabling treatment of ore from the various uranium districts. The mill operated on a custom basis, receiving ore from 25 independent operators. A 125-ton-a-day sulfuric acid plant, using sulfur recovered from sour petroleum gases, was built in connection with the uranium plant to provide acid for the lead circuit and for sale to other consumers. Operation of the acid plant reached design capacity at the end of the year. The corporation assumed buying operations at the Government stockpile at Riverton in February and will process the ore accumulated in the stockpile. Contracts for exploration of the DuBois claims by Kaye Minerals, Inc. and the Rim group of claims by Uranium Research & Development Co. were approved by DMEA. The total value of the contracts was $65,100 with 75-percent Government assistance.

Petroleum production from 21 fields was 2 percent greater than in 1957. One new oilfield, Lysite-W, was discovered and new producing horizons were discovered at the Lost Cabin and Winkleman Dome fields. Two gasfields, Castle Garden and Little Dome, were discovered. Development drilling produced 15 new oil wells and 1 gas well. Northern Utilities Co. operated its Sand Draw natural-gas plant for recovering natural gasoline. Pan American Petroleum Corp. announced plans to build a natural-gas plant at Beaver Creek field to process casinghead and formation gas for recovering natural-gas liquids. Capacity of the plant was to be 47 million cubic feet of gas a day. Coal was produced at the George coal mine.

Fifteen tons of hand-cobbed beryl was recovered from the Billy Jack Nos. 1 and 2, Happy Jack, and Sleeper Nos. 1 and 2 pegmatites and shipped to the Government purchase depot at Custer, S. Dak.

Goshen.—Production of petroleum from the Torrington field dropped to 47,000 barrels in 1958, 24 percent below 1957. A small quantity of sand and gravel and crushed sandstone was used for highway construction and a small quantity of beryl was recovered from the Spook Lode and shipped to the Custer, S. Dak., Government purchase depot.

Hot Springs.—Petroleum production (from 16 fields) was 12 percent below that of 1957, but the county continued to rank second in the State. Major producing fields were the Hamilton Dome, Grass Creek, and Murphy Dome. A new producing horizon was discovered in the Grass Creek field. Nineteen successful development wells were completed. Empire State Oil Co. operated its 5,000-barrel-a-day refinery at Thermopolis. Coal was produced from the Roncco and Coleman mines.

Johnson.—Petroleum production (from seven fields) increased 7 percent over 1957. Output was principally from the Sussex and Meadow Creek fields. Thirteen successful development wells were completed. Continental Oil Co. operated its natural-gas plant No. 23 at Linch

for recovering natural-gas liquids and maintaining pressure in natural-gas transmission lines.

Uranium ore produced at six mines was shipped to mills in Wyoming, Colorado, and South Dakota for processing.

Benton Clay Co. produced bentonite from its Johnson County mines and shipped to a company mill at Casper for processing.

Laramie.—Petroleum production (from four fields), 16 percent over 1957, came principally from the Horse Creek and Pine Bluffs fields. Two successful development wells were completed. Frontier Refining Co. operated its 20,000-barrel-a-day refinery at Cheyenne; throughput was 2 percent greater than in 1957.

Lincoln.—Lincoln County led in producing bituminous coal, and the entire output came from the Elkol strip mine and the No. 8 Brilliant underground mine, both operated by the Kemmerer Coal Co. Natural gas was produced at the Willow Creek field, and two new gasfields were discovered—Emigrant Springs south of Willow and a second south of the Hogsback-E field. A third discovery, west of the Hogsback field, was classified as a development well. Three other development wells also were successful. El Paso Natural Gas Co. neared completion of its natural-gas plant at Opal, designed to process 250 million cubic feet a day and recover 122,000 gallons of natural-gas liquids.

With the operation of the new beneficiation plant of San Francisco Chemical Co. at Leefe, output of phosphate rock increased sevenfold. The rock from the open-pit mine was used to produce various agricultural and industrial phosphate products.

Natrona.—Petroleum production (from 24 fields) increased nearly 2 million barrels or 20 percent over that of 1957 and supplied 99 percent of the total value of mineral production in the county. Major producing fields were Salt Creek, Grieve, and Salt Creek-E. One new oilfield, Poison Spring Creek, and one new gasfield, Badwater, were discovered. Development drilling was extensive, and 51 successful oil wells were completed. Pan American Petroleum Co. operated its Salt Creek natural-gas plant at Midwest for recovering natural-gas liquids. Residual gas was an important source of natural gas delivered through pipelines to consumers. Refineries at Casper, operated by Socony-Mobil Oil Co., Standard Oil Co. of Indiana, and The Texas Co., were active the entire year. Throughput of the three refineries, combined daily capacity of 48,000 barrels, was 5 percent below that of 1957. Standard Oil Co. also operated its lubricating-oil plant at its Casper refinery. The sulfuric acid plant operated by the company since 1930 was abandoned.

Uranium ore produced at two mines was shipped to Wyoming mills for processing.

Niobrara.—Petroleum production from eight fields, principally the Lance Creek and Lance Creek-E fields, increased nearly threefold over 1957. One new field, Buck Creek, was discovered. Wet-petroleum gas was processed at Continental Oil Co. plant at Manville for recovering natural gasoline. The C & H Refinery Co. operated its 175-barrel-a-day plant at Lusk, processing crude oil from the Lance Creek field.

Uranium ore from four mines was shipped to mills in South Dakota and Colorado for processing.

Park.—Park County led in production of petroleum and value of mineral output.

Petroleum came from 27 fields, of which the Elk Basin, Oregon Basin, Frannie, and Little Buffalo Basin were the major producers. Successful development wells were completed in the Little Buffalo Basin field. Pan American Petroleum Corp. operated its Elk Basin natural-gas plant north of Powell for recovering natural-gas liquids and elemental sulfur. Husky Oil Co. operated its 5,500-barrel-a-day refinery at Cody and announced plans to increase the capacity of the plant. Sulfur also was recovered at the Silvertip plant of Texaco Seaboard, Inc.

Platte.—Production of iron ore from the Sunrise underground mine of The Colorado Fuel and Iron Corp. furnished most of the mineral output. An average of 285 men was employed during the year, and 498,500 tons of iron ore was mined.

Sheridan.—Bituminous-coal production from the Big Horn No. 1 and Welch strip mines and the Storm King underground mine decreased 10 percent below that of 1957. Petroleum production at the Ash Creek field declined slightly from 1957. The combined value of the fuels produced in 1958 supplied 97 percent of the total value of mineral production.

Sublette.—Petroleum and natural gas were produced at five fields; principally the La Barge, Tip Top, and Big Piney. One new gas-field, Deer Hill, was discovered north of the principal producing area of the Big Piney field. Late in the year many of the fields near the Big Piney and La Barge fields were combined into a single field designated Big Piney-La Barge field. Development drilling in the subdivisions of the Big Piney-La Barge and Tip Top fields resulted in 16 oil wells and 40 gas wells.

Sweetwater.—Bituminous-coal production from four underground mines was 46 percent below that of 1957. The Union Pacific Coal Co., operating the Rock Springs No. 8 and Superior D. O. Clark 7 and 7½ mines, was the major producer. Gunn-Quealy Coal Co. operated the Rainbow No. 6 mine and Swanson Mining Co., the Swanson mine. Petroleum production from seven fields, but principally the Lost Soldier field, increased 2 percent over 1957. Natural gas was produced from the Church Buttes field that lies in both Sweetwater and Uinta Counties. New gas discoveries included the Desert Springs field with production from two horizons, Playa Unit also with production from two horizons, and the Wamsutter field. New producing horizons were found in the Middle Mountain and Trail fields. Development drilling resulted in five gas wells in the Church Buttes field. Sinclair Oil & Gas Co. operated its natural-gas plant at Bairoil for recovering natural gasoline.

Mining of trona at the Westvaco mine of Intermountain Chemical Co. was the most important activity in the nonmetal field. Employment averaged 400 men and reportedly [5] 617,700 tons of crude ore was mined and 368,300 tons of soda ash produced.

[5] Fearn, Lyman, Annual Report of the State Inspector of Mines of Wyoming, Dec. 31, 1958: 73 pp.

Uinta.—Petroleum and natural gas were produced at the Church Buttes and Spring Valley fields. Mountain Fuel Supply Co. operated its Uinta natural-gas plant for recovering natural gasoline. Residual gas was transported through company pipelines to consumers in the Salt Lake (Utah) area.

Washakie.—Petroleum production from 11 fields increased 3 percent over 1957. Major producing fields were Cottonwood Creek, Worland, and Slick Creek. Twenty-seven successful development wells were completed in the Cottonwood Creek and other fields. Pure Oil Co. operated its Worland natural-gas plant to recover natural-gas liquids. Residual gas was further processed by Texas Gulf Sulphur Co. to recover elemental sulfur. Pan American Petroleum Corp. operated its Cottonwood Creek natural-gas plant east of Worland to recover natural gasoline and sulfur. One hundred tons of sulfur was produced at the Neiber Dome desulfurization plant of Signal Oil & Gas Co. before the abandonment of the plant.

Weston.—Petroleum production from 12 fields, principally the Clareton, Fiddler Creek, and Skull Creek, was 3 percent above that of 1957. Development drilling in the Clareton trend resulted in 12 successful wells in the Skull Creek field, 10 in Osage, and 8 in Mush Creek. One successful well completed in the Lodgepole area was listed as a discovery, but was later classified as an extension of the Lodgepole field discovered in 1949. Wyton Oil & Gas Co. operated its natural-gas plant southwest of Newcastle to recover natural gasoline. Sioux Oil Co. operated its 6,000-barrel-a-day refinery at Newcastle. Throughput was 23 percent above that of 1957.

The county ranked third in the output of bentonite with mines and mills operated by American Colloid Co., Archer-Daniels-Midland Co., and National Lead Co.